REPUBLIC OF BURUNDI MINISTRY OF PUBLIC HEALTH
AND THE FIGHT AGAINST AIDS

KANGAROO CARE AS SUPPORT FOR NEWBORN DEVELOPMENT

TRAINING OF TRAINERS MANUAL

Theoretical Section

PAOLO CHIESI FOUNDATION

SOINS KANGOUROU

Amahoro Pro Africa

Preface

It is with great pleasure that I present this training manual on the provision of Kangaroo Care services for newborns. I am delighted to see that we are implementing innovative practices focused on the well-being of infants.

The concept of Kangaroo Care was developed to improve the quality of care provided to premature or low-birth-weight newborns. It is a holistic approach that promotes skin-to-skin contact between the infant and the parents, recreating a warm and protective environment similar to the marsupial pouch of a kangaroo. This training manual aims to provide you with the knowledge and skills necessary to successfully implement Kangaroo Care services within your health facility. Inside, you will find detailed information on the benefits of Kangaroo Care, the eligibility criteria for infants, the various stages of program implementation, as well as the best practices to ensure the safety and well-being of both babies and their parents.

By promoting the establishment of Kangaroo Care services, we aim to achieve several objectives. First, we seek to support the neurological and emotional development of premature newborns by fostering a close and continuous bond with their parents. Next, we aim to reduce the risk of hospital-acquired infections and medical complications by limiting invasive medical interventions.

Finally, we strive to strengthen the role of parents in caring for their child by actively involving them and equipping them with the necessary tools to ensure their baby's well-being.

I would like to emphasize the importance of your role as healthcare providers in implementing these innovative practices. Your commitment and expertise are essential to ensure the success of this program and to offer to newborns the best possible care.

I strongly encourage you to take the time to familiarize yourself with this training manual. Together, we can make a real difference in the lives of these fragile newborns and their families. I therefore call on your dedication and commitment to the health and well-being of newborns. I am convinced that through your efforts, we will be able to give every child the best chance to grow up healthy and thrive.

Ministry of Public Health and the Fight Against AIDS

Dr Lydwine BARADAHANA

I. Context and justification

Epidemiological data provided by the World Health Organization (WHO) show that over the past decade, there has been a global decline in infant mortality, although neonatal mortality has decreased at a slower rate. Among the main causes, prematurity stands out as one of the three leading causes of neonatal death, along with birth asphyxia and neonatal infections.

Each year, around one million children worldwide die because they are born prematurely or due to conditions related to prematurity, with the highest rates occurring in low-resource countries of Southeast Asia and sub-Saharan Africa — particularly in Burundi.

One intervention that can contribute to reducing neonatal mortality is the use of Kangaroo Mother Care (KMC)[1], a scientifically recognized treatment method recommended by the WHO as an effective intervention to improve the outcomes of premature or low-birth-weight newborns. However, despite its proven effectiveness, the use of the Kangaroo method in the care of premature infants remains limited globally — and particularly in Burundi[2].

As part of efforts to improve the quality of care provided to newborns, the Ministry of Public Health and the Fight Against AIDS, in collaboration with the Paolo Chiesi Foundation and Amahoro, launched a pilot Kangaroo Mother Care project in the health facilities of Ngozi Health Province in September 2022.

A total of 584 health professionals have been actively involved in this project. Based on the results achieved, the MSPLS now aims to scale up this good practice of Kangaroo Care nationwide.

This Training Manual is intended to guide healthcare professionals in the daily practice of Kangaroo Mother Care. Capacity-building sessions will therefore be organized at all levels of healthcare delivery to strengthen providers' skills in implementing this approach.

[1]The term Kangaroo Care will be used instead of Kangaroo Mother Care in order to emphasize and promote the central role of both the mother and the newborn, through a caregiving strategy that involves all family members.

[2]In Burundi, field experience — confirmed by an assessment carried out in 75 health facilities of the Ngozi Health Province — has highlighted the main barriers to the practice of Kangaroo Mother Care, namely: insufficient knowledge about the benefits of the method, limited social support, lack of adequate space, and shortage of human and financial resources.

II. Objectives

II.1. The overall objective of this manual is to contribute to the reduction of perinatal mortality and morbidity and to support the development of newborns through the provision of Kangaroo Care (KC).

II.2. Specific objectives:

- Integrate Kangaroo Care into the technical platform of health facilities (FOSA)
- Train healthcare providers in the theory and practice of Kangaroo Care
- Raise community awareness about the practice of Kangaroo Care
- Organize a follow-up plan for the mother–child pair at home
- Ensure the monitoring of Kangaroo Care implementation in all health facilities (FOSA)

III. How to use this manual

This manual is made available to all professionals in the health facilities (FOSA) who are responsible for training Kangaroo Care (KC) providers.

The manual is composed of two parts:

- The first part addresses the theoretical principles underlying the Kangaroo method: the physiology of neurosensory development, and the relational and environmental factors that can affect the neuropsychological and behavioral development of the child.
- The second part presents, in a didactic manner, the theoretical and practical principles for the implementation of Kangaroo Care.

The bibliography refers to the main publications on the subject, updated through 2023, as well as those published by the WHO (WHO recommendations for care of the preterm or low-birth-weight infant, ISBN: 978-92-4-005826-2).

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KANGAROO CARE AS SUPPORT FOR NEWBORN DEVELOPMENT

1. Kangaroo Care as an Integral Part of Newborn Care and Development Support

Kangaroo Care (KC) is a method of caring for preterm and low-birth-weight newborns, characterized by early, continuous, and prolonged skin-to-skin contact with the mother. Integral components of KC include exclusive breastfeeding (or at least feeding with breast milk) and follow-up care after discharge from the neonatal unit.

This method was introduced by Rey and Martinez in Bogotá at the end of the 1970s to compensate for the shortage of incubators [1]. In the following years, it spread worldwide and today represents the “gold standard” in the care of low-birth-weight newborns in resource-limited countries. Initially developed to ensure adequate thermal regulation in technologically limited settings, KC has progressively expanded its indications based on numerous studies and meta-analyses highlighting its benefits in reducing infection risk, improving metabolic stability, strengthening breastfeeding and parent–infant bonding, with positive impacts on neonatal morbidity and mortality as well as long-term development [4,10,11].

In resource-limited countries, KC is often offered in hospitals with dedicated neonatal care services, regardless of the level of care provided. In well-organized hospital units, usually in referral centers for high-risk newborns, there is often a service dedicated exclusively to KC, with appropriate spaces, trained staff, and proper organization. In more peripheral settings with limited equipment and personnel, KC is also provided, even if it is not part of a fully codified care program, focusing instead on preventing hypothermia, promoting breastfeeding, and reducing risks during potential emergency transport [12].

National health policies toward KC are crucial. The dissemination and effectiveness of KC programs are greatest where governments and ministries of health have contributed to informing and training healthcare workers at all levels on the benefits of adopting this care practice [13,14,15].

In resource-limited settings, KC is typically practiced continuously, at least 18 hours per day, requiring significant maternal commitment, with potential support from family members (usually grandmothers, who may substitute for the mother for a few hours). The modalities and schedule for accessing KC, the implications for families and healthcare providers, and eligibility criteria for

newborns, the need for parental involvement, and follow-up requirements all necessitate a well-organized neonatal care system. Establishing a data collection system to document short- and long-term outcomes after KC is equally important, which also requires as continuous a follow-up system as possible [16,17,18].

Thermal regulation remains the primary objective for low-birth-weight and fragile newborns. While incubators can also provide heat and, in some cases, an oxygen-enriched environment, they cause separation between mother and newborn, with consequences for breastfeeding, neuropsychological maturation of the newborn, and maternal health (in the broadest sense of the term).

The management of incubators is itself problematic in resource-limited countries, where their availability is often insufficient (it was based on this situation that KMC was developed in Colombia in the 1970s [1]), their maintenance is difficult and inconsistent, and hygiene is often inadequate. Many observers have encountered poorly functioning incubators, creating health risks for newborns due to unstable temperature regulation. It is also important to note that unstable electricity supply limits the use of incubators, with periods of several hours during which they are unavailable.

The table below [TAB. 1] lists the main disadvantages and advantages of two different care choices, as reported in the international literature.

In recent years, alongside improvements in thermal regulation, infection protection, breastfeeding promotion, and the structuring of the mother–infant bond, research has increasingly highlighted the important role of Kangaroo Care in neuroprotection [4,6,8,15,17]. Prolonged skin-to-skin contact is among the factors that mitigate the disadvantages of preterm birth on the organization of the cortex and sensory pathways [16,19]. It provides positive stimulation to the nervous system during a crucial phase of development and consequently reduces long-term neurobehavioral and psychological effects in the population of low-birth-weight newborns [16,20,21,22,23]. Indeed, Kangaroo Care functions as a “buffer” system, minimizing the negative effects of various environmental stressors, among which mother–newborn separation probably plays the major role [24].

Furthermore, Kangaroo Care helps mothers who experience emotional and affective challenges in skin-to-skin contact with preterm newborns, which inevitably cause increased stress, anxiety, and concern, as well as feelings of inadequacy and lack of confidence in their maternal role [25,26,27]. Mothers who practice Kangaroo Care report feeling more secure, developing self-esteem and attentional capacity, which strengthen the often fragile affective bond in the early stages. All of this makes mothers more competent in supporting the growth—not only physical—of their own baby after hospital discharge.

The benefits of Kangaroo Care are well documented in terms of the newborn's central nervous system development and the mother's emotional/affective field. However, it should also be emphasized that the effectiveness of this care system is enhanced when care strategies recognize the relational abilities and needs of the newborn, even when very immature, from the first moments of life. A newborn is "competent," meaning capable of adapting to the environment, receiving stimuli, interpreting them, and responding with age-appropriate behavioral methods [28].

Consequently, the entire care system must take into account the newborn's surrounding environment, balancing excessive and insufficient stimuli relative to what the intrauterine experience would have provided at that gestational age.

1. Kangaroo Care as an Integral Part of Newborn Care and Development Support

	INCUBATOR	KC
DISADVANTAGES	Purchase cost Maintenance difficulties Hygiene challenges Staff management issues Unstable energy supply	Staff training Cultural aspects Mother & family involvement Awareness-raising among local administration and decision-makers
ADVANTAGES	Possible thermal regulation Opportunity for observation and monitoring Oxygen therapy	Thermal regulation Metabolic stability Infection protection Apnea prevention Positive stimulation of breastfeeding

Table 1 – Comparison between Kangaroo Care (KC) and Incubator Care

All scientific evidence highlights the role of the mother as a naturally supportive environment, providing her newborn with the best possible relational experience from the very first moments of life [29]. The implication is that the entire organization of the neonatal unit must place the mother–newborn dyad at its center, protecting their intimate bond as much as possible, even if Kangaroo Care cannot be practiced immediately. This can be achieved by maximizing skin-to-skin contact immediately after birth [30] and, in cases where the newborn requires medical care, by ensuring maternal access to the neonatal unit, giving her an active caregiving role, helping her build a gradual alliance with healthcare staff, and restoring her maternal role before hospital discharge.

