

Effectiveness of an Educational Program about Iatrogenic Skin Afflictions on Pediatric Nurses' Performance and Neonates' Clinical Outcomes

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Abstract

Background: Neonates, inherently vulnerable due to low birth weight, physiological immaturity, and extensive medication exposure, are at an increased risk of iatrogenic skin harm. **Aim of the study:** The study aimed to evaluate effectiveness of an educational program on iatrogenic skin afflictions, focusing on pediatric nurses' performance and neonates' clinical outcomes. **Methods:** Conducted at the Neonatal Intensive Care Unit (NICU) of Aswan University hospital, the quasi-experimental study involved a convenient sample of 55 nurses and 39 neonates admitted within one month. Data collection utilized three tools: a structured interview questionnaire encompassing biosocial data and nurses' knowledge, an observation checklist to assess nurse practices regarding iatrogenic skin affliction, and an assessment of neonate clinical outcomes. **Results:** Post-educational program, the study revealed significant improvements in both nurses' knowledge and practices. Statistically significant differences were observed in nurses' knowledge and practices before, immediately after, and one month after the educational program. **Conclusion:** Implementation of an educational program addressing skin injuries resulted in improved nurses' performance in Neonatal Intensive Care Units. Integrating preventive care measures for acquired skin injuries into routine neonatal care is highly recommended. **Practical Implications:** Highlighting neonatal vulnerability to iatrogenic skin issues, the NICU education program proved crucial for nurses. Post-program, enhanced knowledge and practices were noted, emphasizing the practical significance of targeted education to mitigate iatrogenic risks in neonatal care settings. for targeted neonatal education to mitigate iatrogenic risks.

Keywords: Iatrogenic skin afflictions, Nurses' Performance, Neonatal Clinical Outcomes.

Introduction:

The skin, the body's largest organ, plays diverse roles, serving as a barrier against water loss, irritants, and pathogens, regulating temperature, facilitating immunological surveillance, and enabling tactile perception. Comprising three primary layers—the epidermis, dermis, and hypodermis - the outermost stratum corneum of the epidermis, as identified by McKnight et al. (2023), acts as a crucial barrier against water loss and external agent penetration. Iatrogenic Skin damage, as defined by de'Angelis et al. (2023), results from necessary medical interventions, pharmacotherapy, or the use of medical devices unrelated to the primary disease. This can occur during diagnostic processes or treatment administered by a medical team, encompassing physicians, nurses, technicians, laboratories, and all individuals involved in neonatal care. Contrarily, intentional skin

afflictions, such as skin branding for medical relief or body piercing and tattooing for cosmesis, are often performed for non-medical reasons. Chung et al. (2020) highlight the medical and psychological consequences associated with these intentional practices.

Neonatal dermatological issues exhibit a prevalence ranging from 67.3% to 100%. Timely identification of these skin problems in neonates is crucial for accurate diagnosis, effective treatment, and appropriate counseling, as emphasized by De María et al. (2021). Skin afflictions can result from various practices, including skin branding, tattooing, body piercing, and creative scarifications. Skin branding, specifically employed by faith healers for pain relief or medical treatment, is highlighted by Mesjasz et al. (2023).

Despite advancements in acute care and the growing use of minimally invasive techniques,

iatrogenic skin damage remains a notable concern. The recognition and management of iatrogenic skin damage, characterized by unintended skin injury due to medical interventions, pose challenges for healthcare teams caring for neonates, as noted by Bhatia et al. (2020). Neonates with the least developed skin barriers, particularly those under 32 weeks of gestation, face the highest risk of cutaneous damage. Factors such as low birth weight, an extended hospital stay, and indwelling instrumentation further contribute to this risk (Isaac & Siddiqui, 2022).

Neonatal skin immaturity stands out as a crucial risk factor for the occurrence of iatrogenic injuries. Impairment of the skin barrier in neonates can lead to notable physiological consequences, including heightened vulnerability to infections, increased percutaneous absorption of toxic agents, and instability in fluid and thermal homeostasis, as discussed by Gerner et al. (2022). These skin injuries not only cause significant discomfort but also require additional measures for treatment, often extending the duration of hospitalization. In severe cases, permanent aesthetic and functional issues may emerge, emphasizing the lasting impact of such injuries, as noted by Borg et al. (2023).

