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Factors Influencing Developmental Care Practice Among Neonatal Intensive Care Unit Nurses

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ABSTRACT

Purpose: This study aimed to examine factors that influence developmental care practice among neonatal intensive care unit nurses.
Design and methods: This descriptive, cross-sectional study was conducted using a questionnaire. Data were collected from 141 neonatal intensive care unit nurses from 6 hospitals in South Korea. Multiple linear regression analysis was used to examine factors influencing developmental care practice.
Results: This study found that professional efficacy had the largest influence on developmental care practice, followed by perception of developmental care and a task-oriented organizational culture. Clinical and educational experience regarding developmental care and working environment was not associated with developmental care practice among NICU nurses.
Conclusions: To enhance nurses' practice of developmental care, enhancement of nurses' individual competency, positive perception of developmental care, and organizational efforts are required. A practical training program should be provided to nurses to promote confidence in implementing developmental care for preterm infants.
Implications: A trained nurse should provide staff nurses with useful information on developmental care to encourage them to have a positive attitude towards developmental care. The nurse manager should create an organizational culture in which nurses perceive developmental care to be an essential nursing task in their unit.

Preterm infants who are born before 37 weeks of gestation may require long-term medical treatment in a neonatal intensive care unit (NICU) because of their underdevelopment and accompanying medical conditions (Montirosso, Giusti, De Carli, Tronick, & Borgatti, 2018). As neurodevelopment continues in the third trimester of gestation, preterm infant brains are still developing in the NICU, where conditions are very different from the protective environment of the uterus (Altimier & Phillips, 2016; Spilker, Hell, & Rosenblum, 2016). During this time in the NICU, the brain is exposed to stressful experiences, such as pain, excessive light and noise, frequent physical handling, and sleep disturbance (Browne, 2011; Roberts et al., 2011). Stressors experienced in the NICU environment might affect the structural and functional development of the brain, causing neurodevelopmental disabilities in preterm infants (Altimier & Phillips, 2016; Montirosso et al., 2018). As a result, preterm infants may have permanent physical, motor, and cognitive impairments (Burke, 2018).

Developmental care was introduced as a method to protect the preterm infants' neurological system and to decrease the negative effects on preterm infants (Als, 2009). The aim of developmental care is to decrease preterm infants' stress, maximize neurological, cognitive, and behavioral outcomes, and reduce long-term neurodevelopmental problems (Mosqueda et al., 2013; Pineda et al., 2013). The Newborn Individualized Developmental Care and Assessment Program (NIDCAP) is the most well-known standardized model designed for developmental care, and it was developed with the aim of training and educating NICU staff, as well as providing guidance for implementing developmental care (Als, 2009; Ohlsson & Jacobs, 2013). Recently, an integrative developmental care model has been produced, which involves creating a healing environment while offering an individualized, calming, and soothing approach that keeps the family involved in the infant's care (Altimier & Phillips, 2016).

Developmental care practice is defined as nursing care commonly implemented by NICU nurses to support the infants' physiological stability and optimize their neurodevelopment (Burke, 2018; Mosqueda et al., 2013). This involves positioning, skin to skin contact (touch, Kangaroo care), minimizing stress (noise, excessive lights) and pain, an infant-led approach to oral feeds, partnering with parents, and providing adequate stimuli for infants' development (Altimier & Phillips, 2016; Kardaş Özdemir & Güdücü Tüfekci, 2014; Spilker et al., 2016). The role of NICU nurses is vital for the successful implementation of developmental care for preterm infants' neurodevelopment (Altimier, Kenner, & Damus, 2015; Kardaş Özdemir & Güdücü Tüfekci, 2014; Mosqueda et al., 2013). Numerous studies on the effects of

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developmental care practice for preterm infants have shown positive outcomes, including enhanced weight gain, shorter hospitalization duration, enhancement of neurodevelopment, and effective pain control (Burke, 2018; Kardaş Özdemir & Güdücü Tüfekci, 2014; Montirosso et al., 2018; Moody, Callahan, Aldrich, Gance-Cleveland, & Sables-Baus, 2017). Therefore, enhancing NICU nurses' developmental care practice could positively affect preterm infants' development (Kim & Shin, 2016).

