

# Creating an Innovative Curriculum for Developmental Care of Premature Infants in the NICU: Insights from a Delphi Study

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## ABSTRACT

**Background:** The neonatal stage is critical due to the high risk of mortality. The Neonatal Intensive Care Unit (NICU) is essential for preterm infants but can also increase the risk of developmental disorders. Various early intervention programs for preterm babies are being tested and combined into a developmental care model. This study aims to identify the components, content, and interventions of a developmental care model for preterm babies suitable for implementation in Indonesia.

**Methods:** A modified Delphi study with three survey rounds was conducted. In the first round, six experts, including practitioners and academics, were selected. Practitioners were NICU nurses with over 10 years of experience, speakers on developmental care, and those applying it in practice, with research and publications on neonates. Academics were pediatric lecturers, researchers on preterm infant care, and those with relevant training. In the second and third rounds, 30 panelists (nurses or midwives with over 5 years of NICU experience) participated.

**Results:** The first-round expert panel consisted of six experts (100% female) with 13-25 years of service: practitioners (66.7%) and academics (33.3%). For the second and third rounds, the panel included 30 experts (100% female): nurses (73.3%) and midwives (26.7%). Consensus was achieved in the third survey round with 75% cumulative agreement on interventions and training materials. The developmental care model comprised eight components with 126 interventions and 26 training materials.

**Conclusion:** The study identified components, content, interventions, and training metrics for developmental care in NICU nursing practice for preterm babies. Future research should observe neonatal nurses implementing the seven basic developmental care interventions.

**Keywords:** Curriculum, Neonatal Intensive Care Unit, Nursing care, Premature infants

## Introduction

The World Health Organization reports that an estimated 15 million babies are born too early in the world each year, and Indonesia is ranked 5th with the most preterm births, namely 675,700

cases (1,2). This has an impact on increasing the infant mortality rate (IMR), namely 24 per 1000 births, which is still far from the 2030 SDGs target. Ironically, 84% of IMR is caused by premature

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birth (3,4). Several studies show that the determinant of the increase in the average Net Death Rate (NDR) of premature neonates in the NICU occurs due to unpreparedness for services from resources that do not meet the Man, Money, Material, Method, Machine, Market, Technology, Time, Information (6M 2T 1I) factors (5-7). This shows that the life expectancy level of preterm babies is very dependent on the intensive care provided comprehensively while the baby is in the NICU room; therefore, health workers, especially nurses and midwives, need special competencies.

Various efforts in the form of programs consisting of several early interventions for preterm babies are starting to be tested and combined into a developmental care model such as Developmental Supportive Care (DSC), Newborn Individualized Developmental Care and Assessment Program (NIDCAP), Infant Behavioral Assessment and Intervention Program (IBAIP), Universal Developmental Care (UDC) and Neonatal Integrated Developmental Care Model (NIDCM) (8-11). However, so far, the implementation of developmental care in various hospitals in Indonesia is still less than ideal due to many obstacles faced, such as the health workers' lack of knowledge regarding developmental care and not being equipped with adequate skills; there is a perception that developmental care is not suitable to be applied to babies with critical conditions, there are no appropriate standardized guidelines and procedures implemented according to the conditions of health facilities in Indonesia, and there is still a lack of parental involvement in developmental care (12-16).

Health workers who work in the neonatal room should ideally have a developmental care competency certificate. Globally, this certification is obtained through the Wee Care Neuroprotective NICU Program (17). Wee Care's training and consultative programs combine evidence-based practices with seven core steps for family-centered developmental care with the goal of standardizing neuroprotective care practices in the NICU. The Wee Care program trains all NICU staff and has been shown to optimize the NICU environment, improve infant development, increase staff and family satisfaction, reduce length of stay, and reduce hospital costs (9,18-22). Unfortunately, in Indonesia, there is no Wee Care Neuroprotective NICU Program or other similar programs, which is believed to be the main trigger for the non-optimal implementation of

developmental care in the neonatal room. This study aims to identify components, content of components, and intervention models of care for the growth and development of preterm babies that are suitable for implementation in Indonesia.

