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Knowledge, Attitude, and Behavior of Pediatric Medical Surgical Nurses on Breastfeeding: Basis for Capacity Building Plan

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Abstract

Breastfeeding in pediatric medical-surgical units has been shown to significantly reduce the incidence of various complications in hospitalized neonates, including necrotizing enterocolitis, infections, retinopathy of prematurity, and chronic lung disease. Furthermore, breastfeeding lowers both the incidence and mortality rates associated with long-term neurological injuries, making it particularly crucial for vulnerable populations such as preterm infants. Pediatric medical-surgical nurses play an essential role as advocates and facilitators of breastfeeding practices for hospitalized newborns, directly influencing the quality of care provided in these settings. Despite the well-documented benefits of breastfeeding, the lack of standardized management guidelines for neonatal breastfeeding across hospitals has created challenges for nursing staff in both educating families and implementing consistent breastfeeding practices. These inconsistencies may hinder the overall effectiveness of breastfeeding initiatives in improving neonatal health outcomes. This study aimed to evaluate the knowledge, attitudes, and practices of pediatric medical-surgical nurses regarding neonatal breastfeeding. By utilizing comprehensive questionnaires, the study assessed the current level of understanding, attitudes toward breastfeeding, and practical application of breastfeeding practices among local pediatric medical-surgical nurses. The findings from this research provided valuable insights into the specific factors that influence nursing practices and guided the development of standardized protocols and training programs. These efforts were intended to improve the implementation of neonatal breastfeeding practices, thereby enhancing health outcomes for hospitalized infants.

Keywords: neonatal breastfeeding, pediatric medical-surgical nurses, Knowledge Attitudes and Practices (KAP), standardized management guidelines, hospitalized neonates

1. Introduction

Breastfeeding is universally recognized as the optimal feeding method by international health organizations and various health institutions. Breast milk not only contains rich nutrients that are easily absorbed by infants, but it also includes multiple immune-active components that enhance an infant's immunity, helping them resist infections and promote healthy development (Lokossou et al., 2022). Beyond its

essential role in infancy, breastfeeding is increasingly recognized for its importance in pediatric medical-surgical (MS) cases, particularly in post-surgical recovery. Breastfeeding offers non-nutritional benefits such as reducing post-operative pain, accelerating healing, preventing infections, and improving long-term health outcomes for pediatric patients (Elgersma et al.; Søegaard et al., 2024).

In recent years, there has been a global effort to promote breastfeeding. However, according to data from the World Health Organization (WHO), the exclusive breastfeeding rate for infants under six months was only 43% in 2019, which is significantly below the ideal target (World Health Organization, 2019). In China, the "Outline for the Development of Chinese Children (2011-2020)" set a goal for the exclusive breastfeeding rate for infants aged 0-6 months to exceed 50% by 2020 (Yan et al., 2023). Despite these objectives, the promotion and implementation of breastfeeding remain insufficient in many areas, particularly among hospitalized pediatric patients (Moura et al., 2022; Mudau et al., 2023).

Recent statistics indicate that approximately 10-21.2% of newborns and infants require hospitalization due to complications such as congenital anomalies, infections, or surgical needs (China Information News, 2021). This statistic translates to a substantial number of pediatric patients in China requiring specialized care in medical-surgical departments. However, these hospitalized pediatric patients often face challenges including limited parental visitation, postoperative complications, and a lack of structured breastfeeding support systems within hospital environments (Verea-Nuñez et al., 2024; Wu et al., 2024).

Moreover, the management of breastfeeding for hospitalized newborns currently lacks standardized protocols, leading to inconsistencies in nursing practices. For instance, many hospitals do not have clear guidelines regarding the timing and frequency of breastfeeding, resulting in variations in decision-making among healthcare providers. Additionally, nurses may encounter difficulties in educating mothers, such as a lack of effective educational materials and practical opportunities to provide necessary support. Some hospitals may fail to establish breastfeeding support groups or consulting services, which can prevent mothers in need of assistance from receiving timely guidance. Furthermore, the pressures of the hospital environment may limit nurses' ability to provide individualized breastfeeding education, ultimately affecting mothers' confidence and willingness to breastfeed. These issues underscore the necessity for clearer management protocols to enhance the effectiveness of breastfeeding implementation for newborns.

While there is a considerable body of literature on breastfeeding practices in neonatal intensive care units (NICUs), research specifically focused on the knowledge, attitudes, and practices (KAP) of pediatric surgical nurses regarding breastfeeding remains limited (Srichalerm et al., 2024). The pediatric surgical patient population has unique needs that require specific breastfeeding approaches to accommodate surgical recovery and medical treatment plans. Thus, there is a pressing need to develop a capacity-building plan that equips pediatric surgical nurses with the essential knowledge, skills, and support necessary to effectively promote breastfeeding in complex medical and surgical environments.

Therefore, this study aimed to systematically investigate the KAP of pediatric surgical nurses regarding breastfeeding and to identify the correlations between their KAP and demographic characteristics (e.g., age, education level, work experience). Through this analysis, the study sought to provide a foundation for developing targeted training programs and policies that would enhance the practical implementation of breastfeeding in pediatric surgical wards, ultimately improving patient recovery outcomes. The research framework was based on a comprehensive analysis of nurses' KAP, considering the specific needs of pediatric surgical patients, with the ultimate goal of creating a capacity-building plan for pediatric surgical nurses to improve breastfeeding practices and outcomes.

2. Study Objectives

2.1 General Objective

To explore factors related to the knowledge, attitude, and practices of pediatric medical surgical nurses regarding breastfeeding, which will be a basis for a health promotion plan.

2.2 Specific Objectives

1) To describe the demographic characteristics of the respondents as to: a) age, b) sex, c)

highest educational attainment, d) position category, e) years of nursing experience, f) years of pediatric MS experience, g) number of capacity building activity within one year;

2) To describe the knowledge, attitude, and practices (KAP) of the respondents related to breastfeeding;
3) To compare the KAP of the respondents on breastfeeding when grouped according to demographic characteristics;
4) To determine the relationship between knowledge, attitude, and practices (KAP) of the respondents about breastfeeding;
5) Based from the findings, to create a Capacity Building Plan for Pediatric Medical-Surgical Nurses related to Breastfeeding.

3. Review of Related Literature

3.1 Demographic Characteristics of Pediatric Medical-Surgical Nurses

The demographic characteristics of healthcare providers play a pivotal role in shaping their approach to patient care, including breastfeeding support. In the context of pediatric medical-surgical (MS) nursing, factors such as age, gender, educational background, and years of experience directly influence how nurses perceive and promote breastfeeding practices.

Research indicates that nurses' age and professional experience can significantly affect their attitudes toward breastfeeding (Al-Sawalha et al., 2018). Younger nurses, or those new to pediatric MS care, may lack the deep-seated knowledge or confidence needed to support breastfeeding, compared to their more experienced counterparts. Conversely, older nurses may be more resistant to adopting new breastfeeding guidelines or technologies, highlighting the need for tailored training interventions based on experience levels. While nursing is traditionally a female-dominated field, male nurses in pediatric MS settings are increasing. Studies suggest that male nurses may face unique challenges in promoting breastfeeding, often due to perceived cultural barriers or personal discomfort with the subject (Bowdler et al., 2022).

Addressing these gender-based challenges through specific training programs can improve their confidence and ability to support breastfeeding effectively. Higher levels of nursing education are associated with better breastfeeding knowledge and more positive attitudes toward breastfeeding promotion (Khasawneh et al., 2023). Nurses with advanced degrees are more likely to understand the physiological and emotional benefits of breastfeeding, leading to better support for breastfeeding mothers. This highlights the importance of continuous education and professional development for all levels of nursing staff. The number of capacity-building activities nurses participate in also influences their readiness to support breastfeeding. Research shows that nurses who undergo regular breastfeeding-related training are more likely to provide evidence-based breastfeeding support (Gavine et al., 2017). However, in many pediatric MS settings, capacity-building opportunities are either inconsistent or not tailored to the specific challenges faced by nurses in those units. This underscores the need for a structured, frequent, and targeted capacity-building plan to enhance breastfeeding support across all pediatric MS settings (Fok et al., 2022).

3.2 Knowledge, Attitude, and Practices (KAP) Related to Breastfeeding

The KAP framework is widely used to assess the effectiveness of healthcare professionals in promoting health behaviors, such as breastfeeding. For pediatric medical-surgical nurses, their knowledge, attitudes, and practices directly impact how well they support breastfeeding mothers.

Knowledge: Nurses' knowledge of breastfeeding is crucial to providing accurate information and support to mothers. Knowledge gaps among pediatric MS nurses can lead to misinformation, inconsistent advice, and reduced breastfeeding success rates (Čatipović et al., 2022). A systematic review of nursing practices reveals that while most nurses understand the benefits of breastfeeding, they often lack in-depth knowledge of specific techniques, such as managing breastfeeding difficulties or supporting extended breastfeeding (Alakaam et al., 2018).

Attitude: Nurses' attitudes toward breastfeeding are influenced by personal beliefs, cultural norms, and their own experiences with breastfeeding. Positive attitudes toward breastfeeding are essential for promoting its benefits to mothers, but studies show that many nurses still hold reservations about breastfeeding, particularly in medical-surgical

settings where breastfeeding may not be prioritized (Smith et al., 2019). Addressing these attitudinal barriers through targeted interventions is critical for improving breastfeeding outcomes.

Practices: Practices refer to how nurses apply their knowledge and attitudes in clinical settings. Inconsistent practices are often noted, with some nurses failing to implement breastfeeding promotion due to time constraints, workload pressures, or lack of institutional support (Sosseh et al., 2023). Research shows that when nurses receive adequate training and institutional backing, their practices align more closely with breastfeeding recommendations, leading to improved breastfeeding rates (Sandhi et al., 2023).

3.3 Comparison of KAP According to Demographic Characteristics

Comparing the KAP of nurses based on demographic factors can provide insights into targeted interventions. For example, studies have found that younger nurses or those with fewer years of experience tend to have lower breastfeeding knowledge but are more open to learning and adopting new practice (Prokop et al., 2021). On the other hand, nurses with more experience may have stronger knowledge but may resist changes in established practices. Gender, as mentioned earlier, also plays a role, with male nurses often feeling less comfortable discussing breastfeeding with patients, potentially due to societal expectations or lack of exposure during training (Wen et al., 2021).

3.4 Relationship Between Knowledge, Attitude, and Practices

The relationship between knowledge, attitudes, and practices (KAP) is complex, and each component influences the others. Studies have consistently shown that nurses with higher levels of breastfeeding knowledge tend to have more positive attitudes and are more likely to engage in best practices when supporting breastfeeding (Ma et al., 2018). Conversely, nurses with knowledge gaps may develop negative attitudes toward breastfeeding or engage in practices that do not support breastfeeding success. Understanding these relationships can help in designing more effective training programs that address all three components simultaneously.

