Jurnal Kesehatan
Manarang

Jurnal Kesehatan Manarang, 11(3) December 2025, pp. 393 – 401
ISSN 2528-5602 (Online), ISSN 2443-3861 (Print)
doi: https://doi.org/10.33490/jkm.v11i3.1954

EFFECTIVENESS OF TRAINING ON THE NEONATAL DEVELOPMENTAL CARE MODEL IN IMPROVING HEALTHCARE WORKERS' KNOWLEDGE AND ATTITUDES

Andi Fatmawati Syamsu[1], Rachmawati Rahim[2], Ni luh Kompyang Sulisnadewi[3], Hadriani[4], Hana W. Jun Chen[5]

[1,4]Department of Nursing, Health Polytechnic Palu , Indonesia
[2]Department of Nursing, Health Polytechnic Mamuju , Indonesia
[3]Department of Nursing, Health Polytechnic Denpasar , Indonesia
[5]Faculty of Humanities and Health Sciences, Curtin University, Miri, Sarawak

ARTICLE INFO

Article history

Submitted : 2025-01-10
Revised : 2025-10-10
Accepted : 2025-11-20

Keywords:

Neonatal Integrative; Developmental Care Model, developmental care, nurses, knowledge, nurses, attitude; Training intervention;

ABSTRACT

Premature infants frequently confront developmental obstacles that require close monitoring by medical professionals. The neonatal developmental care model was created to help medical personnel provide interventions that support the healthy development of premature infants in hospitals. The purpose of this study was to evaluate healthcare professionals' attitudes and knowledge regarding the neonatal developmental care model before and after training. This quasi-experimental study with a pre-test and post-test design was conducted from March to October 2024 in the NICU units of RSUD Undata and RSU Anutapura Palu, Indonesia. A total sampling technique was applied to 38 nurses and midwives who met the inclusion criteria. The independent variable was developmental care training, while the dependent variables were the knowledge and attitudes of healthcare workers toward neonatal developmental care. Data were collected using validated questionnaires and analyzed using the Wilcoxon signed-rank test. Following the training, knowledge scores increased by an average (mean rank) of 19.50, and attitude scores increased by an average (mean rank) of 20. The training significantly improved the knowledge and attitudes of healthcare personnel, as indicated by the significance value (p-value) of 0.000 (<0.05) for both variables. The NIDCM training significantly enhanced nurses' and midwives' cognitive and attitudinal readiness for developmental care. The integration of structured education and practical learning proved effective in promoting positive behavioral change among healthcare workers. Highlight the importance of institutionalizing developmental care training and strengthening managerial support to ensure sustainable implementation in neonatal settings.

Kata Kunci:

Neonatal Integrative; Developmental Care Model: asuhan perkembangan, pengetahuan perawat, sikap perawat; Pelatihan;

ABSTRAK

Perkembangan bayi prematur sering menghadapi tantangan yang membutuhkan perhatian intensif dari tenaga kesehatan. Model asuhan perkembangan neonatal dirancang untuk mendukung tenaga kesehatan dalam memberikan intervensi guna mempercepat perkembangan optimal bayi prematur di rumah sakit. Mengetahui tingkat pengetahuan dan sikap tenaga kesehatan terhadap model asuhan perkembangan neonatal sebelum dan setelah diberikan pelatihan. Penelitian kuasi-eksperimen dengan desain pre-test dan post-test ini dilaksanakan pada bulan Maret hingga Oktober 2024 di ruang *Neonatal Intensive Care Unit* (NICU) RSUD Undata dan RSU Anutapura Palu, Indonesia. Teknik total sampling digunakan terhadap 38 perawat dan bidan yang memenuhi kriteria inklusi. Variabel independen dalam penelitian ini adalah pelatihan perawatan perkembangan *(developmental care)*, sedangkan variabel dependen adalah pengetahuan dan sikap tenaga kesehatan terhadap perawatan perkembangan neonatus. Pengumpulan data dilakukan menggunakan kuesioner yang telah divalidasi, dan analisis data dilakukan dengan menggunakan uji Wilcoxon signed-rank. Terdapat peningkatan skor pengetahuan dengan rata-rata (*mean rank*) 19.50 dan peningkatan sikap dengan rata-rata (*mean rank*) 20 setelah pelatihan. Nilai signifikansi p-value untuk kedua variabel adalah 0.000 (<0.05), menunjukkan adanya pengaruh signifikan dari pelatihan terhadap peningkatan pengetahuan dan sikap tenaga kesehatan. Model asuhan perkembangan