Kangaroo Care should therefore be considered an integral part of the care system, aimed not only at maximizing the survival of low- or very low-birth-weight newborns but also at supporting the quality of their long-term development, placing it among the early interventions to be implemented during the “first thousand days” of life [28,29,30].

KANGAROO CARE AS SUPPORT FOR NEWBORN DEVELOPMENT

2. Central Nervous System Development and Its Relationship with the Environment

2.1 The Importance of the "First Thousand Days"

"In the early years, we walk all our lives"
— Raffi Cavoukian

"If we change the beginning of the story, we change the whole story!"
— Dimitri Christakis

The "first thousand days" of life are crucial for an individual's development. Early social and environmental experiences interact with genetic predispositions, influencing physical and mental health and development, behavior, learning capacity, and economic productivity throughout life [31,32,33]. It is important to note that many exposures and interventions affecting early development can also act before conception and continue throughout the school years and beyond. There is no single moment when everything begins or ends, but there are periods of maximal opportunity and vulnerability for various dimensions of development, with lifelong implications [34,35].

Adverse childhood experiences, such as malnutrition, neglect, poverty, illness, abuse, pollution, and natural disasters (wars, earthquakes, floods), can have long-term effects on health and may even be transmitted from one generation to the next through a series of mechanisms known as epigenetics, which can alter gene expression (i.e., phenotype) without changing the DNA sequence [24,36,37].

Epigenetics studies chemical changes that can modify gene expression—meaning the phenotype—without altering the DNA sequence, but by regulating its function. The gene itself remains the same, but it does not "perform" as originally programmed.

DNA is like the keyboard of a piano, where the keys (genes) produce notes that can give rise to different musical compositions depending on the skill and choices of the pianist, but can also produce faulty compositions that are less pleasant to hear [Fig. 1].

During the prenatal period, the fetus's nutritional status has been linked to the risk of diseases in adulthood. According to the "programming" theory [31,32,38], the process by which a positive or negative stimulus during a specific period of life—for example, intrauterine growth restriction due to maternal, fetal, or placental causes—affects the development and function of organs throughout life.

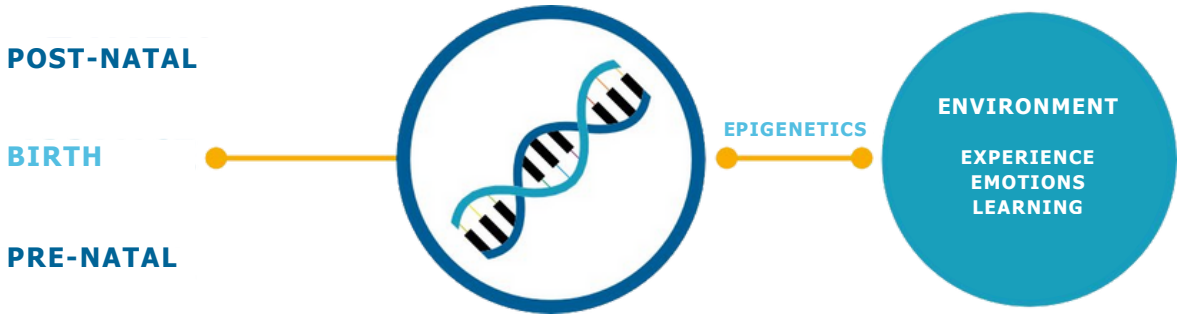


Figure 1 - Epigenetic Mechanisms in Brain Development: Interaction between Genetic Predisposition and Environmental Factors (24)

The "first thousand days" are fundamental, especially for brain development. During this period, the brain absorbs information related to touch, taste, smell, hearing, and vision, allowing it to develop skills, knowledge, and capacities.

Neuroscience has shown [23,24,39] that the brain's architecture is formed in the early stages of life based on stimuli provided by the environment (physical, chemical, biological) and, above all, through relationships with primary caregivers who continuously attend to the child, particularly the mother [21,23,25]. A well-constructed brain architecture built on solid foundations is essential for learning, behavior, and lifelong health. During the phase of cortical organization, the strength and richness of neuronal connections, their selection, and pruning [24,40] enable the child to reach their full developmental potential. The production and programmed elimination of these connections depend on the early experiences of the child—that is on the stimuli received from caregivers and the surrounding physical environment.

The first phase of this process, under normal conditions, is programmed in utero, through continuous interaction between the fetus and its environment, starting from individual genetic characteristics and activating developing sensory pathways.

The phase of cortical organization is programmed to develop in the uterus, where environmental stimuli are aligned with the maturation of sensory pathways. This process can be disrupted by premature exposure to extrauterine life [24,41,42].

The environment that a preterm newborn typically receives is markedly different from the uterus, as neonatal units may subject the infant to repeated stress through excessive auditory and visual stimuli (for which the brain and sensory pathways are only prepared after the 32nd or 36th week of gestation). Conversely, the newborn receives infrequent tactile, gustatory, olfactory, and proprioceptive stimuli—which he needs and which he is ready to receive [24].

The mismatch between environmental stimuli and developmental needs has been considered one of the causes of anomalies in cortical organization [37,42,43].

This can overlap with the negative effects of repeated painful experiences associated with certain diagnostic and therapeutic procedures (heel pricks, intravenous cannula insertions), which are often unavoidable in conditions associated with prematurity.

If not properly managed, the full range of sensory stimuli can also affect the organization of sleep cycles, whose maturation cannot follow the natural rhythms provided in the uterine environment. Sleep is central to the developmental process of the cerebral cortex, and its deprivation compounds other factors that can hinder proper development [9,44,45,46].

From a developmental perspective, the negative impact of mother–infant separation is even more significant [24,26,27,28]. In some situations, separation is unavoidable when the newborn requires specialized care. While this topic will be revisited in another chapter, it is important here to highlight how deprivation of fundamental stimuli for maturation, caused by premature disruption of the mother–fetus bond, can be detrimental.

The fetus grows inside the mother, sharing, at least in part, various life experiences —through movement fluctuations related to life rhythms, the sound of the mother's voice, the smell and taste of amniotic fluid (which varies with dietary habits), and maternal circulation variations influenced by emotional experiences.

The prolonged separation during this "sensitive period" prevents these nature-provided experiences, acting as a true "toxic stress" [47,48,49], characterized by a strong and prolonged activation of the stress response, which is associated with abnormalities in brain structure, functional cortical networks, and metabolic and endocrine circuits.

The knowledge of risk factors related to adverse health outcomes in adulthood provides an opportunity to intervene positively, limiting the negative effects of transitioning a preterm infant from the intrauterine to the extrauterine environment and ensuring the best possible long-term quality of life. Fortunately, there is a "window" for early intervention, from the very first moments of life, to at least mitigate the negative effects of preterm birth. While it is impossible to fully replicate the uterine environment in neonatal care units, actions can be taken to limit inadequate stimuli, separation, painful experiences, and to protect sleep.

The ability to intervene in the maturation process relies on brain plasticity, the capacity of the brain to compensate for damage. If a brain area is damaged, neighboring circuits can be activated to compensate for its function [50]. This mechanism highlights the potential to intervene in the interaction between the newborn and its environment. The physical environment of the neonatal unit and the daily actions of doctors and nurses around the newborn must consider the need to protect brain development ("neuroprotection") and to take advantage of brain plasticity to reduce neonatal damage and its long-term consequences. Neonatal interventions are part of early interventions, which are necessary for all newborns to "get a good start," as early interventions can modify developmental trajectories.

The WHO document "Nurturing Care Framework for Early Child Development" (NCF) [32] provides guidance on how to invest in the early days of life, from pregnancy up to the third year, considering five key domains of action: health, nutrition, parental role, early education, and social protection, with specific policies and interventions for each sector [Fig. 2]. The document emphasizes the crucial role of parents, as they are the primary agents of the child's well-being.

The goal is not only the child's physical health (nutrition, medication, vaccines) but also their optimal psycho-emotional and relational development (speech, touch, play). It is important to reconsider newborn and child care from this perspective. Preventing risks during the "first thousand days" thus becomes a public health priority.

Effective early interventions provide benefits at individual, social, and economic levels [51,53,54,55] [Fig. 3].