Recent advancements in technology, along with innovations in diagnostics and therapeutics, have notably elevated the survival rates of newborns in critical care. This improvement has led to an increased utilization of current invasive diagnostic and therapeutic methods, as highlighted by Kolimi et al. (2022). However, these forms of skin afflictions can have diverse consequences, extending beyond the medical realm to ethical considerations. Past instances of such procedures being performed without knowledge or prior information about potential medical consequences raise ethical concerns. The psychosocial impact before and after these afflictions is noteworthy, as it may influence subsequent medical management, as discussed by Kim et al. (2023).

Maintaining skin integrity in neonatal units is a critical aspect of newborn care, significantly influencing survival rates. Physicians play a central role in focusing on skin health throughout neonatal care, but the interdisciplinary team's collaboration is essential to create, implement,

and enhance effective solutions. Gupta et al. (2023) stress the need for recognizing the importance of neonatal skin care and understanding the limitations of interventions to drive the adoption of new practices. However, insecurity, particularly in the use of topical treatments, is prevalent among nursing teams. Preventing skin lesions requires routine activities, and the team often requires guidance in these efforts. Kipps et al. (2023) highlight that a lack of clear direction can lead to lesions and prolonged healing periods, disrupting continuity of care and fostering uncertainty among team members. Effective communication and collaborative strategies are crucial to address these challenges and ensure optimal neonatal skin care.

Neonatal nursing stands as a specialized field, requiring specific knowledge and training to adhere to recognized internal and external policies. This adherence ensures that neonatal nurses maintain the established standard of care for their practice area, mitigating legal liability, as emphasized by Salah et al. (2021). A significant aspect of neonatal nursing involves the preservation of skin integrity and the reduction of risk factors, contributing substantially to the alleviation of the care burden associated with skin injuries in Neonatal Intensive Care Units (NICUs). De Faria et al. (2022) stress the importance of integrating appropriate and timely prevention strategies into NICU practices, including regular assessments, identification of infants at risk, early detection of injuries, and adherence to skin care guidelines. These measures collectively aim to reduce the likelihood of neonates acquiring skin injuries, promoting optimal neonatal care.

Significance of the study:

The skin plays a multifaceted and crucial role in facilitating the transition from intra- to extra-uterine life, serving as a vital protective barrier for newborns both mechanically and immunologically. It serves various functions, including the reduction of insensible trans epidermal water loss, facilitating transcutaneous absorption of substances, regulating body temperature, and enabling environmental perception. The postnatal period triggers numerous adaptation and maturation mechanisms in response to the newborn's exposure to the

extra-uterine environment (Zanatta & Carvalho, 2023).

Effective neonatal skin care practices are considered paramount for the survival of neonates and are closely tied to the knowledge and skills of healthcare professionals in implementing scientifically valid procedures for neonatal care. Among healthcare providers, nurses play a central and indispensable role in safeguarding skin integrity, monitoring physiological conditions, and preventing skin breakdown, particularly during the critical period for neonates in the Neonatal Intensive Care Unit (NICU). Skin injuries, a prevalent issue in critical care units, can significantly compromise neonatal health (Metallinou et al., 2022). So that the study aimed to evaluate the effectiveness of an educational program about iatrogenic skin afflictions on pediatric nurses' performance and neonates' clinical outcomes.

Aim of the Study

This study was conducted to evaluate the effectiveness of an educational program about iatrogenic skin afflictions on pediatric nurses' performance and neonates' clinical outcomes, through:

- Assessment of nurses' knowledge, practices and neonatal clinical outcomes at Neonatal Intensive Care Unit before implementing the educational program regarding preventive measures of neonatal iatrogenic skin afflictions.
- Design and implementation of the educational program regarding knowledge and preventive measures practices of neonatal iatrogenic skin afflictions at Neonatal Intensive Care Unit.
- Evaluation of nurses' knowledge, practices and neonatal clinical outcomes of skin state at Neonatal Intensive Care Unit regarding preventive measures of neonatal iatrogenic skin afflictions after implementing the educational program immediately and one month later.

Research hypothesis:

- After implementing the educational program regarding preventive measures of neonatal iatrogenic skin afflictions at Neonatal Intensive Care Unit, nurses' knowledge would be significantly greater than it was before.
- After implementing the educational program regarding preventive measures practices of

neonatal iatrogenic skin afflictions at Neonatal Intensive Care Unit, the nurses' practices would be significantly improved compared to previously.

- After implementing the educational program regarding preventive measures practices of neonatal iatrogenic skin afflictions at Neonatal Intensive Care Unit, neonatal clinical outcomes of skin state would be significantly improved compared to previously.