## Methods

This study employed a qualitative design with a Delphi study approach with three survey rounds, identified as an iterative process designed to combine expert opinions into a group consensus (23,24). The first round aimed to formulate components, content of components, and interventions in a developmental care model for preterm babies appropriate for conditions in Indonesia. The second round focused on determining appropriate developmental care interventions in the caring practice for premature infants in the NICU room to form the training material needed by nurses/midwives. The third round aimed to determine the sequence of developmental care training materials that are priorities and needed by nurses or midwives in the caring practice for preterm babies so as to produce preterm babies developmental care training curriculum drafts for nurses and midwives who work in the NICU room.

The study was conducted from January to October 2023. The research locations included several hospitals spread across Indonesia, such as 4 hospitals on the island of Kalimantan, namely Abdoel Wahab Sjahranie Hospital Samarinda, Dr. Kanujoso djatiwibowo Balikpapan, Beriman Hospital Balikpapan, and Pertamina Hospital Balikpapan; 2 hospitals on the island of Bali, namely the Mangusada Badung Hospital and the Surya Husada Denpasar General Hospital; and 5 hospitals on the island of Central Sulawesi, namely Torabelo Sigi Hospital and Banggai District Hospital, Madani Palu Hospital, Poso Hospital and Anuntaloko Parigi Hospital.

In particular, the first round of study involved six experts, including practitioners and academics. Practitioners involved in this study should fulfill some criteria, such as: 1) NICU nurses who have worked for more than 10 years; 2) presenters in developmental care-related training; 3) they who apply developmental care in the workplace; 4) research and publications specific to neonates. Meanwhile, academics chosen to be the participants should fulfill the criteria such as 1) having an educational background and working as a lecturer teaching children; 2) having conducted research related to the development care of

preterm babies; 3) having attended training related to developmental care. For Delphi round two, 30 panelists were involved, and those also got engaged in Delphi round three.

The collected round 1 data was processed by means of content analysis using Microsoft Excel tools through several stages, namely determining case classification, condensing to streamline meaning, and compiling to produce content and sub-content. The content analysis results were used to develop the instrument for round 2. The data for round 2 were processed by calculating the percentage of agreement (cumulative agreement) of the panelists regarding the intervention and training materials in the training curriculum draft of developmental care for preterm babies for nurses and midwives in the NICU room. The assessment criteria refer to standards (25), which formulate that if the percentage of agreement is around 40-60%, it means that the intervention/training material was not agreed upon (dropped out), 61-74% means that the panelists agreed with the intervention/training material but the material needs to be modified, >75% indicates panelists agree with the intervention/training material without any modification. The percentage of agreement was calculated using Microsoft Excel tools. Round 3 data was analyzed using the pivot function in Microsoft Excel to find the highest order of panelist answers for each intervention item and training material. Then, it was compiled into a training curriculum draft of the developmental care for preterm babies for nurses and midwives who work in the NICU room and then visualized as a model of developmental care that suits the needs in Indonesia.

### **Ethical Approval**

This research has obtained ethical approval with the ethical number 0030/KEPK-KPK/II/2023 at the Poltekkes Kemenkes Palu, and participation involved informed consent.