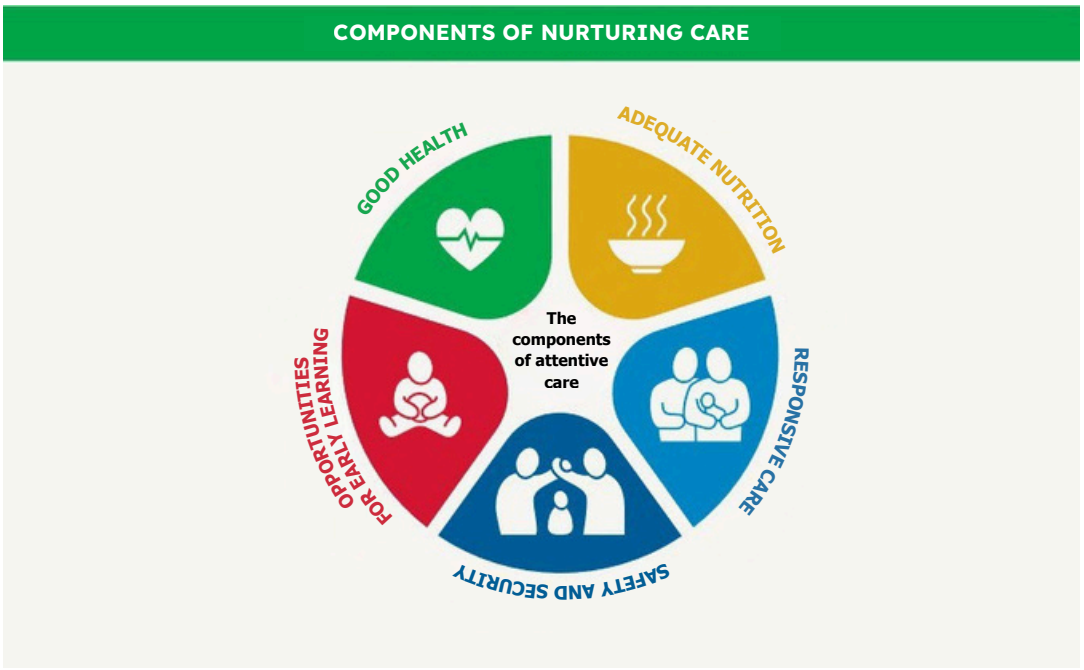


Figure 2 - Components of Nurturing Care

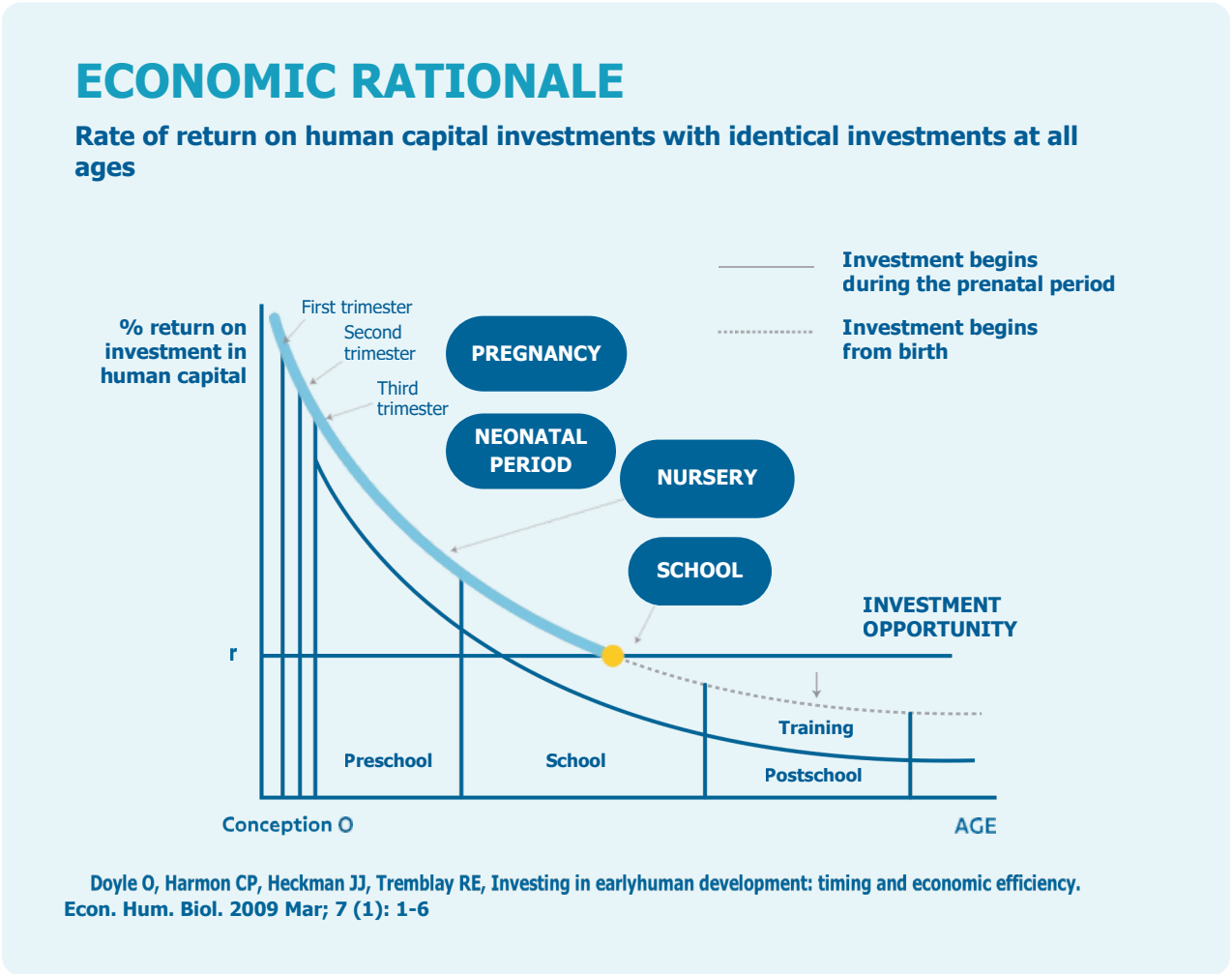


Figure 3 - Investing in the Early Stages of Human Development

2.2 Contact and Separation

2.2.1 Contact and Separation at Birth

It should be emphasized that mother–newborn contact plays a crucial developmental role, both for preterm infants and for full-term newborns of adequate weight with normal extrauterine adaptation.

Separation of the mother and baby immediately after birth is often a practice dictated by cultural norms focused on hygiene and the perceived need for rest for both, but it lacks critical assessment and scientific basis. On the contrary, scientific evidence [23,25,27,28] demonstrates the positive impact of early contact on the mother's emotional life, as "it is in the presence of the newborn during the first hours that the mother deeply takes the positive meaning of her experience, her expectations, and her hopes, whereas separation from her child leads to sadness, agitation, and discouragement."

Separation from the mother exposes the newborn to highly stressful experiences, which significantly affect the autonomic nervous system (increased heart rate, respiratory rate, muscle tone, alertness), metabolic function, and neuroendocrine responses, especially if the separation is prolonged.

At birth, the intrauterine environment is replaced by the external world, where gustatory, olfactory, tactile, postural, auditory, and visual experiences are highly diverse.

Figure 4 - Skin to Skin Method

A newborn's crying is an inevitable but necessary signal. To prevent this stress - A prolonged separation is potentially harmful or "toxic [41], it is essential to help the newborn reestablish close contact with the mother by placing the baby on her chest, face near the breast, protected by a warm, dry cloth. In this position, the newborn regains at least some of the tactile, gustatory, olfactory, and auditory sensations experienced during fetal life.

The mother's skin warmth facilitates thermoregulation. The smell of amniotic fluid is gradually replaced by that of the areola, guiding the baby to the nipple, aided also by the mother's heartbeat and voice. Skin-to-skin contact triggers a neurohormonal cascade in both mother and newborn, forming the basis of shared well-being.

Moreover, skin-to-skin contact promotes visual experiences fundamental to imprinting, which in turn helps activate the emotional bond between mother and newborn (bonding) [56]—a physical and emotional process that supports caregiving and attentive interaction.

Table 2 – From Skin-to-Skin to Kangaroo Care: No Separation

Skin-to-Skin Care

- Recommended for all babies immediately after birth to ensure warmth and well-being.
- Also recommended during the transfer of sick newborns to another health facility.

Immediate Kangaroo Care at Birth

No prior use of an incubator, to maximize the significant health benefits of close contact from birth between a preterm newborn and the caregiver, ensuring they are not separated (WHO 2022).

Intermittent Kangaroo Care

Skin-to-skin contact as much as possible, according to the mother's and baby's condition, once the newborn is stable.
Even if the baby is cared for in an incubator, contact should be gradually introduced each day, for no less than 90 minutes.

Continuous Kangaroo Care

WHO defines Kangaroo Care as early, continuous, and prolonged skin-to-skin contact between the mother and preterm infant.
Care includes breastfeeding, early discharge after Kangaroo Care is initiated at the health facility (FOSA) and continued at home, with adequate support and follow-up for mothers at home.

Additionally, skin-to-skin contact encourages bacterial colonization, important for infection prevention [59], and facilitates early initiation of breastfeeding, its duration, and effectiveness [57,58,60].

Table 3 – Positioning the Newborn on the Chest Using the Kangaroo Method

- Naked, with or without a diaper, placed on the mother's chest in a prone position, with the lower limbs flexed and abducted
- Head turned to the side, covered with a hat, face fully visible, nose and mouth uncovered
- Cover both mother and newborn with a blanket or sheet.

Table 4 – Implementation of the Skin-to-Skin Method at Birth

Enabling skin-to-skin contact between mother and newborn at birth requires:

- A positive and supportive attitude from healthcare providers in the delivery room or operating theatre
- A practical care protocol (guideline) that is shared and implemented by all staff
- Informing and motivating the mother and/or father, preferably before birth

Note: A complete clinical examination of the newborn, if the initial observation shows no signs of emergency, should be postponed until after skin-to-skin contact. Additionally, newborn measurements and essential care (such as prophylaxis for hemorrhagic disease and eye care) can also be performed later, within six hours of birth.

Table 5 – Environment and Skin-to-Skin Care

Ideal conditions

- Ambient temperature between 22°C and 24°C
- Sufficient lighting to observe the baby's color
- Calm and quiet environment

Table 6 – Conditions for Performing Skin-to-Skin Contact in the Delivery Room

- Baby is crying and breathing well
- Baby has good muscle tone
- Mother is healthy, alert, and available
- Delivery room activities compatible with monitoring
- Ability to call for assistance if needed
- Staff available to support the initiation of breastfeeding

Table 7 – Potential Obstacles to the Skin-to-Skin Method

- Risk of hypothermia in the newborn
- Newborn requires a clinical examination
- Mother needs suturing Newborn requires bathing

2.2.2 Contact and Separation in Neonatal Units

It is clear that the long journey toward reducing infant mortality, and more specifically neonatal mortality, relies on the organization of a territorial network providing a continuum of care, starting with prenatal follow-up services and extending to post-discharge follow-up. It is beyond the scope of this chapter to discuss in detail the characteristics such an organization should have or the challenges involved in creating an effective network. Nevertheless, it is central to establish a "hub and spoke" system, with a central referral hospital surrounded by nearby health centers of various types and with differing logistical and organizational capacities, all connected through effective transport systems.

In most low-resource countries, it is important to implement strategies aimed at gradually reducing home births [29,61]. The reality in these countries is highly variable, ranging from peripheral facilities with minimal standard resources and organization for basic care, to hospital centers equipped to handle complicated pregnancies and newborns.

Focusing especially on the latter, there is a clear trend [29,62] to design projects and create dedicated areas exclusively for neonatal care, moving beyond the often-observed reality of newborn services embedded within general pediatric services. Projects for "special" neonatal care units in low-resource countries have been based on optimizing hygiene conditions, as the risk of infection is considered particularly high during the neonatal period.