Methods

The current study employed a quasi-experimental research design to investigate the impact of a targeted intervention within the Neonatal Intensive Care Unit (NICU) at Aswan University Hospital. The quasi-experimental design was chosen for its practical applicability in the context of the NICU, where random assignment of participants to different groups may pose challenges. This design allowed for the assessment of the intervention's effects on a single group of participants without the need for a control group. The study aimed to evaluate the effectiveness of the intervention in improving neonatal care practices among the nursing staff.

The setting for this study was the NICU at Aswan University Hospital, a critical healthcare environment dedicated to the specialized care of neonates requiring intensive medical attention. The choice of this setting was deliberate, given the unique challenges and considerations associated with neonatal care. The NICU setting ensured a focused examination of the intervention's impact on nursing practices and, by extension, neonatal outcomes.

The sample size for this study consisted of 55 nurses and 39 neonates. All 55 nurses working within the NICU during the study period were included in the research, ensuring a comprehensive representation of the healthcare professionals directly involved in neonatal care. Additionally, all 39 neonates present in the NICU throughout the data collection period were included in the study. The decision to involve the entire nursing and neonatal population during the specified period was based on the practical constraints of the NICU setting and aimed to provide a holistic perspective on the outcomes of interest.

Inclusion criteria for nurses involved all those currently working within the NICU, while inclusion criteria for neonates encompassed all those present in the NICU during the data

collection period. The study employed a convenient sampling technique, acknowledging the pragmatic considerations inherent in the NICU environment. Exclusion criteria were not explicitly mentioned, but the study design and sampling approach reflected the need for practical and feasible participant selection within the unique context of the Neonatal Intensive Care Unit at Aswan University Hospital

Data collection tools:

Three tools were utilized for data collection:

Tool I, referred to as the Structured Interviewing Questionnaire, was meticulously developed by the researcher after a thorough review of pertinent literature. This tool comprises two components presented in simple Arabic, serving as an instrument to measure biosocial data of the studied nurses and neonates, as well as assess the nurses' knowledge regarding neonatal iatrogenic skin afflictions within the Neonatal Intensive Care Unit (NICU). The first part of the questionnaire focuses on collecting biosocial data, encompassing information about the studied nurses, such as age, educational level, years of experience, and participation in any training programs related to neonatal care. For neonates, the biosocial data includes gender, weight, length, gestational age, methods of feeding, medical diagnosis, and the length of hospital stay. This comprehensive approach ensures a holistic understanding of the demographic and clinical characteristics of both nurses and neonates.

The second part of the questionnaire is designed to assess the knowledge of the studied nurses regarding neonatal iatrogenic skin afflictions. This section comprises seven multiple-choice questions covering essential aspects such as the definition of skin, anatomical structure of the skin, skin function, characteristics of neonatal skin, risk factors for skin breakdown/excoriation, common causes of neonatal skin injury, and neonatal skin care management to prevent iatrogenic skin afflictions. These items were carefully selected and adapted from reputable questionnaires developed by Broom et al. (2019), El-Hadary & Hassan (2023), and Zanatta & Carvalho (2023).

The scoring system for assessing nurses' knowledge is structured to provide a nuanced evaluation. Each complete and correct response receives two points, an incomplete but correct answer is awarded one point, while incorrect or unknown answers receive zero points. The

cumulative score is then converted to a percentage, allowing for a clear classification of the nurses' overall knowledge level. A score of 65% or higher is deemed satisfactory, reflecting a robust understanding of neonatal iatrogenic skin afflictions, while a score below 65% is classified as unsatisfactory, indicating areas that may require further attention or education. This systematic and comprehensive approach ensures a robust evaluation of the knowledge levels of the studied nurses in the NICU.

Tool II, the Preventive Measures of Neonatal Iatrogenic Skin Afflictions Checklists, represents a comprehensive and meticulously designed instrument initiated by Ligi et al. (2008) and Abkenar et al. (2020). This tool addresses seven main areas crucial for implementing preventive measures within the Neonatal Intensive Care Unit (NICU). These areas encompass general preventative measures for neonates of all gestations (18 items), specific preventative measures for infants born before 32 weeks gestation and/or weighing less than 1.5 kg (19 items), preventative measures for infants with infected skin (6 items), those with intravenous lines (6 items), intubated babies and those on Nasal Continuous Positive Airway Pressure (10 items), as well as measures related to the use of tape/adhesive dressings (6 items), and the use of monitoring equipment (6 items). The checklist's comprehensive coverage ensures a thorough assessment of the NICU's adherence to critical preventive measures, providing a structured approach to maintaining optimal neonatal skin health.