**Table 1.** Expert agreement regarding components and content of components in the appropriate developmental care model in Indonesia

Contents		Sub-Contents
Eight core components of developmental care for preterm babies	1	Safeguarding sleep
	2	Minimizing stress and pain
	3	Partnering with families
	4	Healing environment
	5	Positioning and handling
	6	Optimizing nutrition
	7	Protecting skin
	8	Teamwork and collaboration
Content of components varies	1	Modification of content of components: assessing the infant's sleep-wake status; baby pain; family interactions; interdisciplinary care - optimal infant positioning.
	2	Contents of components combination of DSC and NIDCM

## **Results**

### **Round 1: Formulating components, content of the components, and interventions in a developmental care model for preterm babies that is appropriate for conditions in Indonesia**

The Delphi round 1 study aimed to obtain expert agreement regarding the formulation of a model of developmental care for preterm babies that is appropriate for conditions in the NICU room, especially in Indonesia. Experts were given information about the 3 current models of developmental care for preterm babies, and each model produced a program that guarantees the competence of health workers regarding developmental care. Specifically, experts assessed how appropriate the existing components are to conditions in the field and the needs of health workers in the NICU. The results of the expert agreement regarding the components and content of components in the appropriate developmental care model in Indonesia (Table 1).

Table 1 shows that the terms in the NIDCM model are more dominantly suited to conditions in Indonesia because 7 of the 8 terms were chosen by experts, whereas in the DSC model, only 1 term is used, namely "nutrition optimization." Regarding the content of components, several experts suggested modifying the content of components to make them more suitable and to combine DSC and NIDCM contents of components, but overall, the NIDCM model is more dominant, and all contents of components can be adopted.

### **Round 2: Determining appropriate developmental care interventions in the practice of caring for preterm babies in the NICU room so as to form the training material needed by nurses/midwives**

The aim of the Delphi round 2 study was to

determine appropriate interventions to be implemented in the NICU and the training materials needed by nurses/midwives. In this case, 30 nurses/midwives who worked in the NICU were involved and referred to as panelists in the study. Panelists were given a list of 149 interventions and asked to tick off interventions that could be implemented in the NICU, as well as a list of 29 training materials that were considered important and to add materials that still needed to be listed on the list. The material suggested by the panelists (Table 2).

**Round 3: Sequencing of priority training materials and developmental care interventions in the practice of caring for preterm babies in the NICU room**

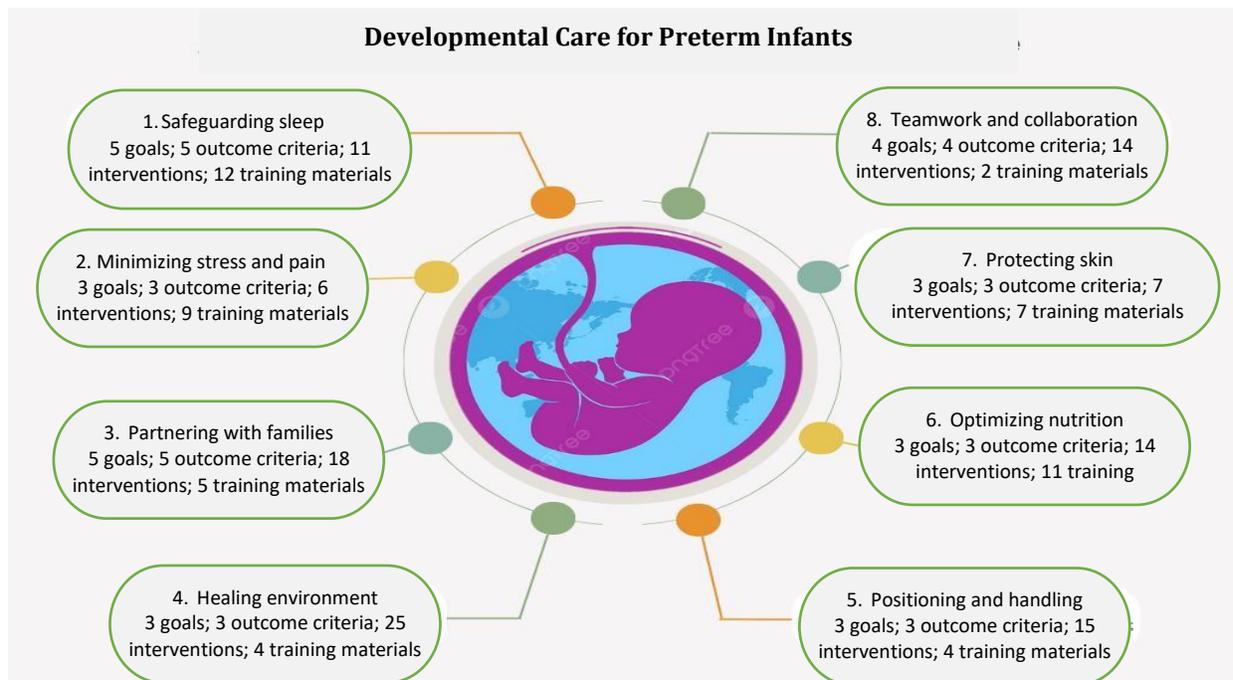
Round 3 aims to determine the sequence of priority developmental care training materials nurses or midwives need to care for preterm babies in the NICU. The panelists involved were still the same as the round 2 panelists. They were asked to sort them by ticking the most important parts in sequence and selecting the additional material needed. The results of this study show

