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Research Article

Preterm Infant Care Practice among Nurses in Neonatal Care Units of Selected Hospitals of Nepal: A Cross-Sectional Study

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Introduction. Preterm infants (PTIs) are vulnerable to morbidity, disability, and mortality. They require meticulous care for survival and development in neonatal care units (NCUs). PTI care in NCUs is a collaborative and team effort among different health professionals. However, nurses have a key role for quality care. This study aimed to assess nurses' PTI care practices across different hospitals in Nepal. *Methods*. A descriptive cross-sectional study was conducted in NCUs of six randomly selected public hospitals in Nepal. After obtaining ethical approval, structured observation was completed among 40 NCU nurses using a practice checklist. After observation, a self-report questionnaire was administered among 102 nurses. Both descriptive and inferential statistics were used for data analysis. *Results*. The observation and self-reported mean infant care practices were 73.7% and 70.7%, respectively. The overall practice median score and the interquartile range (IQR) were 4.0 (3.5–4.3) with the highest score of (4.5 [4.1–4.7]) for daily supportive care and the lowest score of (2.8 [2.1–3.5]) for pain management. The care practice was strongly associated with the nurse-infant ratio (adjusted odd ratio (aOR) = 18.52, confidence interval (CI) = 5.83–58.77, and $p = < 0.001$) and training status (aOR = 4.95, CI = 1.59–15.39, and $p = 0.006$). *Conclusion*. Nurses have adequate practice of thermal care, safe oxygen administration, nutritional care, and infection prevention in NCUs, whereas lacking is found regarding developmental supportive care components (sleep promotion and a supportive sensory environment), parental support, and pain management practices. Consideration of the proper nurse-infant ratio and continued professional development opportunities are essential for practice enhancement in NCUs. These findings might be useful to identify the gaps in PTI care practice in NCUs.

1. Introduction

Preterm birth (PTB) is a live birth that occurs before 37 completed weeks of gestation. Globally, the preterm birth rate is near consistent, i.e., 9.8% in 2000 and 10.6% in 2014 [1] and 9.9% in 2020 [2]. The Lancet Global Health Estimate of PTB shows that approximately 14.8 million live births were preterm in 2014 [1]. In 2020, there was an insignificant reduction in PTB (13·4 million) with a similar 1 in 10 live births [2]. Its highest prevalence is in southern Asia (13·2%) in 2020 which was slightly higher than 13.3% in 2010 [2]. Asian countries including India, China, Bangladesh, and Pakistan are among the countries having a high PTB rate (44•6% of the global PTBs) [1]. In Nepal, different studies reported its incidence as 9.3%–14% [3–5].

Globally, prematurity and its related complications are the leading causes of neonatal mortality consisting of 35% of total neonatal mortality and 18% of under-five mortality [6]. Although the risks of mortality and morbidity are much higher in early gestation (<34 weeks), late PTB (34–37 weeks) occurs more often, and they have significantly higher risks of adverse outcomes compared to term infants. A hospital-based study conducted in India and Nepal showed a significant number of PTIs admitted in NCUs

(28.2%, 18.4%–39.2%) [7–9]. Preterm births usually have low birth weight (LBW) which is a greater risk for morbidity and mortality [2]. The risk is inversely proportional to the gestational age and birth weight of infants [10]. In addition to morbidity and mortality risk, PTIs are at risk of disabilities and poor development and requiring extra attention for optimal development [11]. The survival of preterm and LBW infants is an important agenda to achieve the Sustainable Development Goals of reducing neonatal and child mortality and to end preventable newborn mortality by 2030 [11].

Most of the PTB infants require special care in NCUs for their survival and developmental potential [11, 12]. The quality of care provided in NCU determines the survival, timely discharge, and long-term outcome of these infants [11]. In addition to survival care like adequate respiratory, thermal, and nutritional support, these infants require developmental supportive or neuroprotective care for their survival without developmental sequel. There are various evidence-based interventions and models of care of these infants in NCUs recommended for international [11–13] and national contexts [14, 15]. The overall goal of such care is to create a more natural and stress-free (healing) environment for the PTIs' physiological stability and normal neurological development. The components of PTI care include skin-to-skin contact which is practiced as kangaroo care (KC), nutritional care with exclusive breast milk feeding, proper positioning and handling, sleep promotion measures, supportive sensory environment, stress and pain management, and parent involvement in infant care among others [11, 16].