3.5 Capacity Building for Pediatric Medical-Surgical Nurses on Breastfeeding

Capacity building is essential to address the identified gaps in KAP. Pediatric medical-surgical nurses are at the forefront of patient care, and their ability to support breastfeeding has a direct impact on both maternal and infant health outcomes. However, existing breastfeeding training programs in China primarily target general nursing staff and do not specifically address the unique challenges faced by pediatric MS nurses (Liu et al., 2021).

To improve breastfeeding outcomes, a comprehensive capacity-building plan for pediatric MS nurses must be developed. This plan should include regular training on breastfeeding techniques, management of breastfeeding challenges, and strategies to support both exclusive and extended breastfeeding. Additionally, this capacity-building plan should be validated by experts to ensure its relevance and effectiveness in pediatric MS settings.

3.6 Breastfeeding Program in China: Existing Capacity Building Efforts

Breastfeeding promotion has been a key focus of China's national health agenda, particularly with the introduction of the "Outline for the Development of Chinese Children" (2011-2020), which aimed to increase the rate of exclusive breastfeeding. However, most capacity-building efforts have focused on general hospital staff or maternity units, with little attention given to pediatric medical-surgical nurses.

Existing capacity-building initiatives have successfully increased breastfeeding rates in some areas, but they often lack the specialized focus needed for pediatric MS nurses, who face unique challenges in promoting breastfeeding, such as managing infants with complex medical needs (Xin, 2020). A more tailored approach is needed to address these gaps and ensure that pediatric MS nurses are equipped to support breastfeeding effectively.

3.7 Future Research Perspectives

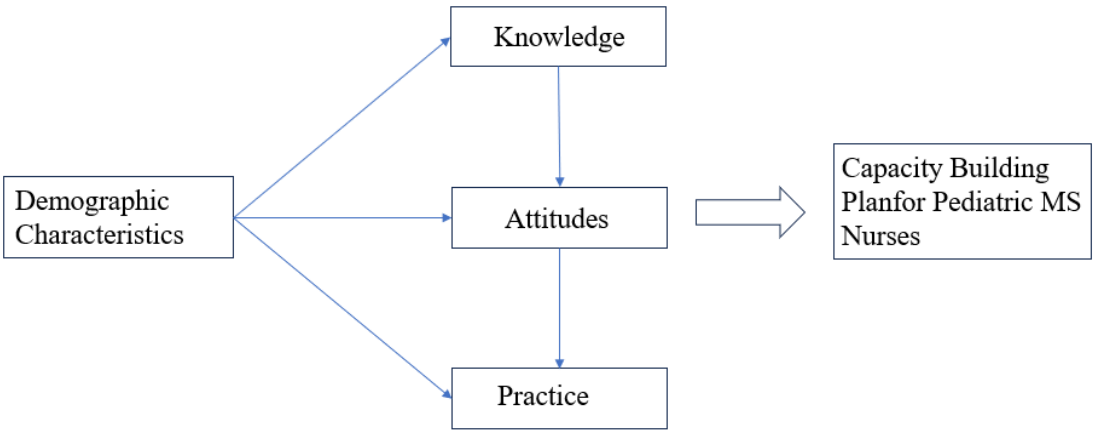
Much of the current literature focuses on general nursing staff or neonatal units, with limited research on pediatric MS nurses. While capacity-building programs exist, their long-term impact on breastfeeding rates, particularly in pediatric MS settings, remains under-researched.

3.7.1 Theoretical Framework

This study adopted the Health Belief Model (HBM) as its theoretical foundation to explore the

factors and interrelationships within the knowledge, attitudes, and practices (KAP) of pediatric medical-surgical nurses regarding breastfeeding. HBM is a widely applied framework in health behavior research, primarily used to explain how individuals' cognition, attitudes, and beliefs shape their decisions to engage in health-related behaviors (Anuar et al., 2020). In this study, HBM was utilized to analyze how nurses perceived the benefits of breastfeeding, the barriers they may encounter, and their sense of self-efficacy, as well as how these factors influenced their clinical practices.

3.7.2 Conceptual Framework



4. Methods

4.1 Study Design and Locale

This study employed a cross-sectional survey method to comprehensively describe the knowledge, attitudes, and practices (KAP) of respondents regarding neonatal breastfeeding within a specific time frame. Cross-sectional surveys are efficient in terms of time and resources, suitable for large sample sizes, and capable of identifying relationships between variables. Additionally, they provide baseline data for future research. This design is particularly suited to capturing the current state of respondents KAP without the need for long-term follow-up, aligning with the study's goal of providing immediate recommendations for capacity building.

To ensure the homogeneity and representativeness of the study data, this research selected hospitals with well-established pediatric medical-surgical care systems as the study sites. Shenzhen was chosen as the study location due to its hospitals' strong pediatric services and comprehensive breastfeeding education programs integrated into routine care. The study was conducted in four tertiary hospitals in Shenzhen, all of which will remain anonymous to ensure data confidentiality. These hospitals provided a diverse and representative sample of pediatric medical-surgical nurses' knowledge, attitudes, and practices (KAP) regarding neonatal breastfeeding.

The selected hospitals **varied** in size, with bed capacities ranging from 305 to 2,941, and pediatric medical-surgical nursing teams ranging from 25 to 135 nurses. These differences in scale represented a balanced cross-section of healthcare facilities within the same geographic region, ensuring homogeneity while accounting for variations in bed capacity and nursing staff. Such diversity allowed the study to assess differences in resource allocation and staffing practices. The collected data contributed to the development of breastfeeding policies and capacity-building training programs tailored to these healthcare environments.

Table 1. Details of Beds and Pediatric Medical-Surgical Nurses in Hospitals

	Hospital	Beds	Pediatric Medical-Surgical Nurses
1	Hospital A	2941	60

2	**Hospital B**	**600**	**135**
3	**Hospital C**	**830**	**33**
4	**Hospital D**	**305**	**25**

4.2 Study Participants

4.2.1 Sample Size and Sampling

Sample Size Calculation

According to the multi-factor analysis formula $n=4\frac{U_{\alpha}^{2}S^{2}}{\delta^{2}}$(Xiao, 2008), the sample size was estimated. The significance level was set at α=0.05, with the corresponding critical value $U_{\alpha/2}$=1.96. Based on previous studies, the S=11.28 (Xin, 2020) and the δ was set as (0.25S,0.5S) (Ni & Zhang, 2011). In this study, "behavior" was selected as the primary outcome indicator for sample size estimation. The rationale for this choice is that behavior is the most direct and critical indicator of nurses' performance in clinical practice, effectively reflecting their actual performance in the workplace. Compared to knowledge and attitude, behavior has a more significant impact on clinical outcomes. Therefore, selecting behavior as the primary outcome helps capture nurses' real-time responses to various nursing tasks, providing stronger support for the development of subsequent intervention measures.

The final calculated sample size ranges from 62 to 246. Based on these calculations and to account for potential variability, the final sample size was set at 150 participants, which falls within the recommended range and provides a sufficient number to ensure robust statistical analysis.

Sampling Method

A proportionate stratified random sampling method was employed to ensure a representative sample of respondents from four anonymized hospitals in Shenzhen, China. First, the total population of 253 Pediatric Medical-Surgical Nurses will be stratified by hospital. The sample size allocated to each hospital was proportionate to the number of respondents in each hospital. Specifically, Hospital A accounts for 23.7% of the total respondent's population, Hospital B for 53.4%, Hospital C for 13.0%, and Hospital D for 9.9%. To achieve the final sample size of 150 participants, the sample from each hospital was adjusted to the nearest whole number: 36 nurses from Hospital A, 80 from Hospital B, 20 from Hospital C, and 14 from Hospital D. Minor rounding adjustments were made to ensure the total sample size of 150 while maintaining representativeness.

Within each hospital, simple random sampling was used to select respondents. Each of population will be assigned a random number, and random numbers will be generated using a random number table or computer-based random number generator to ensure equal selection probability. Recruitment was coordinated with each hospital's nursing administration, and selected respondents were invited to participate via email or phone. Informed consent was obtained from all participants before data collection begins.

To protect the anonymity of participants and smaller hospitals (e.g., Hospital D), all results will be aggregated during data analysis and reporting. Detailed demographic or professional information will not be disclosed in a way that allows identification of individual participants or hospitals. Additionally, specific results from smaller groups will not be reported independently, further safeguarding confidentiality.

4.2.2 Inclusion and Exclusion Criteria

Inclusion criteria:

(1) Actively working registered pediatric medical-surgical nurses in neonatology or pediatric departments were included.

(2) Respondents had successfully completed pre-job training specific to pediatric or neonatal care.

(3) A minimum of 6 months to 1 year of experience in pediatric medical-surgical nursing was required, as this timeframe was regarded as necessary to master basic skills (Kreedi et al., 2021).

(4) Direct experience or formal training in supporting breastfeeding (e.g., hands-on assistance or collaboration with lactation consultants) was required.

(5) Respondents voluntarily agreed to participate in the study after being fully informed about its objectives and procedures.

Exclusion criteria:

(1) Respondents who were on medical leave due to illness.

(2) Respondents who were on leave for educational purposes or were enrolled in full-time educational programs.

(3) Respondents who declined to participate in the study after being fully informed about its objectives, procedures, and potential impact.

Nurses who were on medical leave or pursuing advanced education were excluded from the study, because their unique circumstances did not reflect the typical work conditions of active pediatric medical-surgical nurses, which could have affected the consistency and generalizability of the data. These exclusion criteria were designed to minimize bias and enhance the scientific rigor of the study.

4.3 Research Instruments

Scales were in written form. As participants are Chinese, the language of the surveys used Chinese.

(1) General Information: (APPENDIX 1, section 1)

The questionnaire used a self-developed demographic questionnaire, which included the following items: a) age, b) sex, c) highest educational attainment, d) position category, e) years of nursing experience, f) years of pediatric medical-surgical experience, g) number of capacity building activities within one year.