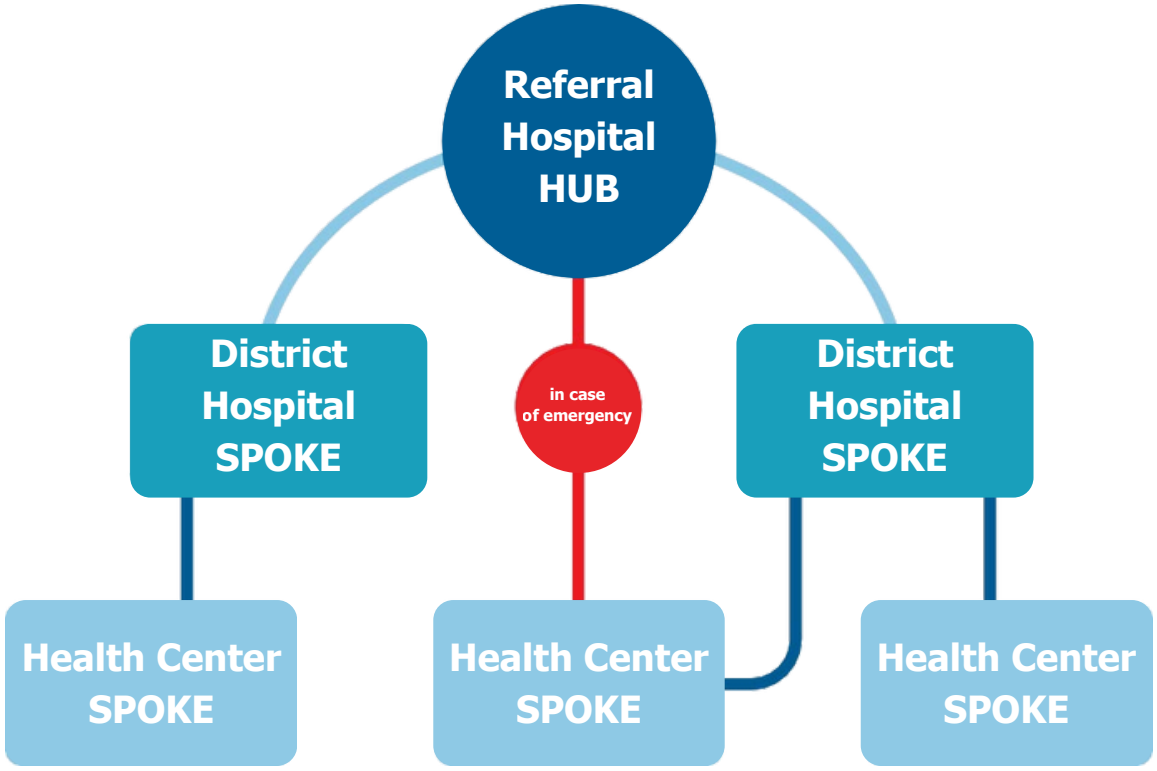


Figure 5 – Hub & Spoke Organizational Model

In practice, neonatal units are generally designed based on the model of intensive care services in high-income countries. The dominant concern with hygiene has led to the concept of isolating the newborn, and therefore separating them from the mother in cases requiring special or intensive care. Creating spacious and well-lit units, with sufficient nurses and doctors as a priority, and technologies adapted to economic and organizational realities, unfortunately remains costly.

The requirement to equip new units with incubators, intended for the care of premature or very low birth weight infants, or sick full-term newborns, is considered central and ideal to ensure effective care. Thus, alongside neonatal services that welcome healthy mothers and their babies immediately after birth, special units have proliferated where mother–infant separation was the prevailing condition. Scientific evidence [23,25,27,28] on the negative impact of mother–newborn separation during the sensitive period, and its potentially adverse consequences on the developmental quality of preterm infants, has motivated the implementation of new strategies in neonatal project design.

Furthermore, the spread of Kangaroo Care from the 1980s–1990s, along with related services, has helped foster a relatively different culture in the management of sick newborns. It highlights the positive role of structural solutions that maximize respect for mother–newborn contact, even in pathological situations [29].

Therefore, spaces for newborn care outside the delivery room or operating room should include:

A. A designated area for mothers who have had a physiological pregnancy and an uncomplicated delivery, with newborns of normal birth weight and normal adaptation to extra-uterine life (postpartum room/maternity recovery room).

A designated area for mothers who have had a physiological pregnancy and an uncomplicated delivery, with newborns of normal birth weight and normal adaptation to extra-uterine life (postpartum room/maternity recovery room).

This area should be close to the delivery room. Healthcare personnel should ensure that skin-to-skin contact is implemented as continuously as possible, that the newborn is covered with dry, sufficiently warm cloths, and that breastfeeding is initiated immediately after birth. Prolonged skin-to-skin contact promotes temperature regulation, respiratory function, metabolic stability (particularly blood glucose stabilization), behavioral self-regulation, and reduces hospital-acquired infections in the newborn. It also increases exclusive breastfeeding rates and the duration of breastfeeding.

The reduction of neonatal mortality in low-resource settings resulting from proper management during the first hours after birth is scientifically validated. The mother is encouraged to care for her newborn herself, with potential support from healthcare staff. Mothers who have delivered via cesarean section can begin caring for their newborn as soon as possible.

B. An area reserved for special or intensive care, if the available equipment, the skill level, and the experience of the healthcare providers make it feasible.

This unit should be located according to the needs of the surrounding population in which the hospital is situated. Space requirements should be calculated based on the number of beds needed [TAB. 8].

For each neonatal bed, an area of 4.5–5 m² should be provided, and similarly, in special care units, sufficient space should be allocated to allow the mother to remain as close as possible to her baby, subject to clinical requirements. A reclining chair or an easily cleanable armchair allows the mother to stay next to the heated cot or incubator when such technical supports are necessary. In this way, the mother is gradually encouraged, according to the timing and routines linked to clinical needs, to take care of her baby under the guidance and psychological support of the healthcare providers. For this purpose, the optimal space for this setup appears to be around 9–10 m².

Each “mother–newborn” station should also be able to provide some privacy at certain times of the day (for example during breastfeeding sessions), which may sometimes be necessary for religious or cultural reasons.

C. An area reserved for Kangaroo Care (KC)

The characteristics of the areas to be made available for Kangaroo Care (KC) are described in a specific chapter. Here, it is useful to recall that each hospital facility should be able to organize a dedicated space for KC, focused on the care of newborns weighing less than 2,500 g and without significant clinical problems (i.e., “stable” newborns), but it can also be used in various clinical situations.

The space allocated for KC depends on the number of deliveries and the structural characteristics available. Generally, an area of approximately 10 m² should be provided for each mother/newborn pair.

It should also be noted that the implementation of KC includes shared spaces for meal consumption and activities to support mothers (such as small crafts) on days primarily dedicated to newborn care. For these details, see the specific chapter.

Table 8 – Calculation of Spaces for a Neonatal Unit, Beds for “Special” or “Intensive” Care

Calculate the number of births per year: for approximately 2,000 births per year, 8 spaces are planned for newborns (i.e., 3 per 1,000 births), to which 2 additional spaces should be added for those transferred from outside. Preventive isolation is preferable, given the higher risk of infection.

These numbers must, of course, be adapted to the reality of each hospital.

KANGAROO CARE AS SUPPORT FOR NEWBORN DEVELOPMENT

3. Environmental Stress

3.1 The Environment Surrounding the Newborn

Separation between the mother and the newborn is a cause of stress. This stress can take the form of “toxic stress,” meaning it is harmful to development. Similarly, the interaction between a newborn and the care environment can cause stress that is detrimental to brain development. The concept of “toxic stress” was introduced in the international literature about a decade ago, in reference to potentially stressful conditions in neonatal care units in high-income countries.

Toxic stress is defined as repeated and prolonged stress caused by an unpleasant event, without the presence of a caregiver who can buffer it [24,27,48]. This buffering role is naturally fulfilled by the mother but can also extend to anyone who takes care of the newborn. Toxic stress must be distinguished from physiological stress or “tolerable” stress, based on intensity, duration, and its different impact on brain development.

At first glance, neonatal care environments with low technological resources in low-income countries may seem non-stressful. However, the gradual increase in technological equipment (infant warmers, pulse oximeters, infusion pumps, oxygen concentrators), often equipped with alarms, can be accompanied by noise pollution, potentially harmful especially for the most immature infants, considering the late maturation of auditory pathways. In utero, noise levels do not exceed 45 dB, whereas in neonatal intensive care units, levels can easily reach 80–90 dB.

The stressful role of visual stimuli is also related to the degree of immaturity of the newborn. Similar to the maturation of auditory pathways, visual pathways develop slowly and reach full maturity only in the final months of gestation. Consequently, a preterm newborn (especially before 32 weeks) is highly susceptible to visual stress, particularly if the eyes are not protected from direct light (for example, during certain procedures, or if the environment is overly bright or lacks a natural day-night light cycle) [42,64,65]. Incubators and various types of heated cradles can meet a real need in certain situations. However, the use of these devices should be limited as much as possible, due to well-known economic reasons, maintenance issues, and also because of the isolation to which the newborn is inevitably subjected. Caregivers should be aware of the potential harm caused by prolonged isolation in a closed cradle, especially when its use is not critically justified. A newborn isolated in an incubator during highly stressful situations (for example, during a blood draw) cannot benefit from the comforting and containment interventions of the mother or nurse.

Moreover, there is a condition of sensory deprivation [66]. A newborn in the intrauterine environment can experience a range of sensory inputs (taste, smell, touch, proprioception) in correlation with the mother's dietary, motor, and emotional experiences. In contrast, a newborn of the same gestational age placed in an incubator has fairly limited sensory experiences, as they cannot perceive the variations in odor and flavor of the amniotic fluid, nor the tactile and movement experiences that the amniotic sac naturally provides.

The organization of assistance can also become a source of stress if the mother is not actively involved in routine care practices. Work rhythms in settings typically characterized by a shortage of nursing staff may prevent the necessary consoling interventions to regulate the newborn's behavior and may not always respect the newborn's sleep/wake cycles.

Similarly, pain [67,68,69] resulting from various diagnostic procedures (as well as hasty or poorly executed hygiene practices) can be a source of stress if not properly managed. It is therefore extremely important to provide this knowledge to healthcare personnel involved in the care of preterm newborns. Care providers must be aware not only of the negative impacts of practices that are inattentive to the needs of a brain in its most crucial developmental phase, but also of the potential developmental benefits that can result from practices aimed at minimizing, if not entirely avoiding, stressful procedures.

Among the practices designed to provide sensory experiences that support development, postural care occupies an important place.

Table 9 – Main Benefits Provided by Postural Care

- Promote respiratory function, digestion, and reduce gastroesophageal reflux
- Improve coordination, postural stability, sudden movements, and extended postures
- Reduce stress caused by routine care maneuvers, even when not painful
- The flexed and adducted posture of the whole body encourages limb movements toward and beyond the midline, tactile body experiences, and hand-to-mouth and hand-to-eye activity

Adequate postural care [70,71,72] requires the most individualized approach possible. The choice of position should be adapted to the physiological function that needs support at that moment, whether neuromotor, respiratory, or digestive. In general, the choice should ensure the newborn's highest possible level of well-being and should not be limited to a simple alternation of positions.

Specifically, the prone position (tummy position) promotes respiratory function, improves lung condition, and also reduces regurgitation (in cases of significant gastroesophageal reflux, it is useful to elevate the trunk by about 30°). When in the prone position, folded cloths can be placed under the abdomen to create a thickness that allows shoulder flexion and abduction. This position is therefore particularly recommended for newborns with respiratory problems.

The supine position (lying on the back) facilitates care interventions and is obviously necessary in cases of umbilical catheterization.

The side-lying position helps maintain symmetry of the head relative to the trunk and aligns the limbs toward the midline, promoting hand-to-mouth contact and thus the consoling use of the hand. For its role in neuromotor development, it is particularly useful after overcoming any critical phase (this position is not recommended in cases of respiratory problems), especially when physical separation from the mother must be prolonged.