Although developmental care is now recognized as an integral component of nursing care for preterm infants, limited studies have reported on the factors influencing developmental care practice among NICU nurses (Mosqueda et al., 2013; Soleimani, Torkzahrani, Rafiey, Salavati, & Nasiri, 2017; Zhang, Lee, Chen, & Liu, 2016). According to previous studies, nurses' characteristics (e.g. education level, years of nursing experience), and nursing work environment (e.g. patient caseloads, work hours) influence the practice of developmental care in the NICU (Soleimani et al., 2017; Zhang et al., 2016). Another study revealed that nurses' perception of the impact of developmental care was positively associated with their practice of developmental care (Mosqueda et al., 2013). Meanwhile, Mahl et al. (2015) reported that a hierarchical organizational culture was associated with neonatal survival without major morbidities in the NICU. Organizational culture refers to the values, beliefs, and behaviors shared by organizational members (Quinn & McGrath, 1985). Similarly, another study has reported that nurses' perceptions of the organizational climate of their unit affected the frequency at which they performed caring practices (Roch, Dubois, & Clarke, 2014). This suggests that one important factor for successful developmental care practice may be organizational culture (Mahl et al., 2015).

Nurses with a high level of professional efficacy, which is defined as a sense of optimism in a person's ability to adapt, could overcome difficult situations and accomplish tasks in their professional situations (Kadivar, Seyedfatemi, Zolfaghari, Mehran, & Hossinzade, 2016; Schaufeli, Leiter, Maslach, & Jackson, 1996). Thus, professional efficacy might be another factor influencing developmental care practice in NICU nurses (Kadivar et al., 2016). According to a study performed by Mosqueda et al. (2013), NICU nurses felt that developmental care was a time-consuming and difficult task. Developmental care requires some level of training and substantial efforts by the nurses because preterm infants in the NICU need highly technical medical care (Altimier & Phillips, 2016).

Comprehensive understanding of factors that influence developmental care practice may help in the development of strategies to improve it among NICU nurses. Based on previous studies (Kadivar et al., 2016; Mahl et al., 2015; Mosqueda et al., 2013; Zhang et al., 2016), researchers hypothesized that nursing work environment, perceptions of developmental care, organizational culture, and professional efficacy might influence the integration of developmental care practice into all aspects of nursing care for preterm infant development in the NICU. By examining the effect of these variables, this study aimed to identify factors that influence developmental care practice among NICU nurses.

Methods

Study design and data collection

This study used a cross-sectional descriptive research design for multiple linear regression analysis. Participants were recruited from 6 hospitals in 3 metropolitan cities in South Korea. These NICUs had a nurse-patient ratio of 1:3 or 1:4, 20–60 beds, and standards for preterm infants (gestational age < 37 weeks and low birth weight (<2500 g)), which are based on standards of the American Academy of Pediatrics. We included nurses who had been working in the NICU for 6 months or more. The exclusion criteria were nurses who did not directly participate in patient care and who had not completed their orientation period and were therefore unable to independently care for patients. The sample size was calculated using G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009). Assuming a significance level of 0.05, an effect size of 0.15 (medium), a power of 0.90, and 7 predictors for a multiple linear regression analysis, the minimum required sample size was 123. Data were collected from June to November 2018.

Institutional review board approval was obtained, and hospitals were selected by convenience sampling. The researchers called the Nursing Department of each hospital and explained the purpose of the study. After obtaining permission for data collection, research assistants visited each hospital and explained the purpose of the study to NICU nurses who had finished the day duty. Written informed consent was obtained from each individual participant. It was explained to participants that anonymity was guaranteed, and no personal information would be disclosed to external parties. Participants were also told that they had the right to withdraw from the study at any point and could refuse to participate at any time without any negative consequences. Research assistants distributed the questionnaires directly to the nurses who provided their written informed consent, and nurses immediately completed the questionnaires. The survey took approximately 5 min to complete, and participants were given a gift card as a reward for their time and cooperation for this study. We distributed 152 questionnaires; however, 11 respondents did not meet the inclusion criteria, while 8 had under 6 months of experience of working in a NICU, and 3 were head nurses who did not participate in direct nursing care for neonates. Thus, 141 nurses were included in the final analysis.