(2) Questionnaire on breastfeeding knowledge of hospitalized newborns:

(APPENDIX 1, section 2)

The knowledge questionnaire from Yang Piaoyu's study was adapted (Yang & Zhang, 2017). The questionnaire had a content validity index (CVI) of 0.99 and a Cronbach's alpha coefficient of 0.748, indicating good reliability and validity. The questionnaire covered various aspects of breastfeeding, including the benefits of breastfeeding, advocacy, screening, collection, storage, transportation, and breastfeeding operations. It consisted of 20 questions, including 12 single-choice questions and 8 multiple-choice questions. Based on the adapted questionnaire, each correct answer was awarded 5 points, while incorrect answers received 0 points. For multiple-choice questions, full points were only awarded if the selected options matched the reference answer completely; no partial points were given for incomplete or excessive selections. The total score for the questionnaire is 100 points. Higher scores indicated a higher level of breastfeeding knowledge among nurses. Using Bloom's cut-off points, the scores were categorized into three levels:

- Low level: Scores below 60
- Moderate level: Scores between 60 and 80
- High level: Scores above 80.

(3) Questionnaire on breastfeeding attitude of hospitalized newborns:

(APPENDIX 1, section 3)

The attitude questionnaire was adapted from relevant literature, including studies by Wang (2017) and Wang et al. (2018), as well as selected items from the *Evidence-Based Guidelines for Breastfeeding of Hospitalized Newborns*. The questionnaire consisted of 8 questions, using a 5-point Likert scale with the following options: "strongly agree" (5 points), "agree" (4 points), "not sure" (3 points), "disagree" (2 points), and "strongly disagree" (1 point). Based on the adapted questionnaire, the total score for the questionnaire was 40 points. Higher scores reflected a more positive attitude towards breastfeeding among NICU nurses. Using Bloom's cut-off points, the scores were categorized into three levels:

- Low level: Scores below 24
- Moderate level: Scores between 24 and 32
- High level: Scores above 32.

(4) Questionnaire on breastfeeding behavior of hospitalized newborns:

(APPENDIX 1, section 4)

The behavior questionnaire was adapted from the *Evidence-Based Guidelines for Breastfeeding of Hospitalized Newborns*, developed by Zhang Yuxia's team at the Pediatric Hospital affiliated with Fudan University. Based on consultation with clinical experts, five dimensions were selected from the guidelines, covering a total of 28 items. The dimensions included breastfeeding advocacy (3 items, questions 1-3), guidance on the collection and transportation of breast milk (9 items, questions 4-12), screening and receiving breast milk (6 items, questions 13-18), storage, thawing, and heating of breast milk in wards (5 items, questions 19-23), and breastfeeding in wards (5 items, questions 24-28). Each item was scored on a 5-point Likert scale, with the options: "always" (5 points), "often" (4 points),

"sometimes" (3 points), "occasionally" (2 points), and "never" (1 point). Questions 22 and 23 were reverse-scored. Based on the adapted questionnaire, the total score for the questionnaire was 140 points. Higher scores indicated better breastfeeding behavior among NICU nurses. Using Bloom's cut-off points, the scores were categorized into three levels:

- Low level: Scores below 84
- Moderate level: Scores between 84 and 112
- High level: Scores above 112.

Pre-survey

Before the formal investigation, a pre-investigation was conducted at four hospitals in Shenzhen, China. Research indicates that for a typical baseline or endline survey, a sample size of approximately 30 to 50 individuals is usually sufficient to identify major issues within the system. Therefore, this study distributed a total of 30 paper-based questionnaires for the pre-experiment (Perneger., 2015). Convenience sampling was used to select participants representing different levels of experience, education, and job roles to ensure a diverse range of perspectives. The purpose of the pre-investigation was to test the rationality of the questionnaire design, evaluate its reliability, and ensure its scientific validity. The questionnaires were distributed in person as paper forms during departmental business meetings at each hospital, with respondents given 20 minutes to complete them. This simulated real-world conditions and assessed the clarity and feasibility of the questionnaire.

Back translation procedures

All questionnaires had received the formal consent of the relevant scale developers, ensuring the legality and ethics of the research. The questionnaires used in this study were adapted from Chinese versions, and the subjects are Chinese individuals; therefore, back-translation of the original questionnaire is not necessary. However, the English questionnaire provided in the appendix underwent back-translation to ensure the accuracy and consistency of the translation.

The back-translation process was carried out as follows: first, the questionnaires were translated from Chinese into English by a professional bilingual translator. Then, a second independent bilingual translator, who was not involved in the original translation, translated the English version back into Chinese. The back-translated Chinese version was compared with the original Chinese version to identify any discrepancies. Any differences were reviewed and resolved to ensure that the English version accurately reflected the meaning of the original Chinese questionnaires.

4.4 Specific Procedures Based on Study Objectives

4.4.1 Preparation Stage

Before the study began, participants were asked to sign a consent form (APPENDIX 2), indicating their willingness to participate in the research. This agreement served as confirmation that the researcher understood the reasons for conducting the study.

4.4.2 Survey Stage

Upon obtaining support from the hospital management department, the survey was scheduled in a way that did not interfere with clinical work. The primary survey times were set in the afternoons after work or on weekends. The location for completing the questionnaires was in a quiet place, such as a departmental study room or an office. Research participants were selected strictly based on the inclusion and exclusion criteria. To minimize bias, all questionnaires were distributed by the researcher in a one-on-one manner, with standardized instructions provided to guide the respondents in completing the questionnaires independently. If participants had any questions about the content of the questionnaire, the researcher provided clarification without influencing their responses, ensuring the reliability of the data collected. The time allotted for completing the questionnaire did not exceed 20 minutes. The questionnaires were distributed, completed, and collected on-site, followed by an immediate review for completeness and logical consistency. If any omissions or obvious logical errors were identified, the participant was asked to correct them on the spot before the questionnaire was officially collected.

4.4.3 Post-Survey Stage

The database for this study was established using Excel 2021, with data entry conducted by the researcher. During the data entry process, the researcher checked for any logical errors, missing values, or outliers in the questionnaires. If the proportion of logical errors, missing values, or outliers exceeded 5%, the questionnaire was

considered invalid and excluded from the analysis. After data entry was completed, the researcher randomly selected 20% of the questionnaires for review, comparing the entered data with the original questionnaires to ensure accuracy. If any errors were found during this review, all data were rechecked and corrected. A statistical expert provided guidance during the data analysis phase to ensure the accuracy and scientific rigor of the analysis.

4.5 Ethical Considerations

4.5.1 Informed Consent Process, Duration of Participation, and Withdrawal Criteria

Strict measures were implemented to prevent any perceived coercion during the recruitment process. Recruitment was conducted in collaboration with the hospital's nursing administration to identify eligible participants. However, participants were explicitly informed that their decision to participate, decline, or withdraw from the study at any time would not affect their employment, professional standing, or workplace relationships. All communication emphasized the voluntary nature of the study, ensuring that nurses felt no obligation to participate due to their employer's involvement. Participation in this research study was entirely voluntary, and individuals could choose not to participate or withdraw at any time without any obligations or consequences. Before the study began, the researcher explained all the contents of the informed consent form in detail in a quiet setting, such as a study room, using language that the respondents could understand, avoiding technical jargon, and without inducing or influencing respondents' decisions. The researcher provided the respondents with sufficient time and opportunity to ask questions about the study details and other concerns, allowing them to decide independently whether they wished to participate. The researcher ensured that the respondents fully understood the informed consent form. Both the researcher and the respondents signed and dated the informed consent form on the same date. One copy of the signed and dated form was given to the respondent, while the other copy was retained by the researcher.

4.5.2 Risks and Inconveniences

There was virtually no risk involved in participating in this study, and no identifying information was collected. All data were used solely for this study. On average, each questionnaire took 20 minutes or less to complete. If any of the questions made respondents feel uncomfortable, they could choose not to answer. If you had any questions regarding this study, you could contact Liu Liyue at +86 13631561198 or via email at liu.liyue@auf.edu.ph.

4.5.3 Benefits of the Study

As respondents in this study, there were no associated costs for participation. The study provided an incentive, offering respondents the chance to win a trophy through a lottery. The aim of the study **was** to assess pediatric medical-surgical nurses' knowledge, attitudes, and practices regarding breastfeeding. The findings from this research **could serve** as a foundation for capacity-building programs, helping to enhance nurses' professional competencies in breastfeeding support. This, in turn, **could improve** maternal and infant health, promote better care practices, and reduce the burden on the healthcare system.

4.5.4 Privacy, Confidentiality, and Data Management

Before each respondent registered for this study, the researchers were responsible for providing a comprehensive and detailed introduction to the study's purpose, procedures, and potential risks, and for obtaining a signed written informed consent form. The informed consent form was kept as a clinical research document for future reference. Respondents had the right to withdraw from the study at any time. Upon withdrawal, their personal information and data were destroyed and were not disclosed to any third party. Personal privacy and data confidentiality were protected during the study.

After respondents completed the questionnaire, the research data were collected and managed by the researchers to ensure the accuracy of the experimental data and the privacy of respondents. The original questionnaires were kept by the researchers and stored in a separate locked cabinet. Respondents were coded, and the data were analyzed in a blinded manner, with unresolved issues in the data being reviewed. The stored data did not include the names of respondents, meaning that the published data analysis could not be traced back to them. All other relevant information, including answers to questions in the survey, was used solely for research purposes. The actual survey forms and summary tables were kept for three years after

the study concluded, after which they were destroyed using a shredder, and a final check was conducted to ensure that all data and questionnaires in the drawer had been completely destroyed. The results of all questionnaires were not used directly or indirectly for any other research.

4.5.5 Conflict of Interest

This research was not funded, and the researcher did not see any conflict of interest in this work.

5. Statistical Analysis of Data

Data were analyzed using SPSS 29.0 software. The numerical data were described using mean and standard deviation for normally distributed data, and median and interquartile range for non-normally distributed data. Categorical data were described using frequency and percentage. The normality of the knowledge, attitude, and behavior scores was assessed using the Shapiro-Wilk test. Scatter plots were also used to determine any linear relationships between variables.

For the comparison of KAP scores across different demographic groups, independent samples t-tests were employed for dichotomous variables (e.g., gender), and one-way ANOVA was used for variables with more than two categories (e.g., educational attainment) when the data were normally distributed. If the data did not meet the normality assumption, the Mann-Whitney U test was used for comparing two groups, while the Kruskal-Wallis test was applied for comparisons involving three or more groups.

To examine relationships between knowledge, attitudes, and practices, Pearson's correlation was used for normally distributed data, while Spearman's rank correlation was applied for non-normally distributed data. Correlation strengths were interpreted as very weak (0.00–0.19), weak (0.20–0.39), moderate (0.40–0.59), strong (0.60–0.79), and very strong (0.80–1.00).

All p-values were two-sided, and statistical significance was set at $p < 0.05$.