Postural care is complemented by the use of “nests.” A nest is a soft, welcoming concavity created by appropriately shaping rolled soft cloths, forming higher or lower edges depending on the size of the premature infant. The nest can be placed both in an incubator and in a bed, providing an environment similar to the uterus, facilitating the flexed posture and smooth movements, while limiting trunk extension and sudden, extended movements.

Figure 6 – Example of the “NEST”

It should be emphasized that postural care must always be individualized according to the well-being or stress signals provided by the newborn, with the understanding that a dynamic assessment is necessary. Nests and positioning can be adjusted multiple times throughout the day.

Swaddling, or "wrapping," is a method of enveloping and containing the newborn in a flexed position with the hands near the face. This is a simple practice that can be taught to parents. It can be useful for reducing stress experiences, mainly related to movement (such as during weighing), performing certain procedures (for example, during the first baths), during painful maneuvers, and also to facilitate feeding. In general, wrapping provides greater postural support stability, similar to the nest, holding, and handling techniques, which will be briefly discussed below.

"**Wrapping**" is done using a square, soft cloth. The baby is placed on the cloth, ensuring that the upper and lower limbs are flexed and the hands are close to the face and mouth. In this position, the baby is wrapped first on one side and then the other, without wrapping too tightly. The head should remain partially free while the shoulders and neck are well supported by the fabric.

Figure 7 – Example of "Wrapping" © Amahoro ONLUS

"**Handling**" refers to the correct use of gestures aimed at reducing negative experiences when the newborn is manipulated, promoting stability and consequently limiting stress that may accompany movements involving the baby. When moving a newborn (from the incubator, bassinet, or when interrupting contact with the mother, for example, to perform hygiene procedures), attention must be paid to the signals the newborn communicates through body language. Signs of circulatory instability (mottling, color changes, etc.), tremors, jerky movements, or fanned-out hands indicate a stressful situation and should prompt adjustments in handling: better support, gentler movements, and allowing time for self-regulation.

"**Holding**" refers to a method that consists of limiting the movements of the body, achieved through the stillness of the hands and body of the caregiver. This approach represents an important means of communication that caregivers should practice and demonstrate to parents. During holding, the hands should not be pushed or rubbed, but rather make gentle, affectionate contact, allowing the newborn to nestle against the supporting hand, stabilize vital signs, and regain balance—especially if it is precarious due to exposure to often inadequate stimulation.

Figure 8 - Holding © Amahoro ONLUS

Immersion **bathing** is often a source of destabilization, but with proper handling, it can become an opportunity for well-being. As such, it should be carried out separately from painful procedures and, whenever possible, with the active participation of the mother. The technique should first pay attention to the ambient temperature and the newborn's temperature, who, in proportion to their degree of immaturity, is at risk of hypothermia. It is recommended to wrap the newborn in a cloth ("wrapping") before immersing them in water up to the chest. The towel should be gradually unfolded, ensuring that the baby remains relaxed. In the water, the baby should be moved slowly, supporting the trunk and head with one hand and the lower limbs with the other. Even when taking the baby out of the water, care must be taken to avoid sudden or rapid movements, wrapping the baby in a dry—and if possible, warm—towel.

Figure 9 - Bathing © Amahoro ONLUS

Weighing the newborn also represents a potential source of stress; before being placed on the scale, the baby should be wrapped in a cloth to stabilize the trunk, head, and limbs. The caregiver (or the mother) can use their own body, in addition to their hands, to support and contain the newborn during the proces.

Figure 10 - Weighing © Amahoro ONLUS

Parents should be actively involved in organizing the environment around their newborn. This begins with proper information and communication provided by the healthcare staff, who should guide them in checking ambient light and noise conditions, and in offering appropriate olfactory, gustatory, and postural stimuli. It is the responsibility of caregivers to help parents understand the purpose of certain procedures and their value in reducing stress experiences while providing opportunities for well-being.

The newborn perceives the presence of the mother and thrives on her love to grow and develop. Feeling and touching are experiences that foster knowledge, trust, and harmony, thereby strengthening their emotional bond. When physical contact is not yet possible, the mother can communicate with her baby through her voice and gaze. Simply being close to the newborn, even just observing, allows parents to learn the baby's body language and recognize signs of stress and well-being [71].

Table 10 – Signs of Self-Regulation/Well-Being and Signs of Stress

Signs of Self-Regulation/Well-Being

- Regular, modulated breathing, no pauses
- Regular color, without marbling
- Spontaneous movements of arms, legs, and trunk
- Ability to maintain flexion of arms and legs toward the midline of the body
- Legs successfully seeking the edge of the nest (if in an incubator or crib) and pushing against it
- Sucking behavior
- Ability to bring hands to the mouth, grasp, and cling

Stress signs

- Irregular, slow, or rapid breathing, with pauses between breaths
- Pale, mottled, grayish, or cyanotic color
- Tremors, jerky movements
- Visceral signs: regurgitation, vomiting, hiccups, gurgling
- Frequent extension movements of arms and legs
- Frequent body contortions and arching
- Fingers fanned out, sudden abduction of arms and legs
- “Frozen” in extension
- Agitation (crying), frequent yawning, sneezing, grimacing

3.2 Pain Management

Pain [67,68,69] is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Until the 1980s, newborns underwent surgical procedures without anesthesia, as it was believed that they could not feel pain due to the immaturity of their nerve pathways. However, based on later studies [74,76], it was demonstrated that newborns do perceive pain — in fact, even more intensely than adults — and that preterm newborns experience it even more than full-term infants.

As shown in Figure 11 below, harmful stimuli applied to the skin and tissues activate receptors located at the peripheral endings of neurons in the spinal cord. These receptors can also be stimulated by mechanical, thermal, or chemical factors. It has been shown that these receptors appear in the fetus as early as the 8th week of gestation and become fully functional by the 20th week. From the spinal cord, pain is transmitted to the thalamus, and then, through a third relay, from the thalamus to the cerebral cortex — the area responsible for pain awareness. Thus, scientific evidence [72,73,74] shows that the brain is already capable, from the second trimester of pregnancy onward, of transmitting and processing painful stimuli in the fetus.

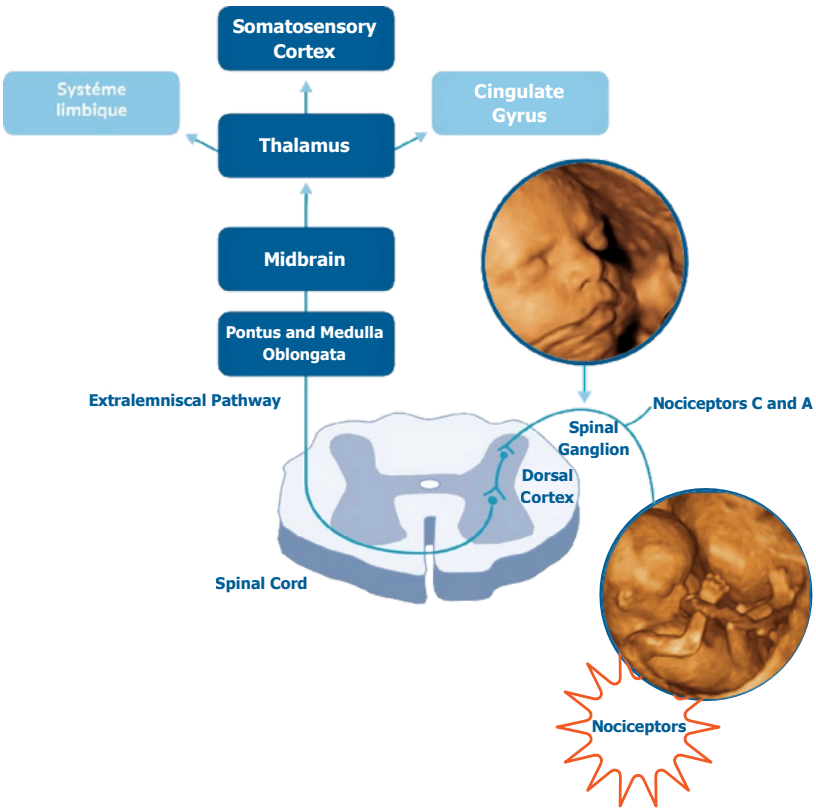


Figure 11 - Pain pathways in the fetus and the newborn

Paradoxically, newborns perceive pain but cannot control or alleviate it, as their inhibitory systems are not yet effective and are inversely proportional to gestational age. It is therefore an ethical — and even biological — duty, for the well-being of the individual, to eliminate unnecessary pain and reduce the effects of painful procedures, even if the newborn is unable to express their pain. From birth, the physiological and behavioral effects of painful stimuli are evident.

During a heel prick or intramuscular injection, for example, the newborn exhibits an increase in heart rate and respiratory rate, a decrease in oxygen saturation, greater motor and facial activity, and prolonged crying. It is well known that excessive and prolonged exposure to pain quickly leads to negative effects such as increased catecholamines and cortisol, hyperglycemia, hyperlactacidemia, and reduced insulin levels [77].

This response, which is initially an adaptive reaction, can lead to serious complications if it persists over time. In preterm newborns, for example, prolonged activation of stress responses increases the risk of intraventricular hemorrhage due to rapid fluctuations in cerebral blood flow (78).

Newborns subjected to repeated pain or stress

STRESS

↓

The body's adaptive responses to external or internal stimuli

General Adaptation Syndrome

- Alarm phase (stage reaction)
- Resistance phase
- Exhaustion phase

Learned hopelessness

In the long term, studies have shown [74,75,79] that repeated and prolonged exposure to pain during a period of maximal brain plasticity can affect the development of the pain system itself, causing hyperalgesia (increased perceptive response to stimuli), allodynia (pain triggered by normally harmless stimuli), and central sensitization (altered sensitivity around the injured area), as well as impaired cognitive and behavioral development resulting from a reduction in the volume of specific brain regions. The infants at greatest risk are the most immature or critically ill newborns—precisely those who, during their first days of life, are subjected to the highest number of painful procedures.

In the premature baby, these signals are necessarily much more subtle, as facial expression is less developed (it matures over time) and also less specific, since they can be similar to signs of other conditions such as early sepsis. It is therefore essential to be even more attentive to their detection and differentiation. When pain is repeated, there may also be an exhaustion of the response, and the newborn may reach what is called “learned despair” [74,80] [Fig. 12].

Itis possible to manage a newborn’s pain by implementing safe and effective non-pharmacological strategies. The mother and father play a fundamental role inthis.

While an adult has many words to express the sensation of pain, a newborn has none—but they do have other ways of communicating, which we must interpret, particularly behavioral signals.