PTI care in NCU is a collaborative and team effort of multiprofessionals, and nurses play a key role in providing quality care [11, 17]. Therefore, NCU nurses must possess required knowledge, attitude, and competence [18]. Furthermore, nursing care practice at NCUs is determined by various factors like workload, related training, resources, and supportive working environment [19, 20]. Limited contextual information and evidence are available regarding nurses' PTI care practice in NCUs. Available literature indicated less systematized care situations in developing countries [17, 21]. Therefore, the study aimed to answer the research question: What is the preterm infant care practice of nurses in the neonatal care units of different hospitals of Nepal?

2. Methods and Materials

2.1. Research Design. This descriptive cross-sectional survey was the second phase of the exploratory mixed-method study. In the first phase of the study, qualitative exploration was performed using focus group discussion among nurses working in NCUs. Based on qualitative findings (codes, subthemes, and themes) of the first phase and pertinent literature, instruments were developed for the second quantitative phase. The cross-sectional survey was conducted using those instruments.

2.2. Study Settings. The study was conducted in NCUs of public hospitals in Nepal. Hospitals having both sick newborn care units (SNCUs) and neonatal intensive care units (NICUs) with eight or more neonatal beds were included in the study. There were a total of 12 hospitals that met the inclusion criteria (four in the capital city of Nepal and eight in the different country sides). Among those hospitals, six hospitals (three from the capital city and three from the countryside) were selected randomly for the study.

2.3. Population and Sampling Procedure. The population of the study was the nurses working in NCUs. Considering the prevalence of the kangaroo mother care (KMC) practice among healthcare providers (0.66) in Nepal [22], the total number of eligible participants (108), and the nonresponse rate of 20%, the calculated sample size was 99. A total of 102 nurses eligible and willing to participate in the study were included in the study from different settings.

2.3.1. Inclusion/Exclusion Criteria. All the nurses working in NCUs for more than six months who were available during the period of data collection and willing to participate in the study were included in the study.

2.4. Instruments

2.4.1. Demographic and Professional Information. Demographic and professional information included participants' age, educational status, working experience in NCUs, and related training.

2.4.2. PTI Care Practice. Two instruments having similar themes and components were developed based on existing literature and unstructured interview findings, i.e., (1) an observation checklist to observe the practice and (2) a self-report questionnaire to obtain their self-reported practice.

(1) Observation Checklist. The checklist had 5 subscales: (1) supportive care of daily living (23 items), (2) sleep promotion (3 items), (3) supportive sensory environment (5 items), (4) pain management (7 items), and (5) parental support (5 items). The supportive care of daily living had six subcomponents: (i) respiratory care and safe oxygen administration (2 items), (ii) thermal care (3 items), (iii) nutritional care (7 items), (iv) positioning and handling (3 items), (v) skincare (3 items), and (vi) infection prevention (5 items). The checklist had 43 items with "yes" and "no" response options and a remark column. The scoring system was "0" for "not done" and "1" for "done" for each item. The total score of the checklist was 44.

(2) Self-Report Questionnaire. The self-report questionnaire was a rating scale. It had 5 subscales similar to the observation checklist and 44 items: (1) supportive care of daily

living (21 items), (2) sleep promotion (3 items), (3) supportive sensory environment (5 items), (4) pain management (7 items), and (5) parental support (7 items). The supportive care of daily living had five subcomponents: (i) respiratory care and safe oxygen administration (2 items), (ii) thermal care (4 items), (iii) nutritional care (8 items), (iv) positioning and proper handling (3 items), and (v) skin care (4 items). Participants had to respond to each item on a five-point rating scale: "1" (never practiced), "2" (rarely practiced), "3" (sometimes practiced), "4" (most of the time practice), and "5" (always practice).