6. Results

The demographic characteristics of the participants indicate that the majority of respondents were female (95.13%), with a significantly smaller proportion being male (4.87%). This gender imbalance aligns with global nursing workforce trends, where females dominate the profession. For instance, the World Health Organization (WHO) reports that over 67.2% of nurses worldwide are female, reflecting historical and sociocultural factors influencing career choices in healthcare (WHO, 2020). In terms of educational attainment, most participants had a bachelor's degree (80.97%), while a smaller percentage held qualifications below a bachelor's degree (18.58%) or a master's degree and above (0.44%). This pattern may be linked to professional thresholds and career advancement mechanisms in nursing. For instance, the high proportion of bachelor's degrees (80.97%) could reflect hospitals' increasing educational requirements for clinical nurses, while the low rate of master's degrees (0.44%) may align with frontline roles prioritizing practical experience over academic credentials (Dall'Ora et al., 2022). Regarding capacity-building activities, the majority (63.27%) attended one to two activities in the past year, while a smaller proportion attended three to five activities (13.72%) or more than six activities (10.18%). A notable 12.83% of participants did not attend any capacity-building activities. This disparity may reflect uneven access to training resources or varying institutional support. Prior studies highlight that nurses in resource-constrained settings often face barriers to continuing education, such as heavy workloads or lack of funding (Mlambo et al., 2021). The numerical characteristics reveal that the average age of participants was 30.76 years (SD = 5.79), with an average of 9.15 years (SD = 5.90) of nursing experience and 8.10 years (SD = 5.59) of medical-surgical experience.

Table 2. Summary of the demographic characteristics of the participants

Characteristics	Categories	Frequency	Percentage
Gender	Female	215	95.13 %
	Male	11	4.87%
Educational Attainment	Below Bachelor's Degree	42	18.58 %
	Bachelor's Degree	183	80.97 %

	Master's Degree and above	1	0.44 %
Number of Capacity Building Activities Within One Year	1-2 times	143	63.27 %
	3-5 times	31	13.72 %
	More than 6 times	23	10.18 %
	None	29	12.83 %
Numerical Characteristics	**Mean**	**Median**	**Standard deviation**
Age	30.76	30.00	5.79
Nursing experience	9.15	9.00	5.90
Medical-surgical experience	8.10	8.00	5.59

Table 2 reveals significant disparities in breastfeeding knowledge among participants. While foundational concepts like colostrum functions (71.24%) and WHO-recommended exclusive breastfeeding duration (51.33%) were moderately understood, critical gaps emerged in clinical and policy-related areas: only 1.77% recognized the WHO/UNICEF breastfeeding initiative, 24.78% identified preterm infant fortification criteria, and 11.95% understood contamination reduction practices. Conversely, practical scenarios such as discarding unused heated milk (97.35%) and labeling stored milk (92.92%) showed high accuracy. Combined with Table 3's findings—88.05% scoring low (mean = 46.02/100)—these results underscore an urgent need for training focused on evidence-based guidelines (e.g., WHO, 2023) and clinical protocols to address underrecognized topics.

Table 3. Summary of the knowledge of participants related to breastfeeding

Item	**Correct Answers**	
	Frequency	**Percentage**
Identify a function that is not considered important for breastfeeding.	115	50.88 %
Up to what age does the WHO recommend exclusive breastfeeding?	116	51.33 %
According to China's guidelines, preterm infants with a gestational age of how many weeks or less and a birth weight of how many grams or less should primarily receive fortified breast milk?	56	24.78 %
Mothers with which diseases should avoid breastfeeding?	168	74.34 %
What is not a basic principle for using medication while breastfeeding?	159	70.35 %
How is colostrum defined in terms of the time frame after birth?	84	37.17 %
To increase milk production, how often should a mother pump, and for how many minutes each time?	18	7.96 %
Identify an incorrect statement about breast milk storage.	75	33.19 %
What is the best method for thawing frozen breast milk?	104	46.02 %
At what temperature (°C) should thawed breast milk be warmed in water?	72	31.86 %
What should be done with thawed breast milk that has been heated but not consumed?	220	97.35 %
Identify an incorrect statement about breastfeeding practices.	205	90.71 %
Which initiative was formulated by WHO and UNICEF to protect, support, and promote breastfeeding?	4	1.77 %

What are some measures to promote breastfeeding in hospitalized infants?	190	84.07 %
What are the functions of colostrum?	161	71.24 %
Identify an incorrect statement about medication use during breastfeeding.	6	2.65 %
When labeling breast milk sent to a hospital, what additional information should be included besides the bed number and name?	210	92.92 %
What are effective methods to stimulate the let-down reflex?	45	19.91 %
What is a correct practice to reduce contamination during breast milk collection?	27	11.95 %
Which statement about breast milk transport is correct?	45	19.91 %

The overall knowledge assessment (Table 3) highlights a significant deficit in breastfeeding expertise among participants, with a mean score of 46.02/100 (SD = 10.30) indicating a widespread lack of comprehensive understanding. Notably, 88.05% of participants scored in the low-knowledge range (5–59), while only 11.95% attained moderate proficiency (60–80), and none achieved high knowledge levels (81–100). This pronounced knowledge gap is particularly concerning given the critical role of healthcare providers in promoting breastfeeding practices (Smith et al., 2018). The high standard deviation (SD = 10.30) suggests considerable variability in knowledge levels, potentially reflecting disparities in prior training or exposure to breastfeeding guidelines. These findings align with specific deficiencies identified in Table 3, such as the minimal awareness of WHO/UNICEF initiatives (1.77%), underscoring the urgent need for targeted educational interventions. Previous studies have demonstrated that structured training programs focusing on evidence-based guidelines and policy awareness can significantly enhance breastfeeding knowledge and clinical competency (Bowdler et al., 2022). For instance, Khasawneh et al. (2023) found that nurses with higher knowledge scores were more effective in supporting breastfeeding mothers, leading to improved infant health outcomes.

Table 4. Descriptive statistics of the total knowledge of participants related to breastfeeding

Statistic / Category	**Value / Score Range**	**Frequency**	**Percentage**
Mean	46.02	-	-
Median	45.00	-	-
Standard deviation	10.30	-	-
Minimum	20	-	-
Maximum	80	-	-
Low level of knowledge	5 – 59	199	88.05 %
Moderate level of knowledge	60 – 80	27	11.95 %
High level of knowledge	81 – 100	0	0.00 %

The attitude assessment (Table 5) revealed strong consensus among participants regarding the value of breastfeeding for pediatric medical-surgical infants. Across all items, mean scores ranged from 4.5 to 4.7 (out of 5), indicating uniformly positive perceptions. A striking 97.35% of respondents strongly agreed (SA) or agreed (A) that nurses play a crucial role in breastfeeding support (M=4.7, SD=0.58). Similarly, 95.58% endorsed the superiority of direct breastfeeding over expressed milk (M=4.62, SD=0.64*M*=4.62, *SD*=0.64), consistent with WHO guidelines advocating for maternal-infant bonding to optimize immunological benefits (Victora et al., 2016).

Paradoxically, despite high confidence in their ability to support breastfeeding mothers (M=4.66, SD=0.61), participants simultaneously acknowledged significant gaps in institutional training (M=4.5, SD=0.76), with 91.15% advocating for enhanced educational initiatives. This discrepancy mirrors findings by Najafi and Nasiri (2023), who identified a pervasive "competency-confidence gap" among nurses lacking updated clinical knowledge.

Table 5. Summary of the attitude of participants related to breastfeeding

Items	Mean	SD	Frequency (Percentage)				
			SDA	D	N	A	SA
I believe that breastfeeding directly by mothers is better than expressing milk for Pediatric Medical-Surgical babies	4.62	0.64	2 (0.88%)	0 (0.00%)	8 (3.54%)	61 (26.99%)	155 (68.58%)
I believe that breastfeeding is beneficial for Pediatric Medical-Surgical newborns	4.71	0.58	2 (0.88%)	0 (0.00%)	2 (0.88%)	54 (23.89%)	168 (74.34%)
I think mothers need more help from nurses to successfully breastfeed Pediatric Medical-Surgical babies	4.68	0.59	2 (0.88%)	0 (0.00%)	3 (1.33%)	58 (25.66%)	163 (72.12%)
I believe that the role of nurses is crucial in the breastfeeding of Pediatric Medical-Surgical babies	4.7	0.58	2 (0.88%)	0 (0.00%)	2 (0.88%)	56 (24.78%)	166 (73.45%)
I believe breastfeeding is better than formula feeding for Pediatric Medical-Surgical babies	4.65	0.62	2 (0.88%)	0 (0.00%)	6 (2.65%)	58 (25.66%)	160 (70.80%)
I am confident in my ability to support mothers in breastfeeding their Pediatric Medical-Surgical babies	4.66	0.61	2 (0.88%)	0 (0.00%)	5 (2.21%)	59 (26.11%)	160 (70.80%)
Our unit provides adequate support and resources for breastfeeding Pediatric Medical-Surgical babies	4.6	0.64	2 (0.88%)	0 (0.00%)	7 (3.10%)	68 (30.09%)	149 (65.93%)
I think more training on breastfeeding Pediatric Medical-Surgical babies is needed for nurses	4.5	0.76	2 (0.88%)	3 (1.33%)	15 (6.64%)	65 (28.76%)	141 (62.39%)

Note: SD= Standard deviation; SDA=Strongly Disagree; D= Disagree; N=Not sure; A=Agree; SA=strongly agree.

Table 6 summarizes the attitudes of participants toward breastfeeding, revealing a predominantly positive stance. The mean attitude score was 37.13 (SD = 4.62), with a median of 40.00 (maximum possible score = 40), indicating a strong skew toward high attitudinal endorsement. Notably, 76.11% of participants scored in the high-attitude range (33–40), while only 0.88% exhibited low attitudes (8–23). The narrow standard deviation (4.62) suggests

minimal variability in responses, reflecting a consensus on the importance of breastfeeding. However, the discrepancy between the mean (37.13) and median (40.00) points to a potential left-skewed distribution, possibly due to a small number of lower scores (e.g., minimum = 8).

Table 6. Descriptive statistics of the total attitude of participants related to breastfeeding

Statistic / Category	Value / Score Range	Frequency	Percentage
Mean	37.13	-	-
Median	40.00	-	-
Standard deviation	4.62	-	-
Minimum	8	-	-
Maximum	40	-	-
Low level of attitude	8 – 23	2	0.88 %
Moderate level of attitude	24 – 32	52	23.01 %
High level of attitude	33 – 40	172	76.11 %

Table 7 highlighted the extensive breastfeeding-related practices among healthcare providers, particularly in pediatric medical-surgical settings. The results indicated a strong emphasis on breastfeeding advocacy, as evidenced by the high mean scores for providing knowledge about breastfeeding (M = 4.14, SD = 1.00) and emphasizing its importance to families (M = 4.35, SD = 0.86). Additionally, the guidance provided for the collection and transportation of breast milk was well-practiced, with notable adherence to hygiene protocols, such as washing hands before milk collection (M = 4.36, SD = 0.96) and maintaining proper storage conditions (M = 4.50, SD = 0.78). Screening and receiving breast milk also showed high compliance, particularly in verifying labels (M = 4.59, SD = 0.71) and ensuring the safety of stored milk (M = 4.58, SD = 0.76). However, certain aspects, such as heating breast milk using a warm water bath (M = 2.46, SD = 1.75) and freezing leftover milk after feeding (M = 2.42, SD = 1.75), received relatively lower scores, indicating areas for improvement. Moreover, breastfeeding-related practices in wards were well-maintained, particularly in verifying the identity of mothers and babies (M = 4.37, SD = 0.89) and monitoring feeding progress across wards (M = 4.65, SD = 0.69).