3.2.1 Communication of Pain in the Newborn

The signs:

- Hormonal: increased catecholamines and cortisol.
- Physiological: increased heart and respiratory rate, decreased oxygen saturation ($SatO_2$), increased blood pressure.
- Behavioral signals: facial responses, such as frowning, eye blinking, deepening of the nasolabial fold, etc.
- Motor responses: arching of the back, arm extension, flexion and extension of the legs, tremors, fanned hands.
- Altered sleep–wake patterns: high-pitched ("siren-like") crying.

In premature infants, these signs are necessarily much more subtle, as facial expressiveness is limited (it will mature over time), and they are also less specific because they can be common to other conditions, such as early sepsis. It is therefore essential to be even more attentive in recognizing and differentiating them [74,81,82].

When pain is repeated, there may also be exhaustion of the response, and the newborn may reach what is defined as "learned despair" [74]. It is possible to soothe a newborn's pain by implementing safe and effective strategies without using medication. The mother and father play a fundamental role in this [74,85,86,87].

Above all, it is important to perform only truly necessary interventions and to schedule them when the newborn is in the best possible condition (quiet awake state, away from feeding, unless the feeding itself is part of the analgesic intervention) and, if possible, in the presence of a parent.

How to limit pain?

Painful procedures should be avoided during sleep. If a painful procedure is performed while the newborn is still asleep, the pain is more intense because it is unexpected. Interventions targeting the environment are essential, as already mentioned: age-appropriate lighting, tolerable noise levels, gentle restraint or swaddling, and soft touch help reduce stress and pain responses. Gentle strategies act quickly to decrease pain. Their mechanisms of action include positive sensory stimulation [86,87] and distraction. Gentle interventions to be applied before and during the procedure, which are effective in both term and preterm newborns, include [74,89,90,91]:

- 24% sucrose solution
- High-concentration glucose solution (20–30%)
- Expressed breast milk

Even more effective are multisensory stimulations, which combine several different positive stimulations according to the "Gate Control" theory [86,87]. Before reaching the brain, the pain signal encounters "gates" along its pathway that modulate it by altering its intensity. If pleasant sensory stimulations occur before the painful stimulus, they can "close the gate" to pain.

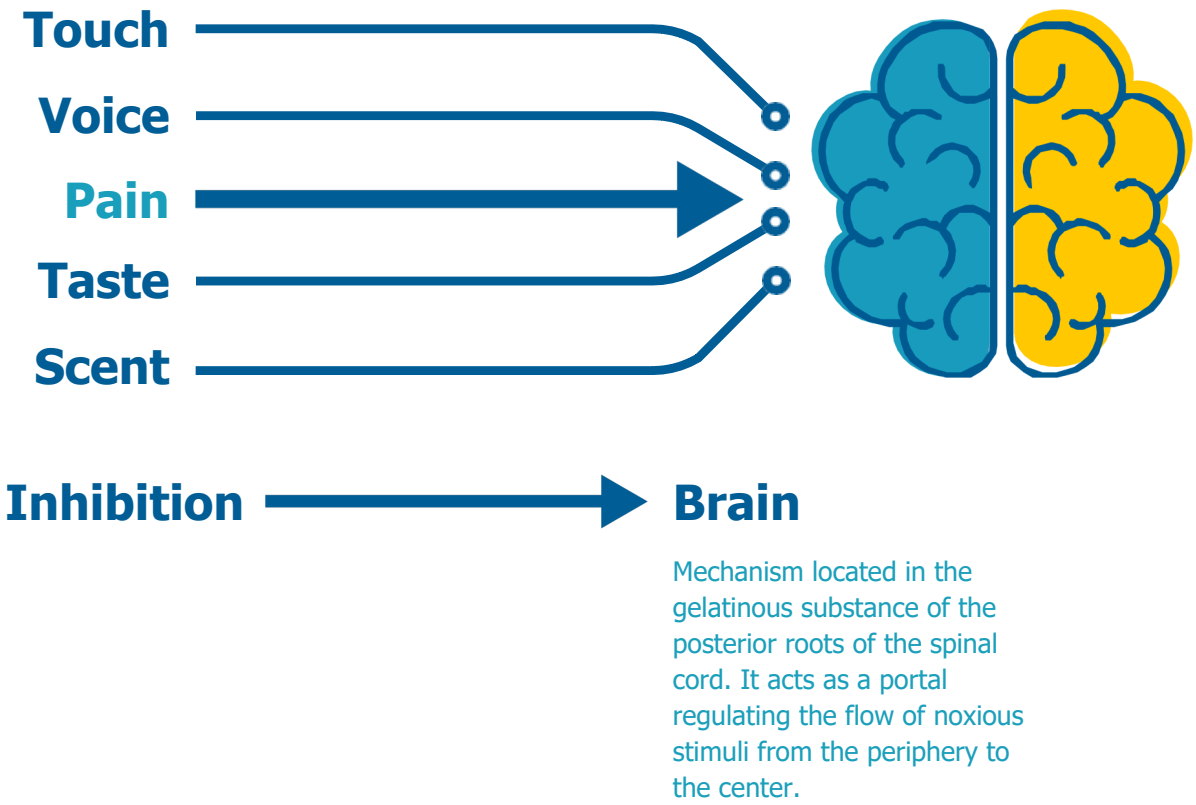


Figure 13 - Gate-Control Theory (74,92)

This is how, for example, gentle touch, massage, as well as simple contact, the mother's voice, her scent, and sweet-tasting substances work. All of this is particularly effective during breastfeeding.

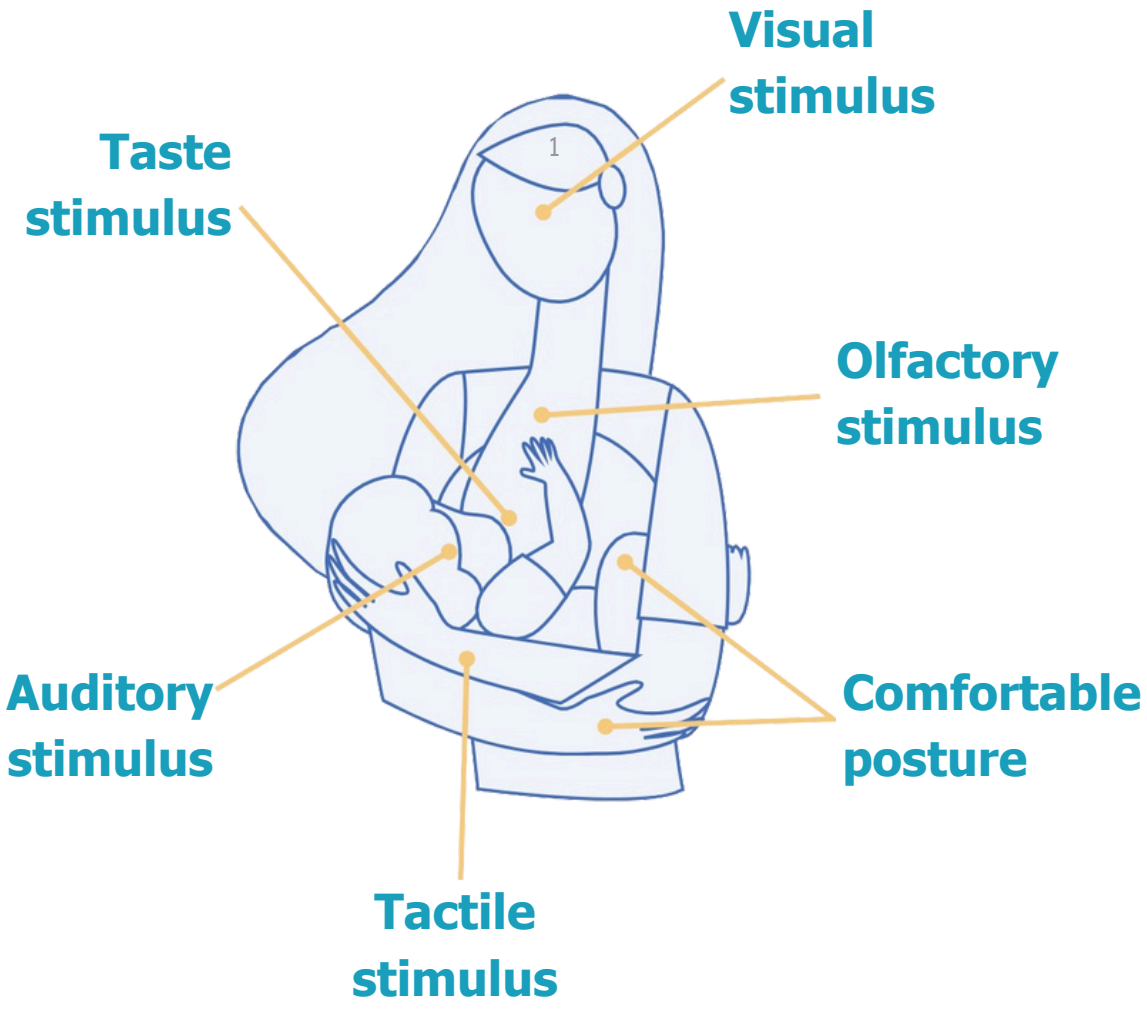


Figure 14 – Multisensorial stimulations

These non-pharmacological interventions have been tested [89,90,91] and validated for all painful procedures to which a newborn is subjected, especially those involving skin breaking, such as heel pricks, intravenous or arterial injections, and lumbar punctures.

We have come to understand that just as we monitor heart rate, respiratory rate, oxygen saturation, and temperature, it is also necessary to assess the presence, absence, or intensity of a newborn's pain—particularly during painful procedures—and to document it in the medical record, just like any other vital sign.

Several valid assessment scales have been developed for this purpose [74,93,94]. They are specifically based on behavioral and physiological signals [see Table 10].

Parameters ↓ Score →	0	1	2
Facial expression	Relaxed	Grimace	
Tears	Absent	Moderated	Vigorous
Type of respiration	Regular	Altered	
Arm	Relaxed, contained	Flexed, extended	
Legs	Relaxed, contained	Flexed, extended	
State of alertness	Asleep/Awake	Agitates	

Tab 11 - NIPS scale with 1 physiological indicator and 5 behavioral indicators

NIPS score ≥ 4 indicates mild to moderate pain. Maximum score = 7 indicates the highest level of pain.

Pharmacological analgesia can be considered by administering paracetamol at the following dosages:

Preterm 28–32 weeks (corrected age):

- First dose: 20 mg/kg
- Then 10–15 mg/kg every 8–12 hours as needed
- Maximum: 30 mg/kg/day

Preterm >32 weeks and term newborns:

- First dose: 20 mg/kg
- Then 10–15 mg/kg every 6–8 hours as needed
- Maximum: 60 mg/kg/day

3.3 The Importance of Infant Sleep
Stress Caused by Sleep Disturbances

Sleep is a very complex process whose progressive organization during fetal life — and, in the case of premature birth, thereafter — is associated with long-term quality of life, as it influences developmental potential in cognitive, emotional, and relational domains [75, 95, 96, 97].