The scoring system for Tool II involves a meticulous evaluation of each item within the checklist. Adherence to preventive measures in each of the seven main areas is carefully assessed, allowing for a nuanced understanding of the NICU's practices. The scoring system likely involves assigning points for each item, with a higher score indicating a higher level of compliance with the prescribed preventive measures. This systematic approach not only aids in identifying areas that may require improvement but also serves as a valuable tool for assessing the overall effectiveness of preventive measures implemented in the NICU, ultimately contributing to enhanced neonatal care practices.

Tool III, known as the Neonatal Skin Condition Score Scale (NSCS), stands as an invaluable instrument in neonatal skin care,

developed through evidence-based practices by Lund & Osborne (2004) and Behr et al. (2020). This tool is designed to comprehensively assess the state of neonatal skin outcomes based on three critical criteria: dryness, erythema, and breakdown. Each of these criteria represents a vital aspect of skin health and integrity in neonates within the Neonatal Intensive Care Unit (NICU).

The NSCS operates on three distinct subscales, each evaluating a specific aspect of neonatal skin condition. The item scores within these subscales range from one to three, where a score of one indicates good skin integrity, and a score of three reflects poor skin integrity. The cumulative scores across these three subscales provide a comprehensive measure of the overall neonatal skin condition, ranging from a minimum score of three, which represents the best possible skin health, to a maximum score of nine, indicating the most compromised skin integrity. The NSCS scoring system offers a clear and systematic approach to assess and quantify neonatal skin health, facilitating healthcare professionals in monitoring and responding to changes in skin condition effectively. A lower score on the NSCS indicates healthier skin, while a higher score prompts attention to potential skin issues, contributing to evidence-based decision-making and optimized care within the NICU.

Procedure:

In the preparatory phase of this research endeavor, an extensive review of literature was undertaken, spanning both historical and contemporary sources. This comprehensive exploration covered a spectrum of aspects related to neonatal iatrogenic skin afflictions within the Neonatal Intensive Care Unit (NICU). The literature review incorporated diverse sources, including books, articles, periodicals, websites, textbooks, scientific journals, and magazines. This exhaustive review aimed to foster a deep understanding of the research problem and facilitate the development of robust study instruments. By delving into a wide range of literature, the researchers gained insights into the intricacies of neonatal skin care, emerging trends, and existing gaps in knowledge, laying a strong foundation for the subsequent phases of the study.

Following the development of study instruments, the validity of these tools was rigorously examined in the second phase. A panel comprising three pediatric nursing specialists and

two pediatric medicine specialists meticulously evaluated the tools. This evaluation focused on aspects such as clarity, relevance, applicability, comprehensiveness, and overall understanding. The insights from this expert jury led to minor adjustments in the tools to enhance their precision and effectiveness. This meticulous validation process ensured that the study instruments were well-designed and aligned with the objectives of the research.

The third phase involved an assessment of the tool's reliability. The internal consistency of the instruments was gauged using the Cronbach alpha coefficient, with a resulting value of 0.781 for nurses' knowledge. This robust coefficient indicated a high level of internal consistency and reliability within the tools, bolstering confidence in their ability to yield accurate and consistent results. Subsequently, a pilot study was conducted on 10% of the total number of nurses in the identified settings before the commencement of the data collection phase. This pilot study served multiple purposes, including evaluating the precision, applicability, and practicality of the research instruments, determining the time required for tool completion, and identifying potential challenges in data collection. The insights gained from the pilot study facilitated necessary adjustments to the research tools, ensuring their optimal functionality. Importantly, participants in the pilot study were excluded from the final study sample, preserving the integrity of the subsequent data collection and analysis phases. Overall, these methodical steps in the preparatory, validation, and pilot phases collectively contributed to the robustness and reliability of the research process.

The fieldwork for this study unfolded through a systematic progression of assessment, planning, implementation, and evaluation phases. In the assessment phase, the researcher initiated contact with each study location, conducted introductory interviews with the participating nurses, and acquired their informed consent. Baseline data were then collected at the Neonatal Intensive Care Unit (NICU), encompassing an evaluation of nurses' knowledge and practices regarding neonatal iatrogenic skin afflictions. This phase spanned three months, from May to July 2023, with data collection tools taking approximately 30 minutes for the self-administered questionnaire and 15 minutes for the observational checklist. Visits to the study

locations occurred three times weekly (Saturday, Tuesday, and Thursday) between 9:00 a.m. and 2:00 p.m.