Table 7. Summary of the practices of participants related to breastfeeding

Items	Mean	SD	Frequency (Percentage)				
			N	OC	S	OF	A
Breastfeeding advocacy							
I provide handouts or brochures to families of Pediatric Medical-Surgical patients to monitor breast milk collection	3.94	1.16	11 (4.87%)	20 (8.85%)	33 (14.60%)	69 (30.53%)	93 (41.15%)
I emphasize the importance of breastfeeding to the families of Pediatric Medical-Surgical patients	4.35	0.86	2 (0.88%)	7 (3.10%)	25 (11.06%)	69 (30.53%)	123 (54.42%)
I actively provide knowledge about breastfeeding (such as teaching and demonstrating techniques, providing supporting equipment, etc.),	4.14	1	5 (2.21%)	11 (4.87%)	36 (15.93%)	69 (30.53%)	105 (46.46%)

creating an encouraging environment to promote the initiation of breastfeeding							
Guidance on the collection and transportation of breast milk							
I guide families of Pediatric Medical-Surgical patients to collect breast milk within six hours after birth	3.81	1.31	23 (10.18%)	14 (6.19%)	40 (17.70%)	56 (24.78%)	93 (41.15%)
I guide families to express milk 2-3 times per day	4.05	1.1	9 (3.98%)	13 (5.75%)	38 (16.81%)	63 (27.88%)	103 (45.58%)
I guide families to wash their hands thoroughly before each breast milk collection	4.36	0.96	6 (2.65%)	6 (2.65%)	23 (10.18%)	56 (24.78%)	135 (59.73%)
I guide families to clean the pumping room (without using disinfectants to avoid skin irritation)	4.27	1	7 (3.10%)	7 (3.10%)	26 (11.50%)	63 (27.88%)	123 (54.42%)
I guide families on cleaning and disinfecting breast milk collection equipment	4.28	0.96	5 (2.21%)	8 (3.54%)	26 (11.50%)	66 (29.20%)	121 (53.54%)
I guide families to store breast milk separately each time	4.41	0.88	3 (1.33%)	6 (2.65%)	23 (10.18%)	58 (25.66%)	136 (60.18%)
I guide families to practice good hygiene when storing breast milk	4.5	0.82	3 (1.33%)	5 (2.21%)	15 (6.64%)	57 (25.22%)	146 (64.60%)
I guide families to discard the first drops of naturally collected milk	4.08	1.19	15 (6.64%)	12 (5.31%)	24 (10.62%)	63 (27.88%)	112 (49.56%)
I guide families to transport breast milk using coolers or dry ice, maintaining the cold chain during transportation	4.5	0.78	1 (0.44%)	7 (3.10%)	13 (5.75%)	61 (26.99%)	144 (63.72%)
Screening and receiving breast milk							
I consult with physicians about medications taken by mothers to ensure they do not affect breastfeeding	4.33	0.92	6 (2.65%)	5 (2.21%)	20 (8.85%)	72 (31.86%)	123 (54.42%)
I consult with physicians about mothers' illnesses to ensure they do not affect breastfeeding	4.34	0.93	7 (3.10%)	3 (1.33%)	20 (8.85%)	72 (31.86%)	124 (54.87%)
When accepting breast milk, I check whether the labels are intact and clear (including date and time of collection)	4.59	0.71	1 (0.44%)	3 (1.33%)	15 (6.64%)	50 (22.12%)	157 (69.47%)
When accepting breast milk, I check the volume and quality	4.58	0.71	1 (0.44%)	3 (1.33%)	14 (6.19%)	54 (23.89%)	154 (68.14%)
When accepting breast milk, I sign according to the	4.61	0.71	2 (0.88%)	1 (0.44%)	14 (6.19%)	50 (22.12%)	159 (70.35%)

regulations							
When accepting breast milk, I store it immediately for later use	4.58	0.76	3 (1.33%)	2 (0.88%)	13 (5.75%)	51 (22.57%)	157 (69.47%)
Storage, thawing, and heating of breast milk in wards							
I check and clean the breast milk freezer in the ward every day	4.54	0.75	2 (0.88%)	3 (1.33%)	15 (6.64%)	57 (25.22%)	149 (65.93%)
I separate and label each mother's breast milk in the freezer	4.6	0.73	2 (0.88%)	2 (0.88%)	14 (6.19%)	49 (21.68%)	159 (70.35%)
I use breast milk according to the order of collection, prioritizing colostrum and fresh breast milk	4.57	0.73	1 (0.44%)	3 (1.33%)	17 (7.52%)	50 (22.12%)	155 (68.58%)
I heat breast milk using a warm water bath	2.46	1.75	126 (55.75%)	6 (2.65%)	13 (5.75%)	27 (11.95%)	54 (23.89%)
I freeze leftover breast milk after feeding	2.42	1.75	131 (57.96%)	1 (0.44%)	14 (6.19%)	27 (11.95%)	53 (23.45%)
Breastfeeding in wards							
When checking in new patients, I verify the identity and labels of the mother and baby	4.37	0.89	2 (0.88%)	9 (3.98%)	24 (10.62%)	60 (26.55%)	131 (57.96%)
When checking in new patients, I check the milk for air bubbles	4.4	0.98	7 (3.10%)	7 (3.10%)	18 (7.96%)	51 (22.57%)	143 (63.27%)
When checking in new patients, I check the color of the breast milk	4.57	0.73	2 (0.88%)	2 (0.88%)	14 (6.19%)	56 (24.78%)	152 (67.26%)
During breastfeeding in the ward, I avoid exposing the milk to light	4.21	1.2	19 (8.41%)	3 (1.33%)	21 (9.29%)	51 (22.57%)	132 (58.41%)
I pay attention to the feeding progress of babies in other wards as well	4.65	0.69	2 (0.88%)	1 (0.44%)	12 (5.31%)	45 (19.91%)	166 (73.45%)

Table 8 indicates a strong adherence to recommended breastfeeding practices among healthcare providers, with a mean practice score of 118.50 (SD = 18.55) out of a possible 140. The majority of participants (61.95%) exhibited high levels of practice proficiency (113–140), while only 4.42% scored in the low range (28–83). This high performance aligns with institutional protocols and standardized workflows, as seen in Table 6's rigorous compliance with hygiene practices (e.g., 64.60% "always" instructed proper storage). However, the significant standard deviation (18.55) and minimum score of 48 suggest variability, potentially linked to gaps in complex clinical scenarios requiring advanced knowledge (e.g., preterm infant fortification in Table 2, 24.78% accuracy).

These findings resonate with studies showing that structured clinical guidelines can drive high compliance in routine tasks, yet knowledge deficits may undermine adaptability in non-routine situations (Najafi & Nasiri, 2023). For instance, while participants excelled in daily freezer maintenance (Table 6, M=4.54), their lower accuracy in applying colostrum

prioritization (M=4.57) reflects a need for deeper integration of evidence-based principles.

Table 8. Descriptive statistics of the total practices of participants related to breastfeeding

Statistic / Category	Value / Score Range	Frequency	Percentage
Mean	118.50	-	-
Median	122.00	-	-
Standard deviation	18,55	-	-
Minimum	48	-	-
Maximum	140	-	-
Low level of practices	28 – 83	10	4.42 %
Moderate level of practices	84 – 112	76	33.63 %
High level of practices	113 – 140	140	61.95 %

Table 9 provided insights into the factors influencing breastfeeding-related practices. Notably, educational attainment showed a significant association with knowledge (p = 0.0476), indicating that participants with a bachelor's degree or higher had greater breastfeeding-related knowledge than those with lower educational attainment, suggesting formal education enhanced theoretical understanding of clinical guidelines, as supported by Pereira et al. (2022). Moreover, age (p = 0.0185) and nursing experience (p = 0.0267) were positively correlated with knowledge, suggesting that more experienced and older healthcare providers possessed greater breastfeeding-related knowledge. In terms of practices, the frequency of engagement in breastfeeding training or education was significantly related (p = 0.0024), with those attending training more frequently exhibiting better practices. Additionally, age (p = 0.0030) and nursing experience (p = 0.0013) were significantly associated with higher levels of breastfeeding practices, implying that experience and professional development played key roles in fostering effective breastfeeding-related practices.

Table 9. Comparison and relationship of knowledge, attitude, and practices (KAP) related to breastfeeding and demographic characteristics

Demographic Characteristics	Knowledge		Attitude		Practices	
	Median	p-value	Median	p-value	Median	p-value
Female	45.00	0.3383	37.20	0.1064	118.90	0.5313
Male	45.00		35.73		110.82	
Bachelor's Degree and Up	46.60	*0.0476	37.41	0.1637	119.35	0.2683
Below Bachelor's Degree	43.45		35.90		114.79	
1-2 times	45.00	0.4201	39.00	0.0758	117	*0.0024
3-5 times	45.00		40.00		132	
More than 6 times	45.00		40.00		132	
None	45.00		40.00		114	
Age	r = 0.16	*0.0185	r = 0.12	0.0717	r = 0.20	*0.0030
Nursing experience	r = 0.15	*0.0267	r = 0.10	0.1237	r = 0.21	*0.0013
Medical-surgical experience	r = 0.09	0.1922	r = 0.10	0.1463	r = 0.17	*0.0114

Note: The Mann-Whitney U test was used for categorical variables with two groups, the Kruskal-Wallis test was applied to categorical variables with more than two groups, and Spearman's correlation was used for numerical variables. * - significant at p-value less than 0.05.

Table 10 examines the correlations between breastfeeding-related knowledge, attitudes, and practices (KAP) using Spearman's rank correlation. The results reveal a nuanced interplay among these dimensions. First, **knowledge** showed no significant association with **attitude** (ρ=−0.04, p=0.6004), suggesting that higher theoretical understanding does not inherently translate to more positive attitudes. This aligns with prior research (Hu et al., 2021). For instance, while participants demonstrated substantial knowledge gaps in critical areas like preterm infant fortification (24.78% accuracy, Table 2), their self-reported confidence in breastfeeding support remained high (Table 4, M=4.66), implying that institutional advocacy or workplace culture may override individual knowledge limitations.