The possible score of the scale ranged from 44 to 220. The content validity index scores of the scale were 0.91 for the scale and >0.75 for the items. The Cronbach alpha values for the subscales ranged from 0.79 to 0.88, and for the overall scale, the value was 0.93.

2.4.3. Ethical Considerations. The ethical approval for the study was taken from the Nepal Health Research Council (Registered no. 2804/2019). Administrative permission was obtained from the study settings. To obtain consent, participants were informed about the research purpose, procedures, rights to voluntary participation, and freedom to withdraw or decline participation without any threat. They were assured about the privacy and confidentiality of the data. For the observation, written informed consent was obtained from the in-charge of each NCU. Verbal consent was obtained from participants after brief explanation about the observation.

2.5. Data Collection

2.5.1. Practice Observation. The direct nonparticipant observation was performed among 40 participants at NCUs after obtaining verbal informed consent. The participants' PTI care practice was observed using a structured checklist over a period of about 20–25 hours in each setting, during morning and evening shifts. The unit of observation was routine care provided in different time schedules. The emergency care and interventions were excluded from observation.

2.5.2. Self-Report. After completion of the observation of care practice, a self-report questionnaire was administered to all the study participants. Questionnaires were distributed in small groups at the convenient time of participants. They completed the questionnaire in the presence of the principal author and dropped it in a box. Data collection began in September 2020 and ended in February 2021.

2.5.3. Data Analysis. Both descriptive and inferential statistics were used for data analysis. The findings of the observation were reported in numbers and percentages.

The responses for the five-point rating scale in the self-report questionnaire were transformed as presence and absence of practice. Responses for always practicing with a score of "5" and practicing most of the time with a score of "4" were categorized as having practice, and responses for never practicing "1," rarely practicing "2," and sometimes practicing "3" were categorized as not having practice.

Obtained practice scores (observation and self-report) for items and subscales were categorized as good practice (>80%), a moderate level of practice (50–80%), and low practice (<50%) [16]. The care practice proportion of the observation and self-report (dichotomized) was compared using the Chi-square test.

The findings of the self-report questionnaire (self-report) were also reported as the subscale and scale mean percentage and median scores with an interquartile range (IQR). A higher score in the item, subscale, and scale represented better practice. An association of PTI care practice with influencing variables was assessed using the Chi-square test. To examine factors influencing care practice, the logistic regression model was applied including the variables having p values <0.05.

3. Results

Among 102 participants, their mean age was 27.2 ± 5.5 years, 57.8% were bachelor-level nurses, most of the nurses (92.2%) were working as the staff nurses (or registered nurses), 72.5% participants had <3 years of working experience in NCU, and 36.3% nurses received neonatal care-related training within five years. Training included two days of training like "helping baby breathe," "breastfeeding," "kangaroo mother care (KMC)," and 15 days of "level II neonatal care training" (Table 1).

The daily supportive care practice showed good practice (scores >80%) on the areas like oxygen administration, thermal care, some items of nutritional care, and infection prevention in both the observation and self-report. Nevertheless, a moderate level of practice (scores 50–80%) was found for KMC practice of any type (75.5%), exclusive breast milk feeding (77.5%), and proper positioning and using nesting (65.0% and 68.5%) during observation. Furthermore, inadequate practice (scores: 45.0% and 37.5%) in the observation and moderate level of practice in the self-report (scores 67.6% and 52.9%) was found for breastfeeding support and nonnutritive sucking (NNS). The moderate level of practice (score 70%) for changing clean/autoclaved gowns daily was because of the lack of gowns in some settings. The observed practice was significantly lower for breastfeeding support compared to the self-report ($p < 0.001$) (Table 2). During the observation, low practice was related to nurses' workload in the NCUs as well as less emphasis on breastfeeding support.