During the planning phase, an educational program was developed based on a thorough assessment of the nurses' needs in relation to knowledge and practices surrounding neonatal iatrogenic skin afflictions. This program incorporated both theoretical and practical components covering essential aspects of neonatal skin care. Theoretical topics ranged from the definition and anatomical structure of the skin to risk factors for skin breakdown, while practical elements encompassed general preventative measures for various neonatal populations and specific practices for invasive procedures. The researcher evaluated nurses' knowledge and practices during multiple shifts in the NICU, setting the stage for the subsequent implementation of the educational program.

The implementation phase involved introducing the educational program to the nurses in six groups. Each session, lasting 30 to 45 minutes, covered distinct topics through various teaching methods such as lectures, brainstorming, and small group discussions. The sessions were supported by teaching media, including presentations, posters, audiovisual materials, and handouts. Following each session, an informative brochure was distributed to each nurse to reinforce learning. The topics ranged from fundamental aspects of neonatal skin care to specific preventative measures for different neonatal populations and practices related to invasive procedures. The implementation phase was meticulously executed three times a week over a specified time frame.

In the evaluation phase, immediate post-implementation and one-month follow-up assessments were conducted to gauge changes in nurses' knowledge and practices regarding iatrogenic skin afflictions at the NICU. Additionally, neonatal clinical outcomes were evaluated, providing a comprehensive understanding of the impact of the educational program on both nursing practices and neonatal health. This systematic and thorough approach across the four phases ensured a well-rounded and evidence-based exploration of neonatal iatrogenic skin afflictions within the NICU setting.

Ethical considerations:

Ethical considerations were paramount throughout the entirety of this study. Following a comprehensive explanation of the study's purpose, nurses were approached to secure their voluntary participation and explicit consent. In addition to individual consents, official approval was diligently obtained from the hospital administrative authorities in the specified setting, ensuring adherence to institutional regulations and ethical standards. Approval from the ethical committee further validated the study's ethical soundness. Recognizing the importance of confidentiality and privacy, the data collection process was conducted with utmost sensitivity. The researcher underscored the voluntary and anonymous nature of nurses' participation, ensuring that individuals could freely contribute without fear of repercussion. Each participating nurse provided informed consent, affirming their understanding of the study's objectives and their role within it. Emphasizing the paramount importance of the subjects' well-being, the study protocols were designed to prevent any harm to the participants. Additionally, the ethical framework extended to providing professional support and counseling, readily available to participants if needed, underscoring the commitment to the welfare and ethical treatment of the individuals involved in the study.

Statistical design

The statistical design for this study involved a meticulous process of data input, validation, and analysis using the Statistical Package for the Social Sciences (SPSS) program, specifically version 21, with a predetermined significance level of 0.05. The data underwent thorough scrutiny to identify and rectify any missing values before proceeding with the analyses. In terms of descriptive analysis, quantitative data were succinctly summarized using mean and standard deviation, offering a comprehensive overview of the central tendency and variability within the dataset. Categorical data, on the other hand, were presented as frequencies and percentages, providing a clear depiction of the distribution of categorical variables. To assess the participants' descriptive features, the Chi-Square test was

employed, enabling an examination of potential associations or differences among categorical variables.

A key aspect of the statistical design involved evaluating the impact of the educational program on the participants' knowledge and practices. This was accomplished by employing an independent samples t-test to compare the scores before and after the implementation of the program. This statistical test allowed for a rigorous examination of the mean differences in scores, shedding light on the effectiveness of the educational intervention. The choice of statistical tools and methods was guided by the specific objectives of the study, aiming to elucidate both the descriptive characteristics of the participants and the quantitative changes in knowledge and practices resulting from the implemented educational program. Through this systematic statistical design, the study aimed to derive meaningful insights, contributing to the evidence-based understanding of neonatal iatrogenic skin afflictions and the impact of educational interventions on nursing practices within the Neonatal Intensive Care Unit.