Measures

The survey questionnaire included questions regarding participants' characteristics, nursing work environment, perceptions of developmental care, organizational culture, professional efficacy, and developmental care practice. Participants' characteristics included age, sex, marital status, education level, length of work experience as an NICU nurse, position, and whether participants attended training on developmental care at a hospital.

Developmental care practice

Developmental care practice was measured using the Developmental Supportive Competency Scale for Nurses caring for preterm infants, which was developed in Korean by Kim and Shin (2016). This scale originally contained 19 items with 6 subscales: “environmental support,” “parental support,” “interaction,” “critical thinking,” “professional development,” and “partnership”. However, the researchers adopted the 4 subscales that measure developmental care as direct nursing practice and excluded the “professional development” and “partnership” subscales. Therefore, this study used 13 items on a four-point Likert scale (1 = “not at all” to 4 = “almost always”). For each item, respondents were asked to indicate the extent to which they practice each item in nursing care. An example item is “I coordinate feeding method observing response of infants during feeding.” The score of each item was summed and the total score ranged from 13 to 52. Higher scores indicate higher developmental care practice integration into all aspects of nursing care for preterm infants. The Cronbach's alpha reliability coefficient in this study was 0.87.

Nursing work environment

Nursing work environment was measured using the “staffing and resource adequacy” subscale of the Practice Environment Scale of Nursing Work Index, which was developed by Lake (2002). This scale originally consisted of 31 items with 5 subscales and was translated into Korean and validated by Cho, Choi, Kim, Yoo, and Lee (2011). The subscale of “staffing and resource adequacy” consists of 5 items on a four-point Likert scale (1 = “strongly disagree,” to 4 = “strongly agree”). For each item, respondents were asked to indicate the extent of similarity between the description and their working environment. A sample item is “Enough registered nurses to provide quality patient care.” The

score of each item was summed and the total score ranged from 4 to 16. Higher scores indicate a better environment of nursing work, such as adequate staffing and supporting resources. The Cronbach's alpha reliability coefficient in this study was 0.76.

Organizational culture

Organizational culture was measured using the Nursing Organization Culture Measurement scale which was developed in Korean by Kim, Kim, and Han (2004). This scale consists of 4 factors based on the Competing Values Framework developed by Quinn and McGrath (1985). This scale contains 20 items with 4 subscales; a) relationship-oriented culture that emphasizes nurses' relationships, b) innovation-oriented culture that emphasizes patients' satisfaction, c) hierarchy-oriented culture that emphasizes regulations and stability, and d) task-oriented culture that emphasizes achievement and productivity. Each item was answered on a five-point Likert scale (1 = "not at all", 5 = "absolutely yes"). For each item, respondents were asked to indicate the extent of similarity between the description and their unit. An example item is "Organization supports the acquisition of the latest nursing information and continuous study." The score of each item was summed and the total score ranged from 20 to 100. Higher scores indicate higher perceptions of which culture(s) predominate. The Cronbach's alpha reliability coefficients of "relation-oriented," "innovation-oriented," "hierarchy-oriented," and "task-oriented" in this study were 0.89, 0.82, 0.77, and 0.73, respectively.

Perception of developmental care

Perception of developmental care was measured using the subscale of the Attitude in Agreement with Theory of Planned Behavior statement that was developed by Van der Pal et al. (2007) to assess the Newborn Individualized Developmental Care among NICU nurses. The subscale of attitude consists of 8 items on a five-point Likert scale (1 = "completely disagree" to 5 = "completely agree"). Four of the items were reverse coded for analysis. The original scale was translated into Korean by a bilingual nursing professor, after which it was back-translated by a professional academic translator to avoid misinterpretations. For each item, respondents were asked to indicate the extent of similarity between the description and their perception of developmental care. A sample item is "Developmental care during care-giving is an improvement of our care." The score of each item was summed and the total score ranged from 8 to 40. Higher scores indicate a higher perception of developmental care. The Cronbach's alpha reliability coefficient in this study was 0.69.