Regarding the promotion of sleep and supportive sensory environment (SSE), good practice was found for minimum handling (82.5%), clustered routine care (82.4%), and covering eyes while exposure to bright light (97.1%) in the self-report, whereas moderate to low practice (scores 79.4–35.0%) was identified for the various sleep and SSE items in observation (Table 3). Significantly lower practice was observed for light minimization and encouraging infant-parent attachment ($p = < 0.05$) compared to the self-

Table 1: Demographic and professional characteristics of the nurses, $n = 102$.

Characteristics	Number	Percent
Age in years		
≤30	81	79.4
31–40	17	16.6
≥41	4	3.9
Mean age ± SD: 27.2 ± 5.5 years, range 19–49 years		
Educational qualification		
Proficiency certificate-level nursing	40	39.2
Bachelor nursing*	59	57.8
Masters in nursing	3	2.9
Years of experience in NCUs		
≤3	74	72.5
4–6	21	20.6
≥7	7	6.9
Median (IQR): 2 years (1–4 years), range 8 months to 19 years		
Designation		
Staff nurse	94	92.2
Senior staff nurse	8	7.8
Training on neonatal care**	37	36.3

Note. *Bachelor in nursing science and B. Sc. nursing. **Training received within five years.

report. During observation, it was found that they used to cover the PTIs' eyes during phototherapy and not for other light exposure. Findings also revealed low practice for most of the pain management items. Observed practice was significantly lower than self-reported practice with p values <0.05 (Table 3).

Parental support practice revealed that the lowest scores were for the infant-parent attachment 57.5% in observation and 54.9% in the self-report. Although there was good practice (scores >80%) for providing information and guidance about PTI care and danger signs in the self-report, a moderate level of practice (scores 60–77%) was found in observation (Table 4).

Among the subscale scores, the highest scores were for daily supportive care with mean percentages of 87.3 in observation and 90.0 with a median score (IQR) of 4.5 (4.5–5.0) in the self-report, whereas the lowest scores were for pain management with mean percentages of 25.0 in observation and 36.2 with a median score (IQR) of 2.8 (2.1–3.5) in the self-report. Among the daily supportive care components, the highest mean percentages were for thermal care (95.0 in observation and 94.1 with a median score (IQR) of 4.7 (4.5–5.0) in the self-report). The lowest mean percentages were for positioning handling (79.7) in observation and (84.0) with a median score of 4.3 (3.6–4.7) in the self-report. The overall scale mean percentages of 73.7 in observation and 70 with a median score of 4.0 (3.5–4.3) in the self-report indicated their moderate level of care practice (see Table 5).

The PTI care practice in NCUs was significantly associated with the nurse-infant ratio (OR: 16.66, CI: 5.91–47.61), nurses' work experience (OR: 4.813, CI: 1.747–13.254), and their neonatal care-related training status (OR: 3.802, CI: 1.579–9.174) ($p < 0.01$) (Table 6).

The logistic regression model for associative factors of PTI care practice constructed by including three significantly associated independent variables predicted 51% of variance. The situation having a near to standard nurse-infant ratio would 18.5 times more likely to provide standard care practice than a below-standard ratio (aOR = 18.520, CI = 5.836–58.773, and $p = < 0.001$). Likewise, having neonatal care training would five times more likely to provide standard care practice than not having training (aOR = 4.955, CI = 1.594–15.399, and $p = 0.006$) (Table 7).

4. Discussion

4.1. Key Findings. The overall median practice score with an IQR of 4.0 (3.5–4.4) in this study was better than the score (3.0 ± 0.4) reported by a study conducted in Iran [23]. The overall practice score of 70.7% in this study was in between the findings of two Iranian studies among neonatal nurses 66.5% and 74.84% [19, 24].