Results:

Table 1 presents a comprehensive overview of the socio-demographic characteristics of the studied nurses in the Neonatal Intensive Care Unit (NICU). The majority of participants fell within the age range of 25-32 years, constituting 69.1% of the sample, followed by those aged 18-25 years (33.6%). The mean age was 27.2 years with a standard deviation of 4.4. Gender distribution showed a predominance of female nurses, accounting for 60.0% of the total, while males constituted 40.0%. Regarding education, a significant proportion of nurses held a technical institute degree (49.1%), followed closely by those with a bachelor's degree (43.6%), while a smaller percentage had graduated from nursing school (7.3%). In terms of experience, the majority had less than 10 years of experience (54.5%), with 10-<20 years and 20-<30 years accounting for 40.0% and 5.5%, respectively. A notable finding is that only 5.5% of nurses had received training courses related to skin care. This comprehensive demographic profile provides a foundational understanding of the studied nurses' background, setting the stage for further analysis of their knowledge and practices related to neonatal iatrogenic skin afflictions.

Table 2 . Provides a detailed representation of the socio-demographic characteristics of the studied neonates in the Neonatal Intensive Care Unit (NICU). The majority of neonates fell within the age range of birth to one week, constituting 61.5% of the total, with the remaining 38.5% being older than one week. Gender distribution showed a slightly higher prevalence of male neonates, accounting for 56.4%, while females constituted 43.6%. Regarding diagnoses, the most prevalent conditions were respiratory distress (23.1%), jaundice (41.0%), transient tachypnea (25.6%), and low birth weight (10.3%). Gestationally, a notable portion of neonates were born at less than 37 weeks (12.8%), with the majority born at more than 37 weeks (87.2%). Weight distribution revealed that 76.9% of neonates weighed more than 3000 grams, while 23.1% weighed less. Similarly, the length distribution showed 89.7% of neonates with a length greater than 50 cm, and 10.3% with a length less than 50 cm. The method of feeding was predominantly artificial, constituting 66.7%, while 33.3% were breastfed. In terms of the length of hospital stay, the majority of neonates had a stay of less than a month (74.4%), with 25.6% staying more than a month. This comprehensive overview of neonatal socio-demographics sets the stage for further exploration of their clinical outcomes and the potential impact of nursing practices on neonatal iatrogenic skin afflictions within the NICU.

Table 3 presents a detailed breakdown of the percentage distribution of studied nurses' knowledge regarding neonatal skin afflictions across different phases of the educational program. The assessment was conducted pre-implementation, immediately post-implementation, and during the follow-up after one month. The categories "Unsatisfactory" and "Satisfactory" were used to classify nurses' knowledge based on their performance. Notably, a significant improvement in knowledge was observed in various aspects following the educational program. For instance, in the definition of skin, the percentage of nurses with satisfactory knowledge increased from 23.6% pre-implementation to 76.4% post-implementation and further to 76.4% in the follow-up phase. Similar positive trends were observed in the anatomical structure of the skin, function of the skin, neonatal skin characteristics,

risk factors for breakdown, causes of neonatal skin injury, and neonatal skin management. The overall percentage of nurses with satisfactory knowledge increased from 32.7% pre-implementation to 41.8% post-implementation and further to 58.2% in the follow-up phase. These findings underscore the effectiveness of the educational program in enhancing nurses' knowledge, reflecting positively on their understanding of neonatal skin afflictions in the NICU setting.

Figure 1 illustrates the cumulative scores representing the knowledge of studied nurses regarding neonatal iatrogenic skin afflictions in the Neonatal Intensive Care Unit (NICU). The data reveals a substantial enhancement in knowledge levels, progressing from 65.5% pre-implementation to 81.8% post-implementation and maintaining a noteworthy improvement at 74.6% in the follow-up phase. Statistical analysis indicated a significant difference in nurses' knowledge concerning iatrogenic skin afflictions at the NICU ($P < 0.05$). These findings underscore the impactful and sustained positive effect of the educational program on enhancing nurses' comprehension of neonatal iatrogenic skin afflictions within the NICU context.

Table 4 presents the mean and standard deviation of preventive measures practices related to neonatal iatrogenic skin afflictions at the Neonatal Intensive Care Unit (NICU) across different phases of the educational program, involving pre-test, post-test, and follow-up assessments with a sample size of 55 participants. The data reveals noteworthy improvements in preventive practices throughout the program. Specifically, in various categories such as general preventative measures for neonates of all gestations, babies with infected skin, intravenous lines, intubated babies/NCPAP/Hi Flow gases, use of tape/adhesive dressings, use of monitoring equipment, and the overall total practice, there were statistically significant increases from the pre-test to both post-test and follow-up phases (P -value $< 0.001^{**}$). These findings underscore the effectiveness of the educational program in enhancing nurses' preventive measures practices, demonstrating a sustained positive impact in the follow-up period.