that interventions and training materials have been arranged based on priorities in developmental care practices in the NICU room, along with objectives and outcome criteria. If we look at the 8 core components of developmental care for preterm babies, the healing environment component that has the most interventions is 25 action plans, followed by the component of collaborating with the family with 18 action plans, and the positioning and handling component which has 15 action plans in developmental care. Meanwhile, in the training material, the sleep care component contains the most material, namely 12 points of material, with the priority material being the baby's sleeping position. It is followed by the nutrition optimization component with 11 training materials, and the priority material is education on skin contact procedures (kangaroo method), which is considered by the panelists to be most needed because it has an impact on the provision of nutrition (breast milk) from mother to baby.

From the three rounds of the Delphi study, it can be concluded that the developmental Partnering with families care model for preterm

**Table 2.** Developmental care training materials suggested by panelists

Core components of developmental care		Additional material suggested by the nurse/midwife	
1	Safeguarding sleep	1	NNS Technique
		2	Nesting Technique
		3	Sound level management
		4	Facilitated tucking baby technique
		5	Positive and negative sleep responses in preterm infants
		6	Minimal handling
		7	Minimize actions/sleep disturbance in preterm infants
2	Minimizing stress and pain	1	Neonatal pain management
		2	Neonatal pain education
		3	Neonatal positioning
		4	NIPS utilization
		5	Administration of sucrose, touch
3	Partnering with families	1	How to support parents with premature babies
		2	How to provide psychosocial support
4	Healing environment	1	Standard neonatal room
5	Positioning and handling	1	IPAT training
		2	Stages of baby development
6	Optimizing nutrition	1	Maximize enteral nutrition
		2	Provide parenteral nutrition
		3	Lactation management
		4	OGT drinking technique
		5	Monitor baby weight gain
		6	Monitor for signs of feeding intolerance
7	Protecting skin	1	Prevention and Management and Administration of Indonesian Hospitals
		2	Baby skin care standards
		3	Baby massage



**Figure 1.** Developmental care model for the preterm babies that suits the needs of NICU room in Indonesia

babies that meets the needs in Indonesia is a combination of the Developmental Supportive Care (DSC) and Neonatal Integrated Developmental Care Model (NIDCM). The content of components in developmental care is modified and combined between DSC and NIDCM, which complement each other. In the DSC model, the core components contain attributes and criteria, while the NIDCM model's core components contain standards, characteristics, and objectives. This is outlined in the design of the training curriculum for developmental care for preterm babies so that the developmental care model for preterm babies in Indonesia can be visualized in Figure 1.

## Discussion

Based on the three rounds of the Delphi study, it can be concluded that the developmental care model for preterm babies that meets the needs in Indonesia is a combination of the Developmental Supportive Care (DSC) and Neonatal Integrated Developmental Care Model (NIDCM). The content of components in developmental care is modified and combined between DSC and NIDCM, which complement each other. In the DSC model, the core components contain attributes and criteria, while the NIDCM model's core components contain standards, characteristics, and objectives. This is outlined in the design of the training curriculum for developmental care for preterm

babies to become a model of developmental care for preterm babies in Indonesia.