Professional efficacy

The scale for professional efficacy used in this study was a subscale of professional efficacy in the Maslach Burnout Inventory-General Survey (MBI-GS). The MBI-GS (Schaufeli et al., 1996) consists of 3 subscales. This scale was translated into Korean and validated by Shin (2003). Professional efficacy consisted of 6 items on a seven-point Likert scale (0 = "never" to 6 = "every day"). An example item is "In my opinion, I am good at my job." The score of each item was summed and the total score ranged from 0 to 36. Higher scores indicate higher satisfaction with past and present accomplishments and higher expectations of continued effectiveness at work. The Cronbach's alpha reliability coefficient in this study was 0.93.

Statistical analyses

The data were analyzed using SPSS Statistics 23.0 (IBM Corp., Armonk, NY, USA). Normal distribution of the main variables was confirmed before analysis. The reliability of related variables was assessed using the Cronbach α coefficient. Participants' characteristics and main variables were described using means with standard deviations and frequencies with percentages. Participants' characteristics and the relationship with developmental care practice were analyzed through independent *t*-tests and analysis of variance (ANOVA). Differences in the main study variables by hospitals were analyzed through ANOVA. The Pearson correlation coefficient was used to examine the correlation between study variables. To examine factors that influence developmental care practice among NICU nurses, multiple linear regression analysis was performed using variables found to be significant in univariate analysis. To ensure that the conditions for regression analysis were met, there should be no auto-correlation or multicollinearity (Jadhav, Kashid, & Kulkarni, 2014). The Durbin-Watson statistic and tolerance tests were performed to confirm statistical assumptions.

Results

The mean participant age was 28.78 years (Table 1). All participants were female, and most were not married (77.3%). The mean length of experience as an NICU nurse was 5.16 years. Most participants were staff nurses (88.7%) and had attended previous education on developmental care at the hospital (82.3%). There was no relationship between developmental care practice and the participants' characteristics.

Table 2 shows the mean score of the main study variables. The mean score for developmental care practice was 40.85 out of 52.0. The mean score for organizational culture was as follows: 15.69 out of 25.0 for relationship-oriented, 18.39 out of 30.0 for innovation-oriented, 17.16 out of 25.0 for hierarchy-oriented, and 11.50 out of 20.0 for task-oriented.

Table 3 shows the differences in the main study variables by hospitals. Innovation-oriented ($p = .008$) and task-oriented organizational culture ($p = .003$) were significantly different according to hospitals.

Table 4 shows the correlation between the study variables. Developmental care practice had a weak correlation with innovated-oriented organizational culture ($r = 0.18$, $p = .029$) and task-oriented organizational culture ($r = 0.17$, $p = .042$), and a moderate correlation with perception of developmental care ($r = 0.29$, $p < .001$) and professional efficacy ($r = 0.41$, $p < .001$).

Table 1
Participants' characteristics and relationship to developmental care practice (N = 141).

Characteristics		n (%)	Mean ± SD		t or F (*p*)
Age (years)			28.78 ± 4.97 (range 23–46)		–
Sex	Woman	141	(100.0)	–	–
Marital status	Marred	32	(22.7)	41.02 ± 4.16	0.25
	Not married	109	(77.3)	40.80 ± 4.47	(0.804)
Education level	Associate degree	15	(10.6)	40.27 ± 4.35	2.73
	Bachelor's	107	(75.9)	40.55 ± 4.26	(0.069)
	Master's/doctoral	19	(13.5)	43.00 ± 4.70	
Length of work experience as an NICU nurse (years)			5.16 ± 4.45 (range 0.6–21)		–
Position	Staff nurses	125	(88.7)	40.57 ± 4.23	−1.82
	Charge nurses	16	(11.3)	43.00 ± 5.11	(0.085)
Attended education on developmental care at hospital	Yes	116	(82.3)	41.08 ± 4.11	1.37
	No	25	(17.7)	39.76 ± 5.44	(0.172)

SD = standard deviation, NICU = neonatal intensive care unit.