neonatal terbukti efektif dalam meningkatkan pengetahuan dan sikap tenaga kesehatan dalam perawatan bayi prematur. Implementasi model ini dapat menjadi strategi penting dalam mengurangi morbiditas dan mortalitas bayi prematur serta meningkatkan kualitas hidup mereka dalam jangka panjang.

✉ ***Corresponding Author:***
Andi Fatmawati Syamsu
Email: fatmaandif@gmail.com

INTRODUCTION

Preterm birth remains one of the most pressing challenges in neonatal health globally. According to the World Health Organization (WHO), in 2020, approximately 13.4 million infants were born before 37 weeks of gestation—roughly one in every ten live births worldwide (World Health Organization, 2023). Complications arising from preterm birth are the leading cause of death among children under five, accounting for nearly 900,000 deaths annually. The survival gap between countries is striking: in low-income settings, fewer than one in ten extremely preterm infants (<28 weeks) survive, while in high-income countries survival exceeds 90% (World Health Organization, 2023).

In Indonesia, preterm birth continues to represent a major contributor to neonatal deaths. Data from the Ministry of Health of Indonesia (2023) report that prematurity contributes to approximately 35% of neonatal mortality, with an estimated 10.5% preterm birth rate, placing Indonesia among the five countries with the highest incidence globally. Limited resources and a shortage of trained neonatal nurses have further constrained efforts to deliver evidence-based developmental care in Neonatal Intensive Care Units (NICUs) (Kementrian Kesehatan RI, 2024)

Neonatal developmental care (NDC) has been widely recognized as an essential evidence-based approach for promoting optimal neurobehavioral development among premature infants. It involves interventions designed to reduce stress, support self-regulation, and enhance physiological stability through individualized and family-centered care (L. Altimier & Phillips, 2016; Campbell-Yeo et al., 2022). Models such as the Neonatal Integrative Developmental Care Model (NIDCM) and the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) emphasize optimizing the NICU environment, minimizing noxious stimuli, and strengthening parental engagement (Héon et al., 2022).

According to the World Health Organization (WHO, 2023), approximately 13.4 million babies were born preterm in 2020, representing about 1 in 10 births worldwide. Complications arising from preterm birth remain the leading cause of death among children under five years of age, accounting for around 900,000 neonatal deaths annually (World Health Organization, 2023).

Nevertheless, many NICU nurses and midwives in low- and middle-income countries still demonstrate limited knowledge, attitudes, and confidence in applying developmental care practices. A recent study in South Korea reported that even experienced neonatal nurses showed only moderate levels of perceived competence in developmental care, highlighting the need for structured education (Lee et al., 2023). Similarly, a multicenter study in Spain showed that after a theoretical–practical training course, healthcare professionals' correct-answer rates regarding developmental care principles increased significantly from 65% to 81% (Mosqueda-Peña et al., 2016b). Evidence from a quasi-experimental study in Iran also confirmed that virtual training programs significantly improved nurses' knowledge and perception scores of developmental care for preterm infants (mean score increase from 77.16 ± 17.20 to 90.33 ± 13.82; $p < 0.001$) (Jalali et al., 2022).

Despite such encouraging evidence, structured developmental-care training and evaluation remain scarce in developing countries, including Indonesia. Systematic training and assessment of healthcare workers' capacity to deliver NDC are crucial for improving neonatal care outcomes and aligning clinical practice with global standards.

Therefore, the present study aims to evaluate the effectiveness of a training program on the Neonatal Developmental Care Model in improving healthcare workers' knowledge and attitudes in the NICU setting. The findings are expected to contribute to evidence-based strategies for integrating

developmental-care principles into nursing education, policy, and clinical practice across Indonesian hospitals.

METHOD

This study employed a quasi-experimental approach with a one-group pre-test and post-test design. The intervention consisted of a structured training program on developmental care for preterm infants, delivered to neonatal nurses and midwives. The training included both theoretical and practical sessions aimed at improving participants' knowledge and attitudes regarding developmental care practices.

Type of Research

This research was a quantitative study that used an intervention-based approach to evaluate the effect of developmental care training. The independent variable was the training on developmental care, while the dependent variables were the knowledge and attitudes of neonatal nurses and midwives toward developmental care practices.

This study received approval from the Health Research Ethics Committee of Poltekkes Kemenkes Palu, Indonesia (Approval No: 000196/KEPK POLTEKKES KEMENKES PALU/2024). All participants were informed about the study's objectives and procedures. Written informed consent was obtained before participation. Confidentiality, anonymity, and voluntary participation were ensured throughout the study, in accordance with the Declaration of Helsinki (2013).

Place and Time of Research

The study was conducted in the Neonatal Intensive Care Units (NICU) of RSUD Undata and RSU Anutapura Palu, Central Sulawesi, Indonesia. The research was carried out from March to October 2024.

Population and Sample

The study population consisted of all nurses and midwives working in the NICUs of the two hospitals, totaling 38 participants. A total sampling technique was applied, meaning that all 38 eligible healthcare workers participated in the study, comprising 19 participants from RSUD Undata and 19 participants from RSU Anutapura Palu

Data Collection

Primary data were collected using validated self-administered questionnaires distributed before and after the intervention (pre-test and post-test). The questionnaires assessed two main variables:

1. Knowledge of developmental care for preterm infants, and
2. Attitudes toward implementing developmental care practices in the NICU.

The intervention consisted of a two-day structured training program on the Neonatal Integrative Developmental Care Model (NIDCM), designed to enhance healthcare workers' understanding and application of developmental care principles. The training combined theoretical instruction, skill demonstrations, and guided clinical practice.

1. Day 1 (Theoretical Session): Participants received lectures and discussions on the concepts, principles, and seven core measures of the Neonatal Developmental Care Model—covering environmental modification, stress and pain management, positioning and handling, sleep protection, family involvement, and sensory regulation.
2. Day 2 (Practical Session): Participants engaged in hands-on simulations and case-based learning in the NICU, focusing on practical applications such as positioning infants using developmental nesting, minimizing noise and light exposure, and supporting parent–infant bonding during care routines.

Instructional media included PowerPoint materials, video demonstrations, and clinical scenarios, facilitated by instructors experienced in neonatal intensive care. All sessions were supervised directly by the research team and followed a standardized module validated by neonatal experts.

The knowledge questionnaire consisted of 25 multiple-choice items, adapted from the Developmental Care Knowledge Assessment Tool developed by Altimier and colleagues, and modified to fit the Indonesian context. Each correct answer was scored 1, and an incorrect answer was scored 0, with a maximum total score of 25 points (100%). Scores were classified as: Good (76–100%), Moderate (56–75%), and Poor (<56%).

The attitude questionnaire consisted of 15 statements rated on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Negative statements were reverse-scored. The total possible score ranged from 15 to 75 and was interpreted as follows: Positive attitude (≥ 60% of total score) and Negative attitude (< 60% of total score).

Both questionnaires were validated through expert review and a pilot test involving ten NICU nurses who were not included in the final sample. The instruments demonstrated acceptable internal consistency, with a Cronbach's alpha of 0.87 for the knowledge scale and 0.83 for the attitude scale, indicating good reliability.

Data Analysis and Processing

All collected data were coded, entered, and analyzed using SPSS version 25. Univariate analysis was conducted to describe the frequency distribution of each variable, while bivariate analysis used the Wilcoxon signed-rank test, as the data distribution was not normal. This test compared pre-test and post-test scores to determine improvements in knowledge and attitudes following the intervention. A p-value of less than 0.05 was considered statistically significant.

Data Analysis and Processing

All collected data were coded, entered, and analyzed using SPSS version 25. Univariate analysis was conducted to describe the frequency distribution of each variable, while bivariate analysis used the Wilcoxon signed-rank test, as the data distribution was not normal. This test compared pre-test and post-test scores to determine improvements in knowledge and attitudes following the intervention. A p-value of less than 0.05 was considered statistically significant.

RESULT

To provide a comprehensive understanding of the impact of the Neonatal Developmental Care Model (NIDCM) training, descriptive statistical analysis was conducted. This section presents an overview of participant demographics, baseline knowledge and attitude levels, and post-intervention improvements. Descriptive statistics help in understanding the distribution of data and the extent of changes observed in participants before and after the training.

Table 1. Frequency Distribution of Respondent Characteristics (n=38)

Respondent Characteristics	Frequency (f)	Percentage (%)
Age (years)		
26 – 35	19	50.0
36 – 45	16	42.1
46 – 55	2	5.3
>55	1	2.6
Length of Service (years)		
< 1	6	15.8
1 – 4	3	7.9
5 – 10	13	34.2
>10	16	42.1

Based on Table 1, the distribution of respondent characteristics by age shows that the majority fall within the 26–35 age range, with 19 respondents (50%). Regarding respondents' years of work experience, most (16 respondents, 42.1%) have more than 10 years of service.

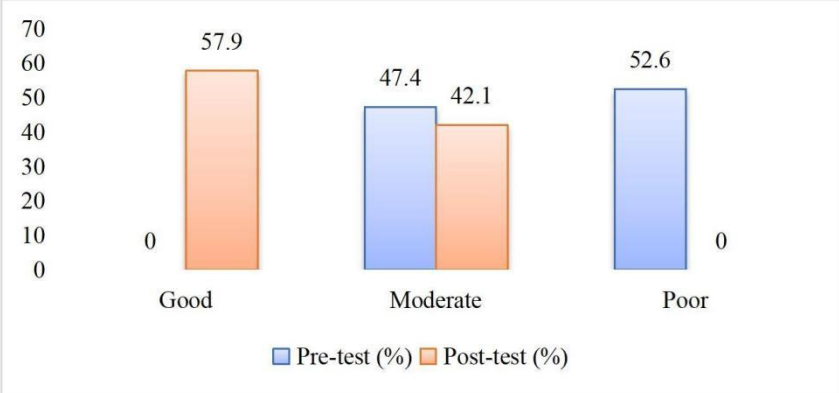

Figure 1. Frequency distribution of Knowledge Levels Before and After The Developmental Care Training for Premature Infants (n=38)

Based on Figure 1, the distribution of knowledge levels before the training showed that the majority of respondents were in the low category, with 20 respondents (52.6%). After the training, most respondents shifted to the good category (57.9%).

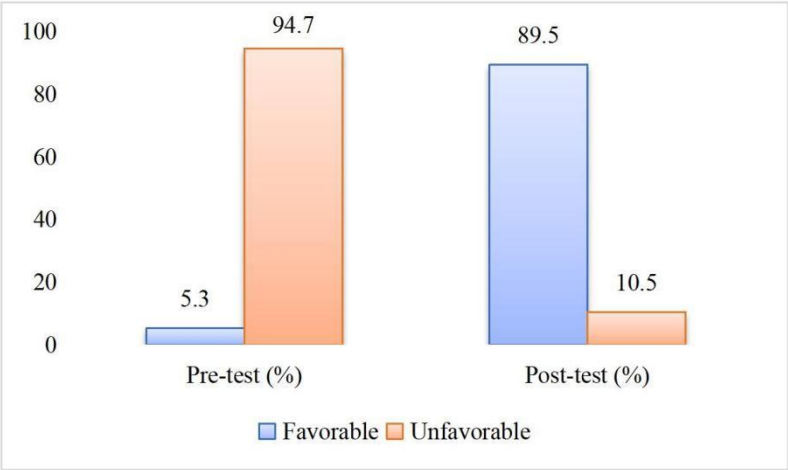

Figure 2. Frequency Distribution of Respondents' Attitude Before and After The Developmental Care Training for Premature Infants (n=38)

Based on Figure 2, the distribution of respondents' attitude levels before the training indicated that most were in the unfavorable category, with 36 respondents (94.7%). After the training, the majority shifted to the favorable category, with 34 respondents (89.5%).

Table 2. The Influence of Neonatal Developmental Care Training on Nurses' Knowledge and Attitudes (n=38)

	Variable mean Rank	Sum of Ranks	N	*P*-value
***Pre Test* Knowledge** **Post Test Knowledge**	19.50	741.0	38	0.000
Pre Test Attitudes ***Post Test Attitudes***	20.0	740.0	38	0.000

Based on Table 2, the Wilcoxon test analysis showed an increase in scores for the knowledge variable before and after the training, with a mean rank of 19.50. Similarly, the attitude variable showed an increase, with a mean rank of 20. The significance value (p-value) for both variables was $0.000 < 0.05$, indicating that the neonatal developmental care training had a significant effect on improving nurses' knowledge and attitudes.

DISCUSSION

The findings of this study confirm that developmental care training for premature infants effectively enhances nurses' knowledge and attitudes toward developmental care practices. This improvement reflects how structured education programs can strengthen healthcare workers' capacity to deliver evidence-based and family-centered care in the NICU setting. The increase in knowledge and positive attitudes observed among participants suggests that the integration of theoretical instruction with practical simulation fosters deeper understanding and behavioral change in clinical practice.

These findings extend previous evidence by demonstrating the applicability of developmental care training in the Indonesian context, where such programs have rarely been standardized. The observed improvement among participants in this study suggests that even short-term, focused interventions can stimulate meaningful changes in professional awareness and motivation. This highlights that the transfer of knowledge alone is insufficient; rather, it must be coupled with reflective learning and organizational support to influence long-term practice behavior.

These results are consistent with earlier studies showing that developmental care interventions, such as the Wee Care Neuroprotective NICU program, improve nurses' competence and confidence in applying neuroprotective strategies (L. B. Altimier, 2015). Similarly, Agustina & Rustina (2017) emphasized that targeted training interventions can optimize nurses' ability to provide supportive and developmentally appropriate care for preterm infants. The improvement observed in this study reinforces their conclusions and provides additional empirical evidence that capacity-building initiatives remain an essential component of developmental care implementation in low-resource NICUs.

Training programs in developmental care serve as crucial learning processes that reinforce nurses' competencies, thereby enhancing their confidence in providing appropriate care in NICU and perinatology units. The two-day training conducted in this study emphasized the concept of developmental care, revealing that nurses initially had a limited understanding of its definition, benefits, and implementation. Observational data indicated that although many nurses had previously received developmental care training, they were uncertain whether their knowledge aligned with standard practices. This finding suggests that knowledge gained from unstructured learning is often fragmented and may not translate into consistent clinical performance without standardized guidance or mentoring.

According to Schunk's cognitive theory (2022), new knowledge must be integrated with existing knowledge to develop a deeper comprehension, underscoring the necessity of structured learning assessments to evaluate knowledge retention and application (Belay, 2022). From this perspective, the training implemented in this study provided not only cognitive enrichment but also opportunities for active reflection, an essential step in transforming theoretical knowledge into clinical competence.

Developmental care is a critical approach designed to optimize the NICU environment by minimizing stress in premature infants, improving physiological stability, maintaining sleep rhythms, and supporting neural maturation (L. Altimier & Phillips, 2016; Sizun, 2004). Despite longstanding recommendations for its implementation, developmental care remains underutilized, particularly in developing countries (Rahayu Fitri et al., 2024). This study adds context-specific insights, showing that barriers in Indonesian NICUs include heavy workloads, limited staffing, and inadequate reinforcement of developmental care as part of standard nursing duties. These factors often lead to inconsistent application of developmental care principles, even when nurses possess adequate theoretical knowledge.

In Indonesia, local research has shown that simple neonatal care interventions, such as delayed umbilical cord clamping, significantly improve newborn hemoglobin levels at Anutapura General

Hospital in Palu (Suryani, 2019). This finding supports the need for structured and systematic interventions in NICU settings, such as the developmental care training program evaluated in the present study, to enhance the overall quality and consistency of neonatal care.

Previous studies (Mosqueda-Peña et al., 2016a; Zhang et al., 2016) have shown that most healthcare providers receive minimal developmental care training during their formal education, and those who do are seldom assessed for their practical application. Such findings align with the present study, suggesting that unstandardized and episodic training contributes to inconsistent competency development. Therefore, there is a pressing need for structured, evidence-based, and contextually adapted training models, such as NIDCM, to ensure skill retention and consistency in neonatal care delivery.

Park & Kim (2019) identified three key factors influencing developmental care implementation: professional efficacy, nurses' perceptions of developmental care, and task-oriented organizational culture. These dimensions are particularly relevant in the Indonesian setting, where organizational structures and managerial priorities often shape the extent to which developmental care is integrated into daily routines. While this study observed significant post-training improvement, some participants expressed that time pressure and workload made it challenging to apply all aspects of developmental care consistently. This indicates that, beyond individual training, organizational transformation is required to cultivate an enabling environment for developmental care..

High professional efficacy, supported by strong motivation and confidence, enhances nurses' professional performance and improves developmental care; however, many NICU nurses do not consistently integrate these practices into their routine care (Kim & Shin, 2014). This study echoes those findings, emphasizing that motivation and knowledge must be reinforced by institutional support and peer collaboration to sustain behavioral change. Developing a supportive organizational culture that prioritizes nurses' well-being, addresses workplace challenges, and optimizes healthcare delivery requires effective nursing management and hospital administration (Aydogdu, 2023). Therefore, strategies to enhance developmental care implementation should consider both individual capacity-building and system-level interventions adapted to specific hospital or regional conditions.

In terms of nurses' perceptions, the results of this study align with previous evidence reporting positive feedback toward developmental care programs. Mohammed et al. (2014) found that nurses acknowledged the benefits of developmental care in enhancing newborn outcomes, improving professional satisfaction, and strengthening emotional connections with families. Similarly, Hendricks-Muñoz & Prendergast (2007) reported that the vast majority of neonatal nurses regarded developmental care as essential for both infants and caregivers. However, as also reflected in the present findings, favorable attitudes alone do not guarantee practice transformation unless accompanied by structured follow-up and supportive management.

This study contributes to the literature by developing a developmental care model curriculum specifically tailored to the Indonesian NICU context. The model comprises eight key components encompassing 29 care objectives and 110 intervention criteria, structured into 54 modules. These elements were prioritized through expert consensus to address the specific developmental needs of preterm infants in Indonesia. By aligning educational interventions with local realities, this study demonstrates that developmental care training can be both feasible and impactful, paving the way for the establishment of national guidelines to promote standardized, family-centered neonatal care.

CONCLUSION AND SUGGESTION

This study demonstrated that structured training based on the Neonatal Integrative Developmental Care Model (NIDCM) effectively enhanced nurses' and midwives' knowledge and attitudes toward developmental care for premature infants. Beyond statistical improvement, the findings revealed a transformation in clinical understanding and professional values—nurses became more aware of the holistic and neuroprotective aspects of neonatal care. The success of this intervention in two Indonesian hospitals highlights the adaptability of the NIDCM framework in low-resource neonatal settings, where developmental care practices are often fragmented or undervalued.

Overall, the study emphasizes that educational interventions alone are insufficient unless supported by a conducive organizational culture and managerial commitment. Sustainable implementation of developmental care requires integrating its principles into daily routines, ensuring

institutional backing, and recognizing the role of nursing leadership in reinforcing evidence-based neonatal practice.

To ensure the sustainability of developmental care practices, hospitals should institutionalize NIDCM-based training as part of regular competency development and continuing education for NICU staff. Strengthening organizational support through effective mentoring and supervision systems is essential to maintain behavioral change and minimize workload-related barriers. Furthermore, fostering interprofessional collaboration among nurses, midwives, and neonatologists will enhance the integration of family-centered and holistic approaches in neonatal care. Future multicenter and longitudinal studies are recommended to evaluate the long-term behavioral and clinical impacts of developmental care implementation, providing a stronger evidence base for policy and practice improvements in neonatal nursing.

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