### ***Components, content of components and intervention formulations in a developmental care model for preterm babies that is appropriate for conditions in Indonesia***

Developmental care is a method intended to adjust the environment in the NICU room to reduce stress in preterm babies, increase their physiological stability, maintain their sleep rhythm, and increase nerve growth and maturation of the baby (9, 26). The developmental care methods compared in this study are DSC and NIDCM to obtain agreement regarding components and content of components that are appropriate to care needs in Indonesia. The research results found 8 suitable components in Indonesia, most of which were sourced from NIDCM. Conceptually, NIDCM has seven core neuroprotective actions and are described as the overlapping petals of a lotus flower consisting of 1) healing environment, 2) partnering with the family, 3) positioning & handling, 4) safeguarding sleep, 5) minimizing stress and pain, 6) protecting skin, 7) optimizing nutrition and one additional component, namely teamwork and collaboration (9, 18, 27, 28).

The results of this study conflict with the findings of Efendi & Rustina (29) that Basic

Developmental Care and Complete Developmental Care can be applied in the NICU but do not affect the long-term developmental outcomes of preterm babies. The content of components in developmental care is recommended to be modified, and a combination of DSC and NIDCM is recommended because they will complement each other. In the DSC model, the core components contain attributes and criteria, while the NIDCM model's core components contain standards, characteristics, and objectives.

The research results found that the demand to involve parents in the care of 57-58 babies was considered difficult, while the concept of developmental care emphasized training and participation of parents or families to support the social, emotional, and physical health of babies and was an important factor in the family-centered care process (30, 31). For optimal growth and development of preterm babies, developmental care includes interventions that manage the NICU environment so that it resembles the intrauterine environment as much as possible and provides integrated individual interventions with health workers and families of preterm babies (32). Developmental care interventions have been shown to be effective in relieving stress, improving sleep quality, and neurodevelopmental outcomes (33).

The results of this study show that most of the interventions in the NIDCM model can be adopted in Indonesia. However, 44% of developmental care interventions are considered inappropriate because facilities and human resources hamper them. To provide quality developmental care for preterm infants, the NICU system and the personal characteristics of providers must be considered. These results are in line with the results of other studies, which reported that working conditions, financial support, workforce support, staff turnover, and patient caseloads in NICUs vary, depending on the health service system and socio-cultural context of each country, and this -this can be a barrier to developmental care (33, 34). Developmental care that is not supported by the institutional administration increases the work intensity of NICU medical staff and has a negative impact on the work environment (18). Therefore, it is necessary to develop a treatment program that is most proper and appropriate to the conditions of each health service. When an intervention is initiated for a baby at risk of developing developmental disorders, the intervention has a preventive focus and strategies to minimize developmental complications. Various

evidence shows that developmental care interventions have an appropriate impact on short-term and long-term developmental outcomes (16, 35, 36).

***Determining appropriate developmental care interventions in the practice of caring for preterm babies in the NICU room, thus forming the training material needed by nurses/midwives***

Based on the results of a study conducted on seven components of developmental care, 30 panelists identified that there were 14 interventions in the 58-59 components of sleep care, there were 8 interventions in the component of minimizing pain and soreness, there were 21 interventions in the component of collaborating with the family, there were 17 interventions in the healing environment component, there were 19 interventions in the position and pain management component, there were 15 interventions in the nutrition optimization component, there were 9 interventions in the skin protection component and there were 14 interventions in the teamwork and collaboration component. According to the researchers' assumptions, several interventions in each component of the combined DSC and NIDCM developmental care models have similar forms of intervention, so there were several interventions that were excluded/dropped out based on the results of the panelists in round two.