Table 5 presents compelling evidence of the substantial impact of the educational program on

neonatal skin condition, as assessed through the Neonatal Skin Condition Score Scale (NSCS) across distinct phases. The highly statistically significant findings indicate a noteworthy improvement in key aspects such as dryness, erythema, and breakdown/excoriation. The data reveal a remarkable decrease in the percentage of neonates experiencing dryness from 69.2% pre-test to 41.0% post-test and 20.5% in the follow-up phase. Similarly, the prevalence of erythema declined significantly from 79.5% pre-test to 28.2% post-test and 15.4% in the follow-up, underscoring the positive impact of the educational interventions. Moreover, the assessment of breakdown/excoriation demonstrated a significant decrease from 53.8% pre-test to 38.5% post-test and 38.5% in the follow-up phase. These findings collectively highlight the program's effectiveness in enhancing neonatal skin condition, affirming its sustained positive influence in the follow-up period.

Table 6 illuminates the correlation between the knowledge scores and preventive measures practices of studied nurses concerning iatrogenic skin afflictions at the Neonatal Intensive Care Unit (NICU) across distinct phases of the educational program. Initially, a positive but weak correlation was observed between the levels of total practice and total knowledge before the program ($R = 0.187$, $p = 0.165$). However, following the program, this correlation significantly strengthened ($R = 0.356$, $p = 0.000^{*}$), signifying a more robust positive relationship between nurses' knowledge and their preventive practices. This positive correlation persisted one month after the program, with a further increase in strength ($R = 0.382$, $p = 0.006^{*}$). The statistically significant differences underscore the meaningful association between nurses' knowledge levels and their corresponding application in preventive practices, highlighting the program's efficacy in aligning knowledge with practical implementation for the prevention of iatrogenic skin afflictions in the NICU.

Table 7 presents the impact of the educational program on nurses' knowledge and practices regarding neonatal iatrogenic skin afflictions across socio-demographic factors. No significant differences were observed in mean knowledge scores post than pre based on age ($F = 1.369$, $p = 0.263$), education level ($F = 0.587$, $p =$

0.560), or years of experience ($F = 1.369$, $p = 0.263$). However, total practice scores at follow-up than pre showed significant differences based on age ($F = 8.419$, $p = 0.001^*$), education level ($F = 3.000$, $p = 0.058$), and years of experience ($F =$

2.205 , $p = 0.120$). These results underscore the program's varying impact on nurses' practices, emphasizing the need to consider socio-demographic factors in assessing educational interventions.

Table (1): Percentage Distribution of Socio-demographic Characteristics of Studied Nurses at NICU (No=55).

Characteristics	No	%
Age		
▪ 18-25 years	13	33.6
▪ 25-32 years	38	69.1
▪ 33 years or more	4	7.3
Mean_+SD		27.2±4.4
Gender		
▪ Male	22	40.0
▪ female	33	60.0
Level of Education		
▪ Nursing school	4	7.3
▪ Technical Institute	27	49.1
▪ Bachelor degree	24	43.6
Experiences		
▪ <10	30	54.5
▪ 10-<20	22	40.0
▪ 20-< 30	3	5.5
Training courses related skin care.		
▪ Yes	3	5.5
▪ No	52	94.5

Table (2): Percentage Distribution of Socio-demographic Characteristics of Studied Neonates at NICU (No=39)

Characteristics	No	%
Age		
▪ Birth to one week.	24	61.5
▪ More than one week.	15	38.5
Gender		
▪ Male.	22	56.4
▪ Female.	17	43.6
Diagnosis		
▪ Respiratory distress .	9	23.1
▪ Jaundice.	16	41.0
▪ Transnet tachypnea.	10	25.6
▪ Low birth weight.	4	10.3
Gestational age		
▪ Less than 37 weeks .	5	12.8
▪ More than 37 weeks .	34	87.2
Weight		
▪ Less than 3000 grams.	9	23.1
▪ More than 3000 grams.	30	76.9
Length		
▪ Less than 50cm.	4	10.3
▪ More than 50cm.	35	89.7
Method of feeding:		
▪ Breast feeding.	13	33.3
▪ Artificial feeding .	26	66.7
length of hospital stay.		
▪ Less than month.	29	74.4
▪ More than month.	10	25.6

Table (3): Percentage Distribution of Studied Nurses' Knowledge regarding Neonatal Skin Affliction throughout the Educational Program Phases. (No=55)