Similarly, knowledge exhibited no meaningful correlation with practices (ϱ=−0.07, p=0.2898), highlighting a systemic disconnect between theoretical guidelines and their clinical application. For example, despite strong adherence to routine protocols such as milk labeling (M=4.59, Table 6), participants struggled with complex tasks like contamination reduction (11.95% accuracy, Table 2), underscoring the need for training that bridges abstract knowledge to actionable workflows.

In contrast, **attitude** and **practices** displayed a robust positive correlation (ϱ=0.54, p<0.0001), emphasizing that proactive attitudes are a critical driver of protocol adherence. This finding resonates with the Theory of Planned Behavior, where attitudinal commitment directly predicts behavioral outcomes (Verplanken & Orbell, 2021). The high practice scores observed in Table 7 (mean = 118.50/140) may thus reflect the pervasive positive attitudes reported in Table 4 (e.g., 73.45% strongly agreeing on nurses' crucial role).

Table 10. Correlation matrix of knowledge, attitude, and practices (KAP) related to breastfeeding of participants

Correlation Matrix		Knowledge	Attitude	Practices
Knowledge	Spearman's rho	—		
	df	—		
	p-value	—		
Attitude	Spearman's rho	-0.04	—	
	df	224	—	
	p-value	0.6004	—	
Practices	Spearman's rho	-0.07	0.54	—
	df	224	224	—
	p-value	0.2898	*< .0001	—

Note: Spearman's correlation was used. * - significant at p-value less than 0.05.

7. Discussion

7.1 Knowledge and Practice Disconnection

The results of this study show a significant imbalance in the pediatric medical-surgical nurses' knowledge of breastfeeding. While basic knowledge is relatively well understood, there are significant gaps in key areas. For example, while most nurses understand the basic principles of breastfeeding, only half of them can correctly identify the World Health Organization (WHO) recommendation for exclusive breastfeeding for the first six months. Additionally, the accuracy rate for questions related to the latest guidelines and professional knowledge, such as fortification criteria for preterm infants and milk storage methods, is relatively low.

This knowledge gap directly affects the nurses' practical behavior. The study found that although most nurses recognize the importance of breastfeeding, the frequency of actively supporting breastfeeding in clinical practice is still low. Few nurses regularly provide guidance on proper breastfeeding techniques or develop lactation support plans for mothers. This finding aligns with Van De Ven and Johnson (2006), who

observed that nurses, despite having certain theoretical knowledge, often encounter difficulties in translating this knowledge into practice.

There are several reasons for the disconnect between knowledge and practice. From the individual level, nurses' confidence and competence are closely related to their knowledge base (Pueyo-Garrigues et al., 2021). If nurses are unfamiliar with scientific feeding plans or handling techniques, even with a positive attitude, they may refrain from taking action due to lack of confidence. Moreover, long-term work habits and departmental divisions may lead nurses to focus more on disease treatment and neglect breastfeeding support, creating a "treatment-heavy, feeding-light" trend. Similar findings have been reported in studies from other countries (Shakhshir & Alkaiyat, 2023). Studies have shown that nurses, although possessing basic breastfeeding knowledge, fail to actively intervene in practice due to high work pressure and lack of systematic training.

At the institutional level, the failure to incorporate breastfeeding into routine nursing processes and performance evaluation systems is a major factor contributing to the disconnect between knowledge and practice. If hospitals fail to provide necessary support and incentive mechanisms, nurses may have the knowledge but lack the motivation and conditions to apply it in practice (Zeng et al., 2022).

7.2 Tension Between Attitudes and Institutional Support

This study also found that while nurses generally hold positive attitudes towards breastfeeding, recognizing its importance for infant health, these attitudes have not consistently translated into practice. This reflects the significant tension between personal attitudes and institutional support. On one hand, positive attitudes are a driving force for breastfeeding support: nurses recognize the importance of breastfeeding for infant health and are willing to provide emotional support to mothers. On the other hand, a lack of systematic institutional support becomes a major obstacle to translating these attitudes into action.

For example, some nurses in this study reported that their departments lacked an environment that encouraged breastfeeding, and the hospital did not provide sufficient resources, such as lactation rooms or personnel to assist mothers with breastfeeding. In such cases, even if nurses have a positive attitude, they may not be able to put it into action due to the lack of institutional support. This finding is consistent with Meek and Noble (2022), who noted that despite nurses globally recognizing the benefits of breastfeeding, the lack of systemic support led to a failure in translating knowledge into practice.

Moreover, the lack of institutional support may also negatively impact nurses' attitudes. When hospital management does not prioritize breastfeeding, nurses may lower their perception of its importance. Some nurses may not see breastfeeding support as part of their core responsibilities, especially in pediatric wards, where the focus is more on medical care, and feeding support is seen as secondary. To address this issue, hospitals need to strengthen institutional support to ensure that nurses' attitudes and their practical work align.

8. Conclusion

Low Level of Breastfeeding Knowledge: This study found that pediatric nurses have a relatively low level of breastfeeding knowledge, particularly in areas such as preterm infant fortification and milk storage. Nurses generally have a basic understanding of breastfeeding, but their knowledge of the latest guidelines and detailed practices is limited.

Positive Attitudes but Insufficient Practice: While most nurses have a positive attitude toward breastfeeding and recognize its importance for infant health, this attitude has not been fully translated into consistent practice. The frequency of support for breastfeeding in daily clinical work is still inadequate.

Disconnect Between Knowledge and Practice: There is a disconnect between the knowledge nurses possess and the actions they take in practice. Some nurses, despite having high levels of theoretical knowledge, fail to actively support breastfeeding due to lack of hands-on experience and institutional support.

Tension Between Attitudes and Institutional Support: Although nurses generally support breastfeeding, the lack of institutional support has hindered their ability to implement breastfeeding practices effectively. This indicates that personal attitudes alone are insufficient without the support of a strong institutional framework.

Multiple Factors Influence KAP: Both personal factors (such as education level and training experience) and institutional factors (such as hospital policies and training opportunities) jointly influence nurses' knowledge, attitudes, and practices related to breastfeeding.

9. Recommendation

9.1 Nurse Continuing Education and Training

Strengthening the continuing education system for pediatric nurses on breastfeeding is crucial to filling knowledge gaps and improving practical abilities. This study identified significant gaps in new breastfeeding knowledge and specialized skills, which need to be addressed through systematic training. Hospitals and relevant departments should develop long-term training programs, incorporating breastfeeding knowledge and skills as key components of continuing education for nurses. Training content should include the latest international and national guidelines, feeding strategies for special populations (such as preterm infant fortification), standards for milk storage and handling, and solutions to common breastfeeding issues, with a focus on the areas highlighted in this study. Training methods should include lectures, workshops, and simulated practice to increase the practical applicability and participation rate.

To ensure the effectiveness of the training, it is recommended to introduce assessment and feedback mechanisms. Nurses should undergo knowledge tests and practical evaluations after training, with results linked to performance reviews to encourage practical application of the learned content. Hospital management should support and reward nurses who participate in breastfeeding-related certifications (e.g., International Lactation Consultant Certification), fostering specialized talent. Additionally, WHO/UNICEF-developed breastfeeding support courses could be adopted, with experienced lactation consultants or nutritionists providing evidence-based guidance. This ongoing education will gradually improve pediatric nurses' knowledge and skills, laying a solid foundation for improving clinical practice.

9.2 Hospital System Construction

Hospitals should create an environment that supports breastfeeding and integrate breastfeeding support into routine pediatric nursing practices. This study reveals that the lack of institutional support is one of the main reasons for insufficient breastfeeding practice, so hospital management needs to take proactive measures to improve related systems. First, hospitals can establish clear breastfeeding support protocols and processes, such as requiring pediatric nurses to assess breastfeeding conditions upon patient admission, provide appropriate guidance, and regularly inquire about and assist mothers' breastfeeding needs during hospitalization. Incorporating these measures into routine nursing practices will help make breastfeeding support an automatic part of every nurse's duties.

Hospitals should provide necessary hardware and resources, such as setting up breastfeeding rooms or private spaces, providing breast pumps, refrigeration equipment, etc., to facilitate mothers' breastfeeding and milk storage. For hospitalized infants who cannot breastfeed directly, a milk storage and feeding system should be established to ensure that breast milk can be safely collected, stored, and fed to the infant.

Furthermore, hospital management should encourage departments to create an atmosphere that supports breastfeeding, integrating it into departmental quality management and performance assessments. Multidisciplinary discussions, where pediatric nurses collaborate with pediatricians, nutritionists, and others, should be held regularly to ensure breastfeeding takes precedence in patient care. Departments and individuals who perform well in supporting breastfeeding can be rewarded as role models. Hospitals can also refer to the Baby-Friendly Hospital Initiative and implement measures that support breastfeeding, such as allowing mother-infant rooming-in or extending mother accompaniment time to minimize unnecessary formula feeding. These institutional reforms will help alleviate nurses' concerns about supporting breastfeeding, enabling them to actively implement practices under the drive of their positive attitudes and reducing the current knowledge-practice gap.

9.3 Policy Guidance

Health administrative departments and industry associations should play a macro role in guiding the improvement of healthcare providers' breastfeeding support capabilities from a policy perspective. First, it is recommended to develop and improve breastfeeding guidelines or technical specifications for healthcare personnel,

incorporating pediatric nurses, and clearly defining their responsibilities in breastfeeding support. These guidelines should be issued to healthcare institutions as industry standards and regularly updated to include the latest evidence-based medical information.

Health authorities should strengthen the supervision and assessment of breastfeeding support practices in healthcare institutions. Indicators such as the breastfeeding rates of hospitalized infants, whether hospitals have established related policies, and nurse training participation rates should be included in hospital evaluation and grading systems, urging hospital administrators to pay attention and take action. This top-down pressure will turn into motivation at the grassroots level, pushing hospitals to implement nurse training and system building.

9.4 Future Research

Although this study has explored the current state of pediatric nurses' breastfeeding KAP, several areas remain for further research. First, similar surveys should be conducted in a wider range of regions and populations to test the generalizability of the findings. Future studies can include a larger sample of pediatric nurses across different provinces and cities, comparing differences between regions and hospital levels and analyzing how influencing factors operate in different contexts. This will help design targeted regional policies and training programs.