One of the most important factors in the development of low-birth-weight babies is sleep. Therefore, disturbances experienced by babies during their sleep can reduce melatonin excretion, thereby increasing stress and significantly changing physiological function (37). Preterm babies experience changes in sleep patterns due to changes in maturity at age and awake sleep, which is very important for normal neurological development, growth, and healing of the baby (9). Apart from the components of maintaining the baby's sleep period, preterm babies in the NICU receive continuous routine care, and pain and stress in the baby need to be reduced to minimize stress and pain in preterm babies. Babies born preterm in their early life are exposed to sounds, bright lights, and many procedures that cause stress and pain with repeated handling and separation from the mother. Preterm babies experience stress due to routine handling in the NICU, such as bathing, giving water and weighing, and vision changes.

This altered sensory experience is inherently stressful and has a negative impact on the baby's brain development (38).

Nursing care during NICU impacts all aspects of the family, not only during intensive unit care but also in the months and years afterward because the first experience of the relationship between baby and parent, whether at home or in the intensive care unit, can shape the relationship between parent and child as well as the perspective and the role of parents (39). Babies treated in the NICU not only impact the physical and emotional health of parents but also impact the bond and development between the newborn baby and its parents (39, 40).

The components of adjusting the baby's position and pain are very important in 60 babies' developmental care; this is in accordance with research by Kahraman et al. (41) in their research identifying the effectiveness of the nesting position in reducing pain, stress, and comfort in preterm babies. The purpose of this identification is to determine the pain, stress, comfort, salivary cortisol, and melatonin values experienced by the baby while in the nesting position during the heel spear procedure in preterm babies in the NICU.

The components of optimizing nutrition have a good impact on the development of the baby's brain. Research shows that breastfeeding needs to be improved because it is evidence of optimal infant feeding and supports the provision of optimal nutrition to infants. Breastfeeding is the most effective action in reducing the risk of a common cause of infant morbidity and mortality. Breast milk (ASI) is the best food substance that can be tolerated by preterm babies (42). In addition, preterm babies have the possibility of experiencing a risk of damage to skin integrity, impaired skin hydration, and increased permeability to infectious agents because preterm babies have an immature vernix caseosa layer, a thin stratum corneum, and little skin protein, which results in this occurring (43). Apart from the components above, teamwork and collaboration are the most important things in caring for preterm babies.

#### ***Sequence of priority training materials and developmental care interventions in the practice of caring for preterm babies in the NICU room***

Based on the 8 core components of developmental care for preterm babies, the healing environment component with the most

interventions is 25 action plans, followed by collaborating with the family with 18 action plans and the positioning and handling component with 15 action plans in developmental care. If you look at the training material, the sleep care component with the most material is 12 points, with the priority material being the baby's sleeping position. This is followed by the nutrition optimization component with 11 training materials, and the priority material is education on skin contact procedures (kangaroo method), which the panelists consider to be most needed because it has an impact on the provision of nutrition (ASI) from mother to baby.

According to the researchers' assumptions, the description of training materials and developmental care interventions is appropriate based on suggestions from 30 panelists and in accordance with the components and interventions in developmental care, this training material can facilitate health workers in the NICU room in implementing or carrying out developmental care appropriately to improve the quality of care in preterm babies in the NICU. This training material also helps improve the skills of health workers in implementing interventions according to developmental care for preterm babies.

#### **Conclusion**

The results of this study are in the form of formulations of components, content of components and intervention models of developmental care for preterm babies based on agreement, appropriate developmental care interventions in the practice of nursing preterm babies in the NICU room, descriptions of training materials and priority developmental care interventions in the practice of caring for preterm babies in the NICU room. It is recommended that the results of this study be applied to provide developmental care for babies in the neonatal ward and to observe the neonatal ward nurses carrying out interventions on the seven basics of neuroprotective developmental care by involving the family.

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#### **Conflicts of interest**

The authors declare that there is no conflict of interest.

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