Sleep is not merely the absence of wakefulness; it is an active process during which brain activity performs fundamental functions for neurophysiological development. Sleep plays a significant role in brain plasticity and is involved in the maturation of sensory systems, as well as in organizing the information acquired by the brain during wakefulness and consolidated during sleep — that is, in the process underlying memory and learning [71, 97].

The duration of the sleep–wake cycle, the amount of nighttime sleep, and the organization of sleep states are therefore associated with cognitive abilities, exploratory behavior, and emotional regulation. Sleep states gradually become distinguishable as development progresses: each state can be identified through neurophysiological studies but also by observing the newborn's behavior during sleep [Tab. 12].

Quiet sleep	Active sleep
• Regular breathing • No eye movements under the eyelids • No movements except for few brief jerks • Possible sucking movements or "smiles"	• Irregular breathing • Rapid eye movements (REM) under the eyelids • Low motor activity with brief jerks or possible "twitching" movements

Tab 12 - Comportement du nouveau-né pendant le sommeil

There is clear scientific evidence [97, 98, 71] that the duration and continuity of sleep in preterm newborns are associated, in developmental scales during the first year of life, with better outcomes when sleep is more organized and less disturbed. Protecting sleep is therefore one of the interventions that contribute to improving long-term prognosis—and consequently the quality of life—of preterm and, more generally, all fragile newborns.

The relationship with immunological potential and hormonal and autonomic regulation is also significant: insufficient or disorganized sleep can reduce a newborn's defense capacities, increasing the risk of infections. Achieving adequate maturation of sleep cycles corresponds to better respiratory stabilization [9].

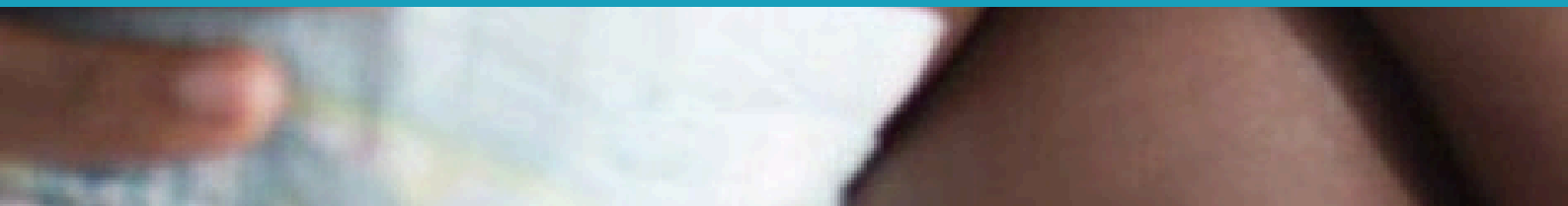
It is not surprising that sensory stimuli play a major role in shaping sleep organization. Light, in particular, regulates the sleep–wake alternation through a pathway that extends from the retina to the hypothalamus, where the "biological clock" governing the circadian rhythm resides [99, 101].

Solid scientific evidence [102, 103] also confirms that mother–infant contact (optimal in skin-to-skin care) is a key factor in promoting sleep. The environment—in the broadest sense of the term—in which a preterm newborn is cared for therefore has a major influence on sleep protection.

Table 13 - Practical recommendations for organizing care to protect the baby's sleep

1. Raise awareness among healthcare providers and parents about the developmental importance of sleep; help them understand that the sleep–wake rhythm should be respected as much as possible by adapting care interventions to protect sleep rather than following a rigid work routine based on fixed schedules. Whenever possible, several interventions should be grouped together: certain hygiene or feeding practices can be postponed if the infant is asleep.
2. Care practices should be organized to ensure at least 90 minutes of uninterrupted sleep, allowing for better structuring of sleep states. Organize the care environment as effectively as possible:
   a. Limit light and noise in general.
   b. Provide curtains (compatible with hygiene requirements) for windows.
   c. If possible, create a low-light area to accommodate the most fragile preterm infants, especially those with a postconceptional age below 32 weeks.
   d. Lighting conditions should ensure, especially after 32 weeks postconceptional age, an adequate day–night rhythm.
   e. If incubators are used in the neonatal unit, they should be covered with dark-colored fabrics on both the top and the sides.
   f. The use of heavy covers can also help reduce the noise transmitted from the environment inside the incubator.
3. Place newborns in skin-to-skin contact with their mothers as often as possible: the sensory experiences associated with this position play a key role in maturation across several domains.
4. The use of open or closed thermal cribs should be minimized; however, when their use is required for clearly defined medical reasons, newborns should be properly contained with sheets and blankets ("wrapping," see previously) and placed in nests that are as individualized as possible.

KANGAROO CARE AS SUPPORT FOR NEWBORN DEVELOPMENT



4. Involving the Mother before Skin-to-Skin Care

Scientific evidence [9, 15, 19, 23, 24, 26, 27, 28] on the importance of physical contact between mother and newborn, as well as on the potential harm caused by separation, leads us to rethink care strategies and to reconsider how neonatal services are organized. Skin-to-skin care (SSC) has been instrumental in highlighting the essential role of early skin contact, recognizing mothers as key players in the care of low birth weight infants and those in unstable or even critical clinical conditions. Beyond SSC, the recommendations developed by WHO [29, 32] and other international organizations have increasingly emphasized the promotion of initiatives aimed at fostering the mother's active presence alongside her newborn and reaffirming her caregiving role—previously delegated to nursery staff or nurses. The mother's assumption of this renewed role in caring for her baby, which reaches one of its highest expressions through SSC, has great emotional value. It restores dignity to mothers who may have felt "unworthy" of caring for their own babies and reestablishes the foundations for a healthy emotional bond. Early separation of newborns from their mothers has proven deeply detrimental to the infant's ability to regulate biological rhythms (temperature, sleep–wake cycles) and to develop appropriately at behavioral and neurological levels. Furthermore, the negative effects of separation extend to parents and families who, by culture and tradition, have never experienced separation from their babies and often find hospitalization difficult to accept.

Being unable to act as parents during the newborn's stay in the neonatal unit leads to a poor understanding of the infant's needs [27, 28]. Among parents, separation from their baby increases depressive and anxious symptoms and may trigger post-traumatic stress disorder and other conditions related to psychological stress. These symptoms can further impair the parent–infant relationship, hinder social and emotional development, behavioral and cognitive functioning of the baby, and increase the risk of problematic parenting (abandonment, neglect, or maltreatment) after discharge. Studies [104, 105] conducted in intensive care units in higher-income countries show that family involvement, on the other hand, is associated with a range of positive long-term physical, cognitive, and psychosocial developmental outcomes. Integrating the family into the healthcare team has demonstrated multiple benefits for both parents and infants. Mothers of low birth weight babies report less stress and greater confidence, while infants show higher discharge weights and increased breastfeeding rates. The same studies [106] indicate that parents who are able to interact with their babies experience less stress during the neonatal stay, lower rates of depression and anxiety, and shorter hospitalizations.

Taken together, these findings provide strong support for interventions that reinforce the parental role and guide mothers and fathers in their first interactions with their babies.

To involve parents in the care and support of hospitalized newborns in neonatal units, strategies often referred to as Family-Centered Developmental Care (FCDC) can be employed. FCDC recognizes the family as an essential member, partner, and collaborator in the care and support of the newborn, aiming to optimize family relationships, including those directly involving the newborn throughout their life. One of the main goals of FCDC is to minimize the potential negative effects that illness may have on parent–child interactions. This approach requires a partnership between healthcare providers and parents, whose importance for both the newborn and the mother must be acknowledged and gradually strengthened through hospital team training. The goal is to recognize the family's role from birth. The mother should be supported by staff in providing daily care for her newborn, with timing and methods that are necessarily individualized, based on the infant's clinical condition, the parents' cultural background, and the mother's emotional experience of having a "different" baby than expected.

In daily practice, the alliance between caregivers and parents should be concretely implemented through a gradual pathway that is necessarily tailored to the mother's cultural and emotional characteristics, as well as her health conditions. This pathway must also take into account the organization of nurses' and physicians' work, as well as the logistics of the neonatal unit.

The mother's psychological experiences

The attachment process, which becomes fundamentally important for a child's development after birth, begins to unfold throughout pregnancy. Progressive body changes ("the growing belly") and, above all, the perception of fetal movements provide the mother with confirmation of a new life within her, gradually perceived as separate from herself. As the pregnancy progresses, the woman begins to form fantasies about what her baby might be like, attributing personality traits and values, and especially in the third trimester, she tends to develop "primary maternal preoccupation" - that is, a growing capacity in her mind to anticipate and respond to her baby's future needs.

In the case of preterm birth, this process is interrupted or lost. The "fantasized" baby is replaced by a newborn very different from what was imagined-too small and too fragile. The resulting "grief" is often difficult for the mother to accept and process. In low-resource settings, the perception of the baby's fragility is amplified by the mother's awareness of living in an environment lacking protection and resources, making it even more challenging to care for a newborn so different from the one she expected. The mother of a preterm infant thus experiences a highly stressful situation, which also interacts with family and social traditions that often attach negative meanings to preterm birth. It follows that it is extremely important to organize care that promotes attachment between mother and newborn and reinforces the mother's awareness of the fundamental importance of her role.

4.1 Stages of Maternal Involvement

Step 1 – Welcoming and supporting the family

If the newborn is in an incubator or a heated open crib, receiving supplemental oxygen, monitored by devices, or has a nasogastric tube, it is important to explain to the mother the purpose and significance of these interventions. In many situations, it is also appropriate to reassure the mother (and the father, if present) about the absence of danger associated with the use of equipment that is generally unfamiliar or outside their traditions. This approach helps overcome the natural fear linked to a lack of knowledge about the types of care required for a preterm or low birth weight newborn and fosters trust in the caregivers initially responsible for the baby.

Figure 14 – Welcoming and supporting the family © Amahoro ONLUS

It is also useful to introduce the concept of the preterm newborn's relational capacities, emphasizing the importance of providing attentive contact to promote well-being rather than stress, and consequently organizing a physical and human environment that supports this.At the same time (always considering the mother's cultural and emotional background), information should be provided on danger signs, such as skin color changes, respiratory activity, or abnormal movements. If possible, explanatory videos can be used to support this teaching

Step 2 – The importance of breastfeeding

It is evident that the mother places breastfeeding at the center of her maternal role. Breast milk significantly reduces complications related to prematurity, including late-onset sepsis, retinopathy, bronchopulmonary dysplasia, and necrotizing enterocolitis. In cases of preterm birth or when the newborn faces health challenges, the mother's potential feelings of inadequacy can jeopardize milk production and the attainment of sufficient daily milk supply.