Table 2
Mean score of the main study variables (N = 141).

Variables	Mean ± SD
Developmental care practice[a] (13)	40.85 ± 4.39
Have responsibility for the progress or health condition of infants.	3.49 ± 0.51
Protect sleep cycles and avoid sleep interruption by covering incubator to shield from bright lights.	3.38 ± 0.54
Coordinate feeding methods by observing response of infants during feeding.	3.37 ± 0.51
Comfort parents by standing by them during visiting hours.	2.93 ± 0.62
Modify care and priorities in accordance with developmental needs.	2.89 ± 0.55
Identify the parents' informational needs and concerns for development of their infant.	2.56 ± 0.66
Nursing work environment (4)	7.96 ± 1.91
Organizational culture	
Relation-oriented (5)	15.69 ± 3.25
Innovation-oriented (6)	18.39 ± 3.49
Hierarchy-oriented (5)	17.16 ± 2.91
Task-oriented (4)	11.50 ± 2.39
Perception of developmental care (8)	28.47 ± 3.11
Professional efficacy (6)	23.73 ± 7.01

(), number of items.
[a] The items having the 3 highest and 3 lowest scores among the 13 items.

Table 5 illustrates the factors that influence NICU nurses' practice of developmental care. Variables that were significant in univariate analysis were included in the model. The professional efficacy score ($\beta = 0.33$, $p < .001$) had the largest impact, followed by the perception of developmental care ($\beta = 0.23$, $p = .005$), and task-oriented organization culture ($\beta = 0.16$, $p = .046$). These variables explained 22.0% of the variance in developmental care practice among NICU nurses. These regression diagnostics confirmed the absence of multicollinearity (tolerance, 0.838–0.916) or autocorrelation (Durbin-Watson statistic, 2.143).

Discussion

In recent studies, NICU nurses did not consistently implement developmental care or evaluate developmental care with the increased nursing workload (Altimier & Phillips, 2016; Zhang et al., 2016). Korean nurses in NICUs reported a high level of developmental care practice in this study. However, among the developmental care practice studied, nurses' assessment of parents' needs and concerns for development was the lowest. This suggests that NICU nurses should be aware of the importance of partnering with parents and should receive more training to properly involve parents in developmental care.

Although professional efficacy is an important factor for the quality of nursing care (Cho & Bang, 2013), little is known about the associations between them. This study found that professional efficacy had the strongest impact on developmental care practice in NICU nurses. High professional efficacy and a strong sense of optimism in their ability and motivation to work may have a positive impact on nurses' professional performance (Jnah, Robinson, & Dowling, 2015). To improve developmental care practice in NICUs, structural training programs for increasing professional efficacy are needed. Additionally, in the present study, many NICU nurses had received training or education on developmental care, although they did not influence developmental care practice. Most of the education provided was in the form of a seminar or lecture, which is known to improve knowledge and awareness of the importance of developmental care (Mosqueda-Peña et al., 2016). However, this form of training may not improve developmental care competency in nursing practice. Similarly, Chinese NICU nurses perform developmental care based primarily on their clinical experiences rather than their educational experiences (Zhang et al., 2016). A previous study (Kadivar et al., 2016) reported that virtual program-based education increased the professional efficacy of NICU nurses. Therefore, a substantial training program, including simulation or virtual education, is needed to improve developmental care practice by enhancing professional efficacy in NICU nurses.

Perception of developmental care was also an influencing factor for developmental care among NICU nurses. Nurses' perception of the importance of developmental care could lead to better implementation of developmental care (Mosqueda et al., 2013). In a previous study (Kim & Shin, 2014), although most NICU nurses were aware of the importance of developmental care, they did not perform developmental care. This was because they considered medical treatment for survival to be the main priority as premature infants commonly have severe conditions. Therefore, nurses need to recognize developmental care as an integral part of nursing care for preterm infants rather than as additional nursing practice. Moreover, developmental care requires cooperation and teamwork among the NICU staff as well as trained personnel (Hendricks-Munoz & Prendergast, 2007). Therefore, to emphasize the importance of developmental care for preterm infants, trained nurses could act as peer mentors to guide developmental care and should provide the opportunity for nurses' perceptions of developmental care to be communicated among NICU nurses.