In this study, the highest practice score was related to daily supportive care (90.0%) and the lowest core was for pain management (36.2%). Similar highest scores for daily supportive care (79.46%, 85.67%) and lowest scores for pain management (59.16%, 66.5%) were reported by previous studies conducted in Iran although pain management scores were better in those studies [19, 24]. This study's findings show higher scores (≥80% or median score ≥4.5) for the daily supportive care components like safe oxygen administration, thermal care, and nutritional care, whereas a moderate level of practice scores (62.5–74.0%) was for the developmental care components like sleep promotion, supportive sensory environment, and positioning and handling. Similar less integration of developmental care in neonatal care practice is reported in the study among nurses and other healthcare professionals in Morocco [25]. Low practice was also reported in a study among nurses in Portugal [26]. Low compliance with best practice, especially for positioning, supportive sensory environment and pain management are reported in the structure observation of health professionals working in 25 NCU settings in South Africa [21]. Though having better health resources and infrastructure, study findings from China reported inadequate knowledge, attitude, care competency, and practice of nurses for developmental care in NCUs [18, 27]. Furthermore, the findings of a Korean study among 132 nurses providing care to preterm infants for more than six months in NCU reported a practice score of 0.8 with a range of 0.5–1 points [28]. Evidence indicated lacking in developmental supportive care practice, especially in middle- and low-income countries.

Among the daily supportive care, safe regulation of oxygen is essential for reducing the burden of visual morbidity like retinopathy of prematurity (ROP) [2, 29]. Findings revealed that there was good practice (scores 95.0% in observation and 89.7% in the self-report) of monitoring and safe oxygen administration, whereas the findings of a study in Sudan reported inadequate monitoring of oxygen saturation for oxygen administration [30]. Furthermore,

Table 2: Participants' care practice in regard to daily supportive care.

Items	Observed practice ($n = 40$) No. (%)	Self-reported practice ($n = 102$) No. (%)
Safe oxygen administration		
Monitor oxygen saturation	40 (100.0)	93 (91.2)
Administer low-flow oxygen via nasal cannula	36 (90.0)	90 (88.2)
Thermal care		
Ensure room temperature >25°C	—	100 (98.0)
Monitor temperature regularly	40 (100)	101 (99.0)
Regulate the temperature in the incubator/warmer	40 (100)	100 (98.0)
Facilitate parents for KMC	30 (75.0)	83 (81.3)
Nutritional care		
Assess condition before feeding	40 (100.0)	95 (93.1)
Scheduled feeding of EBM	40 (100)	98 (96.1)
Provide trophic feeding within 1-2 days	—	87 (85.2)
Feed exclusive EBM	31 (77.5)	89 (87.3)
Oral feeding in an upright position	40 (100)	94 (92.4)
Encourage nonnutritive sucking	15 (37.5)	54 (52.9)
Provide breastfeeding support	18 (45.0)	69 (67.6)*
Monitor daily weight	40 (100.0)	100 (98)
Positioning and handling		
Keep the head and trunk in a neutral midline position with flexion of extremities	26 (65.0)	75 (73.5)
Using nesting for positioning	27 (68.5)	80 (78.4)
Handle the PTI gently with extremities flexed and body well-supported	32 (80.0)	92 (90.2)
Skin care		
Provide oil massage after sponge bath	40 (100.0)	101 (99)
Use Tegaderm to fix the cannula, OG tube		61 (59.8)
Use the minimum adhesive tape to fix the cannula	35 (87.5)	83 (81.4.1)
Position change after routine care	40 (100.0)	99 (97.5)
Infection prevention		
Remove hand ornaments and wristwatches	38 (95.0)	—
Wash hands thoroughly to enter the unit	37 (92.5)	—
Change clean gowns daily	28 (70.0)	—
Maintain hand hygiene to handle an infant	37 (92.5)	—
Daily clean incubators with an antiseptic solution	40 (100.0)	—

Note. EBM: expressed breast milk. *p value significant at 0.01 (Chi-square test [2-sided]).

Table 3: Participants' care practice in regard to promotion of sleep, provision of a supportive sensory environment, and pain management.