It is therefore essential that the mother's role is strongly supported by healthcare providers, who must be well aware of the factors that hinder or facilitate breastfeeding, ensuring that all preterm infants receive breast milk and enabling the mother to become autonomous as soon as possible in managing her own baby's feeding.

Nursing support should take into account the mother's difficulties, providing clearly defined technical guidance on breastfeeding practices. The goal of this approach is to make the mother self-sufficient in managing her child's feeding as early as possible. Specific recommendations are outlined in the diagram below:

DIFFICULTIES

Regarding the mother:

- Medical conditions that may have caused preterm birth
- Stress, anxiety, pain, fear, insecurity
- Lack of skin-to-skin contact with the baby at birth

Related to the facility:

- Organization of the unit that does not allow the mother to be close to her baby and initiate skin-to-skin contact
- Skills and competencies of the healthcare staff
- Insufficient dedicated personnel

FACILITATORS

- Always communicate the baby's condition to the mother
- Encourage and support her
- Explain the importance of her breast milk
- Promote contact with her baby as soon as possible
- Assist her in expressing colostrum within 3 hours after birth or as soon as possible
- Inform her that milk should be expressed at least 7 to 8 times per day, including at least once during the night
- Always empty both breasts after each feeding
- Achieve and maintain a milk production of at least 500 ml per day by day 14 postpartum and until the baby is able to breastfeed directly
- Support the mother in facing psychological and technical challenges

Due to issues related to prematurity—particularly low muscle tone, difficulty coordinating sucking/swallowing/breathing, and frequent bradycardias, apneas, and desaturations—a baby-led feeding approach is often not possible, even several days after birth. If the newborn is very small and immature, it is necessary to support them with expressed breast milk administered via gavage, carefully measuring the amount of milk per feed. Nursing support is essential in managing the nasogastric tube if required, as parents may initially resist its use if the reasons are not clearly explained. Although nasogastric tube insertion is a nursing procedure, the mother should be involved in certain steps—for example, securing the tube to the skin at the end of the procedure or holding the syringe containing the milk in the correct position.

During this feeding method, it is recommended to position the baby with their nose and mouth near the nipple, so that they can gradually begin to lick and taste the mother's milk, thus experiencing their first gustatory and olfactory sensations. A helpful encouragement can be to express a few drops of milk directly into the baby's mouth.

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Step 3 – Maternal involvement

Another area of maternal involvement is in the newborn's daily hygiene practices. These tasks are normally carried out by the nurse, but it is also appropriate for the mother to be gradually involved, even if the newborn is in an incubator or crib.

To begin, hygiene measures will be explained (handwashing, bare arms at least up to the elbows). The mother will first observe the nurse performing the procedures, and then she will be guided to carry out the procedures independently. The importance of focusing on minimizing stress and preventing hypothermia will always be emphasized. If the newborn is in an incubator, the mother should be shown how to safely position and contain the baby, participating in creating the "nest" or "cocoon," or learning how to use "wrapping." As usual, observation of the nurse's work comes first, followed by the mother gradually assuming an active role.

The mother can also be progressively involved in weighing the newborn. This procedure should take into account general principles, including protecting sleep (weighing should not be done at fixed times but in accordance with the sleep–wake rhythm), correct postural support, and proper handling. Medication administration remains a nursing responsibility; preparation, dosing, and timing are tasks that do not fall to the mother. However, in the period before discharge, the mother can take an active role in administering oral medications. It is essential that she achieves sufficient autonomy before leaving the hospital if the newborn still requires ongoing therapy.

KANGAROO CARE AS SUPPORT FOR NEWBORN DEVELOPMENT

5. Barriers to the Implementation of KC

Kangaroo Care (KC) is increasingly being adopted both in developed countries and in low-resource settings. Its implementation is supported by growing scientific evidence demonstrating benefits in reducing neonatal mortality in the short, medium, and long term for low birth weight and preterm infants. This is consistently highlighted in the work of WHO, several governments, scientific societies, and various international organizations involved in neonatal assistance improvement projects. The “Every Newborn Action Plan,” published by WHO in 2014, is part of a broad program promoting the adoption of KC, with the ambitious goal of providing KC to 75% of newborns weighing less than 2,000 g by 2025. However, this target does not appear close: adoption of KC remains uneven. Challenges are linked to obstacles at the level of health policies, the information and training of healthcare providers, the cultural context of the populations involved, and the psychological state of each mother.

These barriers to the dissemination and implementation of KC can be found both inside and outside hospital structures. They may also occur within or outside neonatal intensive care units.

5.1 Barriers outside Hospital Structures

The first barrier lies in the fragmented knowledge of KC benefits among health authorities, both at the central and peripheral levels. Although the advantages—particularly in reducing neonatal mortality and morbidity, as well as the favorable cost–benefit ratio of these care practices—are increasingly recognized, understanding the principles and benefits of KC is a prerequisite for its widespread adoption. Where health authorities have actively supported the implementation of KC, outcomes are consistently more encouraging. Information campaigns and training are critical, involving healthcare and administrative staff from central to community levels. Public awareness initiatives are also essential, especially in communities where adherence to local customs and traditional medicine practices may pose obstacles.

A major barrier is the overall inequality and insufficiency of neonatal care units in many countries, where births often still occur at home or in inadequate health facilities, or where newborn weight cannot be determined accurately, significantly limiting the identification of candidates for KC. Even when neonatal weight can be measured, the possibility of transferring newborns to centers where KCV is practiced is n ot always present.

Transfers can later be hindered by the mother herself, as being far from home makes access to food supplies difficult, often only sporadically provided by the hospital.

Another barrier is distrust of an unfamiliar hospital, either because it is perceived as “distant” or, unfortunately, due to previous experiences of poor performance. The dominant role of the male figure may also pose an obstacle, as he may not accept the separation of his partner from home. From an anthropological perspective, cultural perceptions regarding prematurity or low birth weight (sometimes referred to as “rat-size”) in certain populations—often associated with a very low chance of survival or blamed on personal or familial faults—can further reduce the motivation of the mother and family to commit to KC.

The subsequent phase of KC, following hospital discharge, faces obstacles within the community, particularly difficulties in connecting the hospital with the village or remote area, whether physical (distance) or cultural. While geographic challenges may be difficult to overcome without a transport system, cultural barriers can be mitigated through extensive information campaigns that go beyond the hospital setting. Only the intervention of healthcare providers and community health workers can ensure acceptance of KC monitoring procedures—such as weight checks, breastfeeding guidance, and observation of danger signs—during the post-discharge period.

In this context, recognition of KC by health authorities at all levels is essential, as it provides an effective and competent framework for support and guidance.

5.2 Barriers within the Hospital Structure

Acceptance of Kangaroo Care (KC) by healthcare providers inevitably requires a well-defined training process, both for those directly involved in newborn care and for staff not assigned to the neonatal unit. Practical knowledge necessary to implement the “Kangaroo Method” must be supported by adequate theoretical training, explaining the benefits of KC for the newborn, the mother, and society compared with traditional care.

Collaboration between providers responsible for newborn care and those in obstetrics is essential. KC should be introduced during prenatal consultations, and labor and delivery support must align with KC principles, which prioritize skin-to-skin contact from the earliest moments of life. Delayed information or inconsistent care practices in the delivery room can pose significant barriers to adopting the method.

The theoretical principles and the health and socio-economic benefits of KC should be communicated to all hospital and administrative staff, as broad knowledge helps overcome the inevitable resistance that arises with any new practice.

For example, a frequently encountered barrier that requires solutions at either the healthcare or administrative level is finding adequate space for KC within the hospital. Another example is the usefulness of promoting KC through strategically placed posters throughout the hospital.

Achieving an adequate level of KC provision is strongly correlated with the acceptance of both theoretical and practical aspects by the majority of doctors clinical officers, and nurses involved in neonatal care. Staff resistance or partial acceptance represents a significant barrier to KC implementation. Discordant or even conflicting behavior is associated with ineffective communication with mothers eligible for KC, as it fails to convey the confidence necessary regarding the process and expected outcomes.

It is important for staff to develop adequate counseling skills, highlighting the type of care to be provided collaboratively and personalized according to the newborn's characteristics and family context. The success of KC depends on the alliance between staff and parents during hospitalization in the neonatal unit, where progress and challenges require attentive listening and empathy from caregivers. A lack of shared objectives and resources jeopardizes the post-discharge phase—an integral part of KC—which involves continuing KC at home. Follow-up is effective only if the mother has developed strong trust during the hospital phase, with the crucial support of doctors and nurses. Only under these conditions will the mother find the resources to adhere to the scheduled check-ups.

Collecting data on the newborn's progress (breastfeeding development, weight gain, incidence of complications, difficulties reported by the mother), both during hospitalization and afterward, plays an important role in understanding and disseminating the method. Proper analysis of these outcomes strengthens the evidence for KC, especially at the local level, and becomes an important factor supporting healthcare, administrative decision-making, and the development of favorable public opinion.

Acknowledgements

The following contributed to the development of this manual:

Angelon Maria Chiara, Bellopede Giovanna, Brunello Ada Bruna, Cassera Federica, Colnaghi Alessandra, Foroni Manuela, Hatungimana Noella, Iradukunda Eric, Kanyange Marie Luise, Mezzalira Chiara, Miburo Amelie, Mukeshimana Sandrine, Mukamazera Alphonsine, Murerakure Odille, Namahoro Jacqueline, Nitonde Angele, Nizigiyimana Emilienne, Salvadori Massimo, Verde Elisa, Wizeyimana Alice, Yamuremye Israel.

AMAHORO Association, Zero più Medicina per lo Sviluppo Association, Study Group of the Italian Society of Neonatology (SIN) “Neonatology in Low-Resource Countries”

The text was reviewed and approved by the scientific committee appointed by the Minister of Public Health and the Fight Against AIDS: Dr. Ananie NDACAYISABA, Dr. Hélène BUKURU, Dr. Alice NDAYISHIMIYE, Dr. Félicien BIVAHANGUMYE, Dr. Béatrice NKURUNZIZA, Dr. Scholastique MANYUNDO Risase, Dr. Clémentine IRAKOZE, Thierry NZEYIMANA, Dr. Josiane NIJIMBERE, Dr. Hermès NDUWAYO, Dr. Ezéchiel VYIMANA, Dr. Landry MAKASI, Dr. Thérence NTAWURISHIRA, Dr. Emile RUZOCIMANA, Dr. Pie NIBIRANTIJE.

Editorial coordination: Michela Papotti – Paolo Chiesi Foundation

Translation (in French): Anne-Marie Bordier-Pizzo

Graphic support: Andrea Di Caro

First edition: 2024

The Paolo Chiesi Foundation funded the production of this manual

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Lucia Tubaldi – Pediatrician and neonatology specialist, UNICEF breastfeeding trainer, collaborating with the Paolo Chiesi Foundation’s NEST project since 2016.

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