Qualitative research should be conducted to complement the quantitative findings. In-depth interviews with pediatric nurses can reveal their subjective reasons for supporting or failing to support breastfeeding in their work, such as work pressure, confidence in knowledge, and interpersonal factors, enriching the understanding of factors influencing KAP. Similarly, interviews with mothers or caregivers of hospitalized children can provide feedback on their needs and evaluations of nurse support, offering insights for improving nurse practices.

Intervention studies are encouraged, applying the strategies proposed in this research and evaluating their effectiveness. For example, breastfeeding training programs for pediatric nurses or department support plans could be implemented in a group of hospitals, with a control group of hospitals that have not implemented these interventions, and comparisons can be made after some time to evaluate the changes in nurse KAP levels and patient breastfeeding outcomes. These studies will provide empirical evidence to confirm the effectiveness of training and institutional interventions, further persuading policymakers to invest more resources. Finally, future research could expand into interdisciplinary collaboration, involving clinical medicine, nursing management, public health, and other fields to comprehensively assess and improve nurses' breastfeeding support capacity.

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Appendix 1

Section 1: General Information Questionnaire

No.	Item	Options
A01	Age (years)	( ) years
A02	Sex	(1) Male (2) Female
A03	Highest Educational Attainment	(1) Below Bachelor's Degree (2) Bachelor's Degree (3) Master's Degree and above
A04	Position Category	(1) Nurse (2) Nurse Practitioner (3) Head Nurse or above
A05	Years Of Nursing Experience	( ) years
A06	Years Of Pediatric Medical-Surgical Experience	( ) years
A07	Number Of Capacity Building Activities Within One Year	( )

Section 2: Questionnaire on Pediatric Medical-Surgical Nurses' Knowledge of Breastfeeding for Hospitalized Newborns

The following items are a survey of Pediatric Medical-Surgical nurses' knowledge on breastfeeding for hospitalized newborns. Questions 1-12 are single-choice, and questions 13-20 are multiple-choice. Please fill in the correct options you think are appropriate in the brackets after the questions.

B01. Which of the following is not an important function of breastfeeding: ( )

A. Promotes brain development and long-term developmental outcomes

B. Reduces feeding intolerance

C. Reduces uterine contraction in mothers

D. Prevents infections

B02. WHO recommends exclusive breastfeeding up to the age of: ( )

A. 4 months

B. 6 months

C. 9 months

D. 12 months

B03. According to China's "Feeding Recommendations for Preterm/Low Birth Weight Infants," preterm infants with a gestational age of ≤ _ weeks and a birth weight of ≤ _ grams should primarily receive fortified breast milk: ( )

A. 35; 1500

B. 36; 2000

C. 34; 2000

D. 35; 1000

B04. Mothers with which of the following diseases should not breastfeed: ( )

A. Hypothyroidism treated with thyroid hormone postpartum

B. Hepatitis B with minor symptoms

C. Syphilis

D. Undergoing cytotoxic chemotherapy

B05. Which of the following is not a basic principle of medication use during breastfeeding: ( )

A. Over-the-counter medications are safe to use during breastfeeding

B. If the medication used by the mother is also prescribed for newborns (infants), it is generally safe

C. When not affecting the therapeutic effect, choose medications with minimal transfer into breast milk and minimal impact on the newborn

D. For long-term or high-dose medication, monitor the infant's blood drug levels

B06. Colostrum is defined as the milk secreted within ( )

A. 5 days postpartum

B. 7 days postpartum

C. 10 days postpartum

D. Two weeks postpartum

B07. To increase milk production, a mother should pump every () hours on average, for more than ( ) minutes each time

A. 6; 15

B. 5; 30

C. 4; 30

D. 3; 15

B08. Which of the following statements about breast milk storage is incorrect: ( )

A. At room temperature 25-37°C, it can be stored for 4 hours

B. At room temperature 15-25°C, it can be stored for 8 hours

C. In the refrigerator at 2-4°C, it can be stored for 48 hours

D. In a freezer at -18°C or below, it can be stored for 3 months

B09. The best way to thaw breast milk is to take it out of the freezer and place it in ( )

A. Cold water

B. Bottle warmer

C. Refrigerator

D. Hot water

B10. Thawed breast milk should be warmed in water at ( ) °C:

A. 40-60 °C

B. 60-80 °C

C. 100 °C

D. 37-40 °C

B11. Thawed breast milk that has been heated but not consumed should be: ( )

A. Reheated for the next feeding

B. Discarded

C. Stored in the refrigerator

D. Stored in the freezer

B12. Which of the following statements is incorrect: ( )

A. The amount of collected breast milk should not exceed 3/4 of the container capacity

B. Breast milk can be stored in the refrigerator door

C. Use breast milk according to the collection time, prioritizing colostrum and fresh breast milk; for preterm and high-risk infants, fresh breast milk is best

D. During phototherapy, if continuous breastfeeding is required, avoid light exposure during feeding

Multiple-choice questions

B13. To protect, support, and promote

breastfeeding, WHO and UNICEF have formulated: ( )

A. "The Ten Steps to Successful Breastfeeding"

B. "The International Code of Marketing of Breast-milk Substitutes"

C. "The Hospital Breastfeeding Regulations"

D. "The Baby-Friendly Hospital Initiative"

B14. Measures to promote breastfeeding in hospitalized infants include: ( )

A. Informed choice

B. Establishing and maintaining lactation

C. Kangaroo care

D. Non-nutritive sucking

B15. The functions of colostrum include: ( )

A. Rich in antibodies

B. Acts as a laxative, promoting the passage of meconium

C. Contains growth factors, aiding in intestinal maturation

D. Rich in vitamins

B16. Which of the following is incorrect regarding medication use during breastfeeding: ( )

A. Estrogen in contraceptives affects the sexual development of infants and should be avoided

B. Taking thyroid hormone tablets should not be done while breastfeeding

C. Progestin-only contraceptives can be taken during breastfeeding

D. Mothers taking corticosteroids should stop breastfeeding

B17. When labeling breast milk sent to the hospital, in addition to the bed number and name, it should also include: ( )

A. Date

B. Time

C. Milk volume

D. Hospitalization number

B18. Methods to stimulate the let-down reflex include: ( )

A. Applying warm compresses to the breasts or taking a warm shower

B. Massaging the neck and back

C. Gently massaging, shaking, or tapping the breasts, and stimulating the nipple skin

D. Helping the mother relax and drink warm beverages

B19. To reduce contamination during breast milk collection, which of the following practices is correct: ( )

A. Both the mother and the assistant should wash their hands and disinfect the pump parts

B. Collecting naturally dripped breast milk is not recommended

C. It is not necessary to discard the first 5-10 ml of breast milk collected each time

D. Connect the collection parts directly to the storage container to reduce contamination

B20. Regarding breast milk transport, which of the following statements is correct: ( )

A. Maintain the cold chain state of breast milk: transportation temperature should be kept below 4°C

B. It is recommended to use cooling bags and dry ice for transport (for transport times over 18 hours, dry ice is recommended)

C. Regular ice can be used for insulating storage

D. Clean, dry towels can be used to fill the gaps between breast milk containers practices is correct.

Section 3: Questionnaire on Pediatric Medical-Surgical Nurses' Attitudes Towards Breastfeeding for Hospitalized Newborns

Please answer the following questions based on your actual situation. In the answer area, tick "√" the option that matches your opinion. If you strongly agree or agree with a statement, tick "strongly agree" or "agree". If you disagree or strongly disagree with a statement, tick "disagree" or "strongly disagree". If you are unsure or do not know, please tick "not sure".

No.	About Pediatric Medical-Surgical Nurses' Attitudes Toward Breastfeeding Hospitalized Newborns	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
C-01	I believe that breastfeeding directly by					

	mothers is better than expressing milk for Pediatric Medical-Surgical babies					
C-02	I believe that breastfeeding is beneficial for Pediatric Medical-Surgical newborns					
C-03	I think mothers need more help from nurses to successfully breastfeed Pediatric Medical-Surgical babies					
C-04	I believe that the role of nurses is crucial in the breastfeeding of Pediatric Medical-Surgical babies					
C-05	I believe breastfeeding is better than formula feeding for Pediatric Medical-Surgical babies					
C-06	I am confident in my ability to support mothers in breastfeeding their Pediatric Medical-Surgical babies					
C-07	Our unit provides adequate support and resources for breastfeeding Pediatric Medical-Surgical babies					
C-08	I think more training on breastfeeding Pediatric Medical-Surgical babies is needed for nurses					

Section 4: Questionnaire on Pediatric Medical-Surgical Nurses' Practices of Breastfeeding for Hospitalized Newborns

The following items are a survey of Pediatric Medical-Surgical nurses' behaviors related to breastfeeding hospitalized newborns, based on your actual work situation. Please tick "√" the option that matches your actual work situation.

	No.	Pediatric Medical-Surgical Nurses' Breastfeeding Behaviors for Hospitalized Newborns	Never	Rarely	Sometimes	Often	Always
Breastfeeding Guidance	D-01	I provide handouts or brochures to families of Pediatric Medical-Surgical patients to monitor breast milk collection					
	D-02	I emphasize the importance of breastfeeding to the families of Pediatric Medical-Surgical patients					
	D-03	I actively provide knowledge about breastfeeding (such as teaching and demonstrating techniques, providing					

		supporting equipment, etc.), creating an encouraging environment to promote the initiation of breastfeeding					
Guidance on Collecting and Transporting Breast Milk	D-04	I guide families of Pediatric Medical-Surgical patients to collect breast milk within six hours after birth					
	D-05	I guide families to express milk 2-3 times per day					
	D-06	I guide families to wash their hands thoroughly before each breast milk collection					
	D-07	I guide families to clean the pumping room (without using disinfectants to avoid skin irritation)					
	D-08	I guide families on cleaning and disinfecting breast milk collection equipment					
	D-09	I guide families to store breast milk separately each time					
	D-10	I guide families to practice good hygiene when storing breast milk					
	D-11	I guide families to discard the first drops of naturally collected milk					
	D-12	I guide families to transport breast milk using coolers or dry ice, maintaining the cold chain during transportation					
Breast Milk Identification and Acceptance	D-13	I consult with physicians about medications taken by mothers to ensure they do not affect breastfeeding					
	D-14	I consult with physicians about mothers' illnesses to ensure they do not affect breastfeeding					
	D-	When accepting breast					

	15	milk, I check whether the labels are intact and clear (including date and time of collection)					
	D-16	When accepting breast milk, I check the volume and quality					
	D-17	When accepting breast milk, I sign according to the regulations					
	D-18	When accepting breast milk, I store it immediately for later use					
Storage, Thawing, and Heating of Breast Milk in the Ward	D-19	I check and clean the breast milk freezer in the ward every day					
	D-20	I separate and label each mother's breast milk in the freezer					
	D-21	I use breast milk according to the order of collection, prioritizing colostrum and fresh breast milk					
	D-22	I heat breast milk using a warm water bath					
	D-23	I freeze leftover breast milk after feeding					
Breastfeeding in the ward	D-24	When checking in new patients, I verify the identity and labels of the mother and baby					
	D-25	When checking in new patients, I check the milk for air bubbles					
	D-26	When checking in new patients, I check the color of the breast milk					
	D-27	During breastfeeding in the ward, I avoid exposing the milk to light					
	D-28	I pay attention to the feeding progress of babies in other wards as well					

Appendix 2

INFORMED CONSENT FORM

Project title: Knowledge, Attitude, and Behavior of Pediatric Medical Surgical Nurses on Breastfeeding: Basis for Capacity Building Plan

Purpose and conduct of the study

This study is an academic research project aiming to explore factors influencing the knowledge,

attitudes, and practices of pediatric medical-surgical nurses regarding breastfeeding. By analyzing demographic characteristics and their relationship with breastfeeding-related behaviors, this research seeks to provide data-driven recommendations for capacity-building programs. All collected data will be used exclusively for academic purposes and will adhere strictly to ethical guidelines.