Items	Practice	
	Observed practice ($n = 40$) No. (%)	Self-reported practice ($n = 102$) No. (%)
Sleep promotion		
Provide routine care by a nurse at a time	27 (67.5)	84 (82.4)
Minimal handle in between care	33 (82.5)	84 (82.4)
Keep PTIs wrapped with a blanket/wrapper	29 (72.5)	66 (64.7)
Supportive sensory environment		
Minimize light level during the night	—	74 (72.5)
Minimize light level at the PTI's bed	14 (35.0)	67 (65.7)*
Cover eyes when exposed to bright light	33 (82.5)	99 (97.1)*
Use low sound/voice in the unit	25 (62.5)	62 (60.8)
Provide stimulation while caring	31 (77.5)	81 (79.4)
Encourage infant-parent attachment	22 (55.0)	74 (72.5)*
Pain management		
Assess pain using an assessment scale	0 (0.0)	11 (10.8)**
Feed EBM before a painful procedure	9 (22.5)	22 (21.6)
Position the PTI keeping the extremities and head flexed and near the body with hand support during the painful procedure	0 (0.0)	39 (38.2)**
Use nonnutritive sucking during the procedure	0 (0.0)	38 (37.3)**
Wrap firmly after a painful procedure	21 (52.5)	62 (60.8)
Cuddle to comfort after a painful procedure	28 (75.0)	67 (65.7)
Involve mothers to comfort their PTIs	2 (5.0)	22 (21.6)**

*Chi-square test (2-sided), p value significant at 0.05. **Fisher's exact test (2-sided), p value significant at a <0.05 level.

Table 4: Participants' care practice in regard to parental support for PTI care.

Items	Observed practice ($n = 40$) No. (%)	Self-reported practice ($n = 102$) No. (%)
Encourage infant-parent visit	23 (57.5)	56 (54.9)
Maintain interaction with parents	30 (75.0)	71 (69.6)
Inform about PTI care	28 (70.0)	88 (86.3)*
Inform about the possible danger signs	24 (60.0%)	81 (79.4)
Guide and support for EBM feeding	31 (77.5)	86 (84.3)
Guide and support for KMC	—	81 (79.4)
Assess parents' care ability before discharge	—	82 (80.4)

*Chi-square test (2-sided), significance level <0.05.

Table 5: Overall PTI care practices of participants, $n = 102$.

Subscales and scales	Observation	Self-report		
	Mean (%)	Mean (%)	Median (IQR)	Range
Daily supportive care	87.3	90.0	4.5 (4.1–4.7)	3.1–5.0
Safe oxygen administration	95.0	89.7	4.5 (4.0–5.0)	1.5–5.0
Thermal care	95.0	94.1	4.7 (4.5–5.0)	3.2–5.0
Nutritional care	80.0	89.7	4.5 (4.0–4.7)	2.8–5.0
Positioning and handling	70.7	84.0	4.3 (3.6–4.7)	2.3–5.0
Skin care	95.8	92.4	4.6 (4.0–5.0)	3.0–5.0
Parental support	65.7	76.2	4.4 (3.7–4.8)	1.4–5.0
Supportive sensory environment	62.5	74.6	4.3 (3.5–4.8)	2.6–5.0
Sleep promotion	74.0	76.5	4.0 (3.5–4.5)	2.7–5.0
Pain management	25.0	36.2	2.8 (2.1–3.5)	1.0–4.7
Overall care practice	73.7	70.7	4.0 (3.5–4.3)	2.3–4.8

Note. Self-report measured on a 1–5 scale (never practice "1" to always practice "5"), total score: 215; mean practice scores obtained combining score four and and five.

Table 6: Association of self-reported PTI care practice with selected variables, $n = 102$.

Variables	Practice status		OR	95% CI	p value*
	Substandard	Standard			
Age					
≤27 years	29	32	1.049	0.475–2.320	0.905
≥28 years	19	22			
Qualification					
PCL and B. Sc. nursing	32	42	0.879	0.367–2.106	0.500
BNS and MN	13	15			
Years of experience in NCUs					
≤3 years	42	32	4.813	1.747–13.254	0.002
≥4 years	6	22			
Designation					
Staff nurse	44	50	0.880	0.208–3.729	0.862**
Senior staff nurse	4	4			
Neonatal training					
No	38	27	3.802	1.579–9.174	0.004
Yes	19	27			
Nurse-infant ratio					
Substandard	42	16	16.666	5.917–47.619	<0.010
Near standard	6	38			

Note. Practice status: median score as a cutoff value for standard and substandard practice. *Chi-square test (2-sided); **Fisher exact test (2-sided), p value significant at <0.05 level. Near standard: nurse-infant ratio 1: 2-3 in NICU, 1: <10 in SNCU; substandard: nurse-infant ratio 1: ≥4 in NICU, 1: ≥10 in SNCU.

a literature review on neonatal oxygen therapy in low- and lower middle-income countries including 26 relevant literature studies published during 2007–2017 reported suboptimal monitoring of neonatal oxygen therapy related to inadequate availability of necessary monitoring equipment in some hospitals [31].

Table 7: Logistic regression model of associative factors for self-reported PTI care practice, $n = 102$.

Contributing factors	Practice*		cOR (95% CI)	aOR (95% CI)	p value
	Substandard No. (%)	Standard No. (%)			
Constant				0.372	0.155
Experience					
≤3 years	42 (56.8)	32 (43.2)	4.813 (1.74–13.25)	0.468 (0.13–1.65)	0.239
≥4 years	6 (21.4)	22 (78.6)			
Neonatal training					
No	38 (58.5)	27 (41.5)	3.802 (1.57–9.17)	4.955 (1.59–15.39)	0.006
Yes	10 (27.0)	27 (73.0)			
Nurse-infant ratio					
Substandard	42 (72.4)	16 (27.6)	16.666 (5.91–47.61)	18.520 (5.83–58.77)	<0.001
Near to standard	6 (16.6)	38 (86.4)			

Note. Nagelkerke R squared = 0.513, Cox and Snell square = 0.384, Hosmer–Lemeshow test value = 9.384, df 6, p value = 0.153. VIF: <3 p value significant <0.05, p value significant at <0.01; aOR = adjusted odds ratio, cOR = crude odds ratio, and CI = confidence interval*.

The current study showed higher thermal care practice scores (>90%). Inconsistently, a study about thermal care among 372 term infants (177) and (198) preterm infants in Kenya reported low compliance with the WHO thermal care guidelines, leading to hypothermia among 73.7% of infants [32]. Another study in 32 health facilities in Jordan using direct observations and interviews with staff indicated gaps in thermal care [33]. The lack of thermal care resources was the main reason for the lack of practice in those studies. There was a moderate practice score (75%) of KMC (commonly intermittent) in the present study. During observation, inadequate continued KMC practice was related to a lack of dedicated space, equipment (KMC beds), and personnel. Less or no practice of KMC in some settings was due to less emphasis on KMC along with the lack of infrastructure and equipment in the unit. Other studies also indicated a lack of KMC practice [34] and a need for strengthening KMC practice [35].

Considering the guidelines for feeding the LBW infants [36], there was a good practice of nutritional care (feeding practice) with a practice score of >80.0%. However, a moderate practice score (77.5%) was found regarding exclusive breast milk (EBM) feeding which might be influenced by inadequate breastfeeding support (45% in observation) (Table 2) and lack of donor milk. A multicountry study including India, Indonesia, and Uganda revealed good EBM feeding practices in health facilities in India where there was adequate maternal access to NCU and feeding support [37]. The findings of the study including 32 health facilities in Jordan [33] also reported formula milk feeding practice in the majority of hospitals though they knew that EBM feeding is recommended nutrition [37].

The practice of handling and positioning in the current study was similar (84.0%) to the Iranian study, whereas sleep promotion practice was better (scores 74.0% and 76.5%) than the score of 65.4% in the same study [24]. Practice lacking was reported also in structured observation findings including 25 healthcare settings in South Africa [21]. Similar to study findings of South Africa [21], practice lacking was found in this study regarding minimizing light and sound levels as well as infant-parent attachment.

Regarding infection prevention practice, there was a good hand hygiene practice score (>90.0%), whereas previous studies reported a very low practice score of 14.9% [38] and 16.5% [39]. One of the factor for good practice in present study might be the study conducted after COVID-19 pandemic. Another systematic review reported relatively lower practice scores of hand hygiene practice (9.0–73%) than those in the present study [40], whereas a moderate level of daily gown change practice (70%) in the present study is due to unavailability of daily change. Evidence reported availability of resources as an important influencing factor for infection prevention practice [38–40].

The literature reported the vulnerability of PTIs to painful experiences and its long-term consequences [41]. Previous studies have suggested various evidence-based, nonpharmacological management of neonatal acute pain such as maternal touch, holding and massage by the mother, breast milk feeding, nonnutritive sucking, facilitated tucking, swaddling, skin-to-skin contact, and sweet solutions like sucrose and glucose [38, 39, 42, 43], whereas in the present study, pain assessment and management were the least practiced areas (25% in observation and 36.2% in self-report). Previous studies revealed the better practice of pain management in Spain (39.5%) and Brazil (pain assessment 37.3% and practice of different pain management measures 84.3%). Their good practice was related to the training and orientation provision [44].

The literature indicated attachment with their infant, having information, communication, and interaction with NCU staff as critical for parenting confidence, bonding, and participation in infant care [45, 46]. However, observation findings showed a moderate level of practice for infant-parent attachment, communication, and providing information about PTI care (Table 4).

In this study, nurses' PTI care practice was significantly associated with the nurse-infant ratio, having neonatal care-related training and work experience in NCU (all p values <0.001). Similarly, the nurse-infant ratio was the strongest factor (aOR = 18.5) associated with nurses' PTI care practice followed by neonatal training (aOR = 5.8). Studies indicated the nurse-infant ratio as the strongest factor for care practice in previous studies [18, 23] followed by related training

[27, 47] and work experience of nurses in NCUs [27]. An inadequate nurse-infant ratio was indicated as a higher infant caseload and higher workload in prior studies [19, 26, 27]. Other studies reported training for care competency, working environment in terms of space and equipment, leadership and support from healthcare facility managers, and perception towards care as the influencing factors for care practice [20, 27, 28, 47, 48].

Some strengths of this study are the use of two methods of data collection. Nevertheless, its limitations are chance of social desirability bias among participants during self-report though participants were explained well to respond to the actual practice situation and confidentiality of their information. Likewise, there is a chance of the Hawthorn effect among participants during practice observation, though an observer spent adequate time accustoming the participants and the probability of normalized practice during observation.

5. Conclusion

The care practices necessary for the survival of the PTIs in terms of safe oxygen administration, thermal care, nutritional care, and infection prevention are common in NCUs across different hospitals in Nepal, whereas a lack of appropriate practices was found regarding developmental supportive care components like sleep promotion, proper positioning, provision of a supportive sensory environment, and parental support. In addition, pain assessment and management are the most lacking areas. Practice enrichment is necessary in NCUs, especially in areas such as skin to skin contact (Kangaroo care) and exclusive EBM feeding. Nurses' PTI care practice is strongly influenced by the nurse-infant ratio followed by training status. Consideration for a proper nurse-to-infant ratio and continued professional development opportunities for NCU nurses would enhance the PTI care practice in NCUs.

The study findings related to care practice situations as well as associative factors in the Nepali context might represent other developing countries also. The findings have important implications for nurses and other health professionals in NCUs to improve PTI care practice by incorporating developmental supportive care and parentaal support components. These findings provide crucial information to policymakers and researchers to fill up the gaps in PTI care practice in NCUs and to design and implement interventions for enhancement of the PTI care practice in NCUs.

Abbreviations

aOR: Adjusted odds ratio
cOR: Crude odds ratio
CI: Confidence interval
EBM: Expressed breast milk
IQR: Interquartile range
LBW: Low birth weight
PTI: Preterm infant
NCU: Neonatal care unit
KMC: Kangaroo mother care
SNCU: Sick newborn care unit
NICU: Neonatal intensive care unit.

Data Availability

The supporting data will be available from the first author upon request.

Disclosure

This manuscript is part of the exploratory sequential mixed-method study of the PhD dissertation.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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