Studied Nurses' knowledge	Pre				Post Immediately				Follow up after one month			
	Satisfactory		Un Satisfactory		Satisfactory		Un Satisfactory		Satisfactory		Un Satisfactory	
	No	(%)	No	(%)	No	(%)	No	(%)	No	(%)	No	(%)
Definition of skin	23	41.8	32	58.2	18	32.7	37	66.3	13	23.6	42	76.4
Anatomical structure of skin	19	34.5	36	65.5	7	12.7	48	87.3	10	18.2	45	81.8
Function of the skin	30	54.5	25	45.5	16	29.1	39	70.9	21	38.2	34	61.8
Neonatal skin Characteristics	11	20.0	44	80.0	4	7.3	51	92.7	10	18.2	45	81.8
Risk factors for breakdown	16	29.1	39	70.9	8	14.5	47	85.5	13	23.6	42	76.4
Causes of neonatal skin injury	14	25.5	41	74.6	6	10.9	49	89.1	11	20.0	44	80.0
Neonatal skin management.	25	45.5	30	54.5	13	23.6	42	76.4	20	36.3	35	63.7
Total%	19	34.5	36	65.5	10	18.2	45	81.8	14	25.5	41	74.6

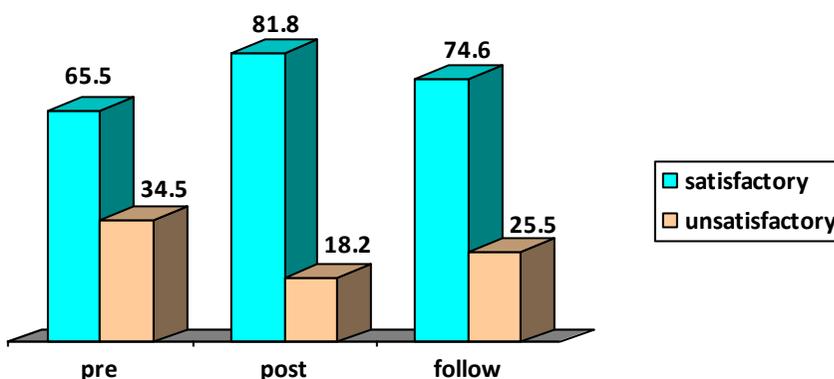


Figure (1): Total Scores of Studied Nurses' Knowledge regarding Neonatal Iatrogenic Skin Afflictions at NICU throughout the Educational Program Phases. (No=55)

Table (4): Mean & Standard Deviation of Preventive Measures Practices regarding Neonatal Iatrogenic Skin Afflictions at NICU throughout the Educational Program Phases. (No=55).

Preventive Measures Practices	Pre test X SD	Post test X SD	FU test X SD	P-value pre vs post	P-value pre vs Flow up
General preventative measures for neonates of all gestations	13.43±3.33	14.59±2.32	14.42±2.45	0.001**	0.001**
Babies with infected skin	2.66±.95	3.36±.81	3.15±.90	0.001**	0.001**
Intravenous lines	2.70±.96	3.22±.92	3.26±.87	0.001**	0.001**
Intubated babies / (NCPAP)/Hi Flow gases	2.61±1.43	3.24±1.03	3.03±1.30	0.001**	0.001**
Use of tape/adhesive dressings	7.84±2.60	9.33±1.68	8.68±2.22	0.001**	0.001**
Use of Monitoring Equipment	2.57±1.43	3.05±1.31	3.01±1.28	0.001**	0.001**
Total practice	31.84±4.85	36.82±3.69	35.57±3.85	0.001**	0.001**

#**= highly statistically significant

Table (5): Percentage Distribution of Neonatal Skin Condition Score Scale throughout the Educational Program Phases (NSCS) (No=39)

Neonatal Skin Condition	Pre test		Follow up		P-value pre vs post
	No	(%)	No	(%)	
Dryness;					0.000**
▪ 0=normal, no sign of a dry skin.	16	41.0	27	69.2	
▪ 1=dry skin, visible scaling	15	38.5	4	10.3	
▪ 2=very dry/cracking/fissures	8	20.5	8	20.5	
Erythema					0.000**
▪ 0=no evidence of erythema	11	28.2	31	79.5	
▪ 1=visible erythema < 50% body surface	22	56.4	2	5.1	
▪ 2=visible erythema > 50% body surface	6	15.4	6	15.4	
Breakdown/excoriation					0.000**
▪ 0=none evident	15	38.5	21	53.8	
▪ 1=small localized areas	9	23.1	15	38.5	
▪ 2=extensive	15	38.5	3	7.7	

#**= highly statistically significant

Table (6): Correlation between