Participant's information (nature and extent of involvement)

You will be invited to participate in a 4-week cross-sectional study involving 150 pediatric medical-surgical nurses. If you decide to participate, you will be asked to answer a series of survey questions that will collect demographic information, including your age, sex, highest educational attainment, position category, years of nursing experience, years of pediatric medical-surgical experience, and the number of capacity-building activities you will have attended in the past year. Additionally, you will complete four questionnaires: the "General Information Questionnaire", the "Questionnaire on Breastfeeding Knowledge of Hospitalized Newborns," the "Questionnaire on Breastfeeding Attitude of Hospitalized Newborns," and the "Questionnaire on Breastfeeding Behavior of Hospitalized Newborns." The information collected from these questionnaires will help us understand your future knowledge, attitudes, and practices regarding breastfeeding and will serve as a basis for developing a capacity-building plan to enhance health promotion efforts in pediatric nursing.

Study-related treatments and probability for random assignment

In this study, proportional stratified random sampling will be used to ensure a representative sample of pediatric medical-surgical nurses from four anonymous hospitals in Shenzhen. A total of 253 nurses will be stratified by hospital, and the sample size from each hospital will be proportionally allocated based on the number of nurses. Specifically, Hospital A accounts for 23.7% of the total number of nurses, Hospital B 53.4%, Hospital C 13.0%, and Hospital D 9.9%. To achieve the final sample size of 150 participants, the sample from each hospital was adjusted to the nearest whole number: 36 nurses from Hospital A, 80 from Hospital B, 20 from Hospital C, and 14 from Hospital D. Minor rounding adjustments were made to ensure the total sample size of 150 while maintaining representativeness.

Within each hospital, simple random sampling will be applied to select participants from the eligible nurses. Each eligible nurse will be assigned a random number, and participants will be chosen using a random number table or computer-generated random numbers. This method ensures that all nurses have an equal probability of being selected, minimizing selection bias and ensuring a fair and representative sample.

To protect the anonymity of participants and smaller hospitals (e.g., Hospital D), all results will be aggregated during data analysis and reporting. Detailed demographic or professional information will not be disclosed in a way that allows identification of individual participants or hospitals. Additionally, specific results from smaller groups will not be reported independently, further safeguarding confidentiality.

Specific Procedures Based on Study Objectives

This study aims to explore the knowledge, attitudes, and practices (KAP) of pediatric medical-surgical nurses regarding breastfeeding. By analyzing the relationship between these factors and demographic characteristics such as age, education, and work experience, we seek to develop a capacity-building plan to enhance the support provided for breastfeeding in pediatric medical-surgical settings. The goal is to improve nurses' ability to support breastfeeding, thereby enhancing care quality and improving patient recovery outcomes.

Risk and inconveniences

There is virtually no risk involved in participating in this study, and no identifying information was collected. All data will be used solely for this study. On average, each questionnaire will take 20 minutes or less to complete. To minimize potential risks during face-to-face questionnaire completion, the process will be conducted in a private, well-ventilated environment to ensure your comfort and confidentiality. Hygiene measures, such as hand sanitization and optional mask usage, will also be implemented. Additionally, you may skip any questions that make you feel uncomfortable or withdraw from the study at any point without any consequences. To address any psychological discomfort, you will have access to contact information for support services if needed. The study team is committed to maintaining your

privacy and confidentiality, ensuring that your responses cannot be traced back to you. If you have any questions regarding this study, you can contact Liu Liyue at +86 13631561198 or via email at liu.liyue@auf.edu.ph.

Possible benefits for the participants

As respondents in this study, there are no associated costs for participation. The study provides an incentive, offering respondents the chance to win a trophy through a lottery. This incentive is entirely optional and is not tied to the quality or completeness of participants' responses. It is solely a token of appreciation for the time and effort contributed by participants. The aim of the study is to assess pediatric medical-surgical nurses' knowledge, attitudes, and practices regarding breastfeeding.

The findings from this research can serve as a foundation for capacity-building programs, helping to enhance nurses' professional competencies in breastfeeding support. This, in turn, can improve maternal and infant health, promote better care practices, and reduce the burden on the healthcare system.

Contact persons

If you have any questions regarding the study or need assistance in answering the questionnaire, you may contact the corresponding author Ms. Liu Liyue at +86 13631561198 or via email at liu.liyue@auf.edu.ph.

Voluntariness of participation

Strict measures will be implemented to prevent any perceived coercion during the recruitment process. Recruitment will be conducted in collaboration with the hospital's nursing administration to identify eligible participants. However, you will be explicitly informed that your decision to participate, decline, or withdraw from the study at any time will not affect your employment, professional standing, or workplace relationships. All communication will emphasize the voluntary nature of the study, ensuring that you feel no obligation to participate due to your employer's involvement. Your participation in this research study is entirely voluntary, and you may choose not to participate or withdraw at any time without any obligations or consequences.

If any new information arises during the study that could affect participants' willingness to continue, participants or their legally acceptable representatives will be informed promptly. Should a participant choose to withdraw from the study, all associated data will be destroyed and will remain confidential and anonymous.

Confidentiality and data management

Before each respondent registers for this study, the researchers will be responsible for providing a comprehensive and detailed introduction to the study's purpose, procedures, and potential risks, and obtaining a signed written informed consent form. To ensure anonymity and blinding in this study, all participant data will be anonymized by assigning unique codes. Personal identifiers such as name, hospital will not be included in the dataset used for analysis. Consent forms will be stored separately from the survey data to prevent identity linkage. The researcher will only analyze de-identified data, and any data issues or anomalies will be addressed without linking back to individual participants' identities. Data analysis and reporting will be conducted in an aggregated format, ensuring no individual participant can be identified. Respondents will have the right to withdraw from the study at any time. Upon withdrawal, their personal information and data will be destroyed and will not be disclosed to any third party. The personal privacy and data confidentiality of respondents will be protected during the study.

After respondents complete the questionnaire, the research data will be collected and managed by the researchers to ensure the accuracy of the experimental data and the privacy and confidentiality of respondents. The original questionnaires will be kept by the researchers and stored in a separate locked cabinet. Respondents will be coded, and the data will be analyzed in a blinded manner, with unresolved issues in the data being reviewed. The stored data will not include the names of respondents, meaning that the published data analysis cannot be traced back to the respondents. All other relevant information, including answers to questions in the survey, will be used solely for research purposes. The actual survey forms and summary tables will be kept for three years after the study concludes, after which they will be destroyed using a shredder, and a final check will be conducted to ensure that all data and questionnaires in the drawer have been completely destroyed. The results of all questionnaires will not be used directly or indirectly for any other research.

The data management practices of this study

fully comply with all relevant national and international data protection regulations, including China's Personal Information Protection Law (PIPL) and the General Data Protection Regulation (GDPR). These measures ensure that participants' data are handled securely and ethically, meeting the highest standards of privacy protection.

Access to the results of the study

The participants shall be immediately notified once the study is done. If the participants choose to be informed of the results, the researchers will be able to do so upon submission of a request to the corresponding author. To ensure effective communication of the study results, the researchers will implement a detailed dissemination plan. Results will be shared in an accessible format, such as summary reports or visual presentations, within three months after the study concludes. Participants may request the results through the corresponding author, and these will be provided in a clear, non-technical language that ensures all participants can easily understand the findings.

Only the authors, participants, and those who are directly concerned with the study (e.g., Ethics Review Committee, etc.) have the right to access the results.

Withdrawal Criteria

Participants may withdraw from the study at any time without any obligations or consequences. In the event of unforeseen interruptions, such as natural disasters, public health emergencies, or institutional changes, the researcher will notify the Ethics Committee and provide plans for restarting or halting the study.

Participation in this study may also be terminated under the following circumstances:

- Non-compliance with study procedures that compromises data integrity.
- Significant health-related changes or adverse events that make participation unsuitable.
- Regulatory or institutional requirements that necessitate study termination.

Participants will be informed promptly of any termination reasons and follow-up actions. All data from withdrawn or terminated participants will be excluded from analysis and securely destroyed to maintain privacy and confidentiality.

Ethical approval

This study has been approved by the Ethics Review Committee of Suining Central Hospital as a research site. For clarification, please contact the Ethics Committee at 0825-2292068. The Ethics Review Committee of Angeles University Foundation has approved this study. If you have any questions, the committee can be reached through ERC chair:

Dr. Bella G. Panlilio

Chair, ERC

Ethics Review Committee, Angeles University Foundation

panliliobg@auf.edu.ph

(045) 625 2888 local 170

As part of compliance with ethical and regulatory standards, study monitor(s), auditor(s), the AUF-ERC, and relevant regulatory authorities will be granted direct access to participants' medical records. This access will strictly adhere to confidentiality and data protection regulations, ensuring that participants' privacy and anonymity are preserved throughout the review process.

Statement of the Participant

I have read and understood the above information and have been given the opportunity to consider and ask questions on the information regarding my involvement in this study. I have spoken directly to the investigator/s of this study who have answered to my satisfaction all my questions. I have received a copy of this Participant's Information and Informed Consent Form. I hereby voluntarily agree to participate.

_____	_____	_____
Name of Participant	Signature of Participant	Date

Statement of the Researcher

I hereby attest that the participant has read and understood the above information and has been given the opportunity to consider and ask questions on the information regarding the involvement in this

study. The participants were also given a copy of this Participant's Information and Informed Consent Form. I also attest that the participant has volunteered for this study and was not coerced.

_____	_____	_____
Name of Participant	Signature of Participant	Date

Appendix 3 Gantt Chart