Finally, this study also noted that a task-oriented organizational culture influenced developmental care practice in NICU nurses. Organizational culture is the organization's norms and expectations of members' behavior and roles. Of the organizational culture types, the task-oriented organizational culture places emphasis on the achievement of organization tasks and is orientated towards efficacy and productivity (Quinn & McGrath, 1985). Accordingly, nurses who perceive a task-oriented culture in the NICU would consider developmental care as a nursing task that should be achieved and would strengthen developmental care as part of their competency building. Although a task-

Table 3
Differences in main study variables by hospitals.

Variables	A hospital (n = 54) M ± SD	B hospital (n = 26) M ± SD	C hospital (n = 18) M ± SD	D hospital (n = 16) M ± SD	E hospital (n = 15) M ± SD	F hospital (n = 12) M ± SD	F	*p*
Developmental care practice	41.32 ± 3.80	40.48 ± 5.07	39.65 ± 4.97	40.84 ± 3.53	41.89 ± 6.35	38.99 ± 4.22	0.72	0.609
Nursing work environment	8.06 ± 2.02	7.38 ± 1.74	7.59 ± 2.00	8.53 ± 1.96	8.78 ± 1.30	8.20 ± 0.84	1.34	0.252
Relation-oriented organizational culture	15.61 ± 3.38	14.97 ± 3.51	17.29 ± 2.76	16.27 ± 2.52	14.56 ± 3.24	15.80 ± 2.39	1.46	0.206
Innovation-oriented organizational culture	18.62 ± 3.15	16.34 ± 3.89	20.06 ± 3.44	19.20 ± 2.24	18.56 ± 4.48	18.80 ± 2.77	3.25	0.008
Hierarchy-oriented organizational culture	17.42 ± 3.00	17.21 ± 2.54	15.88 ± 3.55	17.20 ± 2.91	17.56 ± 2.24	16.80 ± 2.39	0.81	0.543
Task-oriented organizational culture	11.44 ± 2.33	10.48 ± 2.54	12.35 ± 2.15	11.00 ± 2.14	13.00 ± 1.41	14.00 ± 1.73	3.78.	0.003
Perception of developmental care	28.85 ± 3.16	27.86 ± 3.15	27.59 ± 2.45	28.53 ± 3.89	28.67 ± 3.04	29.40 ± 1.14	0.78	0.563
Professional efficacy	24.11 ± 6.26	24.59 ± 8.03	22.71 ± 6.89	22.93 ± 8.57	23.00 ± 7.70	21.00 ± 6.67	0.40	0.849

Table 4
Correlation coefficients between the study variables (N = 141).

Variables	1 r (p)	2 r (p)	3 r (p)	4 r (p)	5 r (p)	6 r (p)	7 r (p)	8 r (p)	9 r (p)	10 r (p)
1. Developmental care practice	1									
2. Relation-oriented organizational culture	0.09	1								
3. Innovation-oriented organizational culture	0.18*	0.52***	1							
4. Hierarchy-oriented organizational culture	0.08	−0.06	−0.25**	1						
5. Task-oriented organizational culture	0.17*	0.13	0.35***	0.25**	1					
6. Nursing work environment	−0.10	0.40***	0.33***	−0.12	0.04	1				
7. Professional efficacy	0.41***	0.26**	0.18*	−0.07	0.07	0.02	1			
8. Perception of developmental care	0.29***	0.33***	0.11	−0.03	−0.13	0.10	0.24**	1		
9. Age	0.15	0.01	−0.02	0.01	0.19*	−0.23**	0.33***	0.06	1	
10. Years of NICU experience	0.06	−0.01	−0.02	0.03	0.21*	−0.21*	0.34***	0.03	0.85***	1

NICU = neonatal intensive care unit.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

oriented organizational culture had a smaller impact on developmental care practice than professional efficacy and perception of developmental care, it is recommended that future study would consider organizational culture as a potential factor influencing developmental care in NICUs.

Meanwhile, the hospital with the highest score for developmental care practice had the highest scores for nursing work environment and hierarchical organizational culture, as well as the lowest score for relationship-oriented organizational culture. This suggests that hospitals having adequate staffing and resource, and emphasizing regulations and stability could promote developmental care practice in NICU nurses. However, these findings should be interpreted with caution given the small number of participants from hospitals B–F. Further study would be required to investigate these findings in more details.

Nurse managers need to understand that individual factors, such as professional efficacy and the perception of developmental care, could influence developmental care practice among NICU nurses. Furthermore, they need to understand that unit factors, such as organizational culture, can have a considerable influence. Nurse managers could create an open environment in which nurses could discuss developmental care as a nursing task that should be accomplished in the NICU. They can also encourage NICU nurses to be confident that they can accomplish their own tasks in accordance with the organization.

The strength of the present study is that it integrated individual and organization factors while investigating influencing factors for developmental care practice among NICU nurses. An interesting finding was that a task-oriented organizational culture, as well as individual factors, could affect developmental care practice among NICU nurses. This finding suggests that unit-level efforts can influence the practice of developmental care for preterm infants. Nevertheless, there are some limitations that may have affected the accuracy of the results. Data were only collected in 6 hospitals in metropolitan cities, which could limit the generalizability of the study findings. In addition, even though most large hospitals in South Korea with >1000 beds have a NICU, the NICU is not divided into levels based on neonatal conditions. Therefore, the severity of the NICU preterm infants' conditions may vary from hospital to hospital. This limitation should be considered when interpreting the study findings. This study only surveyed day shift nurses who may have a different experience to those working the night shift, which might in turn lead a different perception of developmental care practices. Furthermore, this study used a cross-sectional design and thus causal relationships could not be inferred. Finally, study variables explained only 22% of the variance. There might be various factors affecting developmental care practice; however, this study could not involve all confounding variables.

Table 5
Factors influencing developmental care practice among neonatal intensive care unit nurses (N = 141).

Variables	β	t	p
Innovation-oriented organizational culture	0.04	0.51	0.612
Task-oriented organizational culture	0.16	2.01	0.046
Perception of developmental care	0.23	2.88	0.005
Professional efficacy	0.33	4.26	<0.001
Adjusted R^2			0.22
F (p)			10.55 (<0.001)

Conclusions

Our findings suggest that simulation and virtual program-based education may be effective in encouraging NICU nurses to implement developmental care. A practical training program such as this may help NICU nurses become more confident while implementing developmental care for preterm infants. In addition, nurse managers may stress the necessity of practicing developmental care for preterm infants among NICU nurses. Trained core nursing staff could act as peer mentors and provide information about the association between developmental care and neurobehavioral outcomes in preterm infants so that nurses understand the importance of developmental care. An interesting finding was that a task-oriented organizational culture was associated with developmental care practice among NICU nurses. This finding suggests that efforts of nurse managers are also needed to enhance developmental care practice among NICU nurses. Therefore, nurse managers could create an organizational culture where nurses recognize developmental care as an essential nursing task for preterm infants. In addition, they need to encourage the NICU nurses to accomplish their nursing tasks in accordance with the organization goals. Future studies might consider developmental care practice according to NICU level. It is recommended that future studies should add other factors, such as parental factors (e.g., parental involvement in the developmental care) to identify factors affecting developmental care practice.

Author contribution statement

This manuscript (titled “Factors influencing developmental care practice among neonatal intensive care unit nurses”) was completed by Jisun Park, and Ji-Soo Kim.

-Study design: Ji-Soo Kim, Jisun Park.
-Data collection and analysis: Jisun Park, Ji-Soo Kim.
-Manuscript writing: Ji-Soo Kim.

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Ethical approval

Ethical approval for this study was received from the Institutional Review Board of Gachon University (1044396-201809-HR-176-01), and Seoul National University Hospital (1808-171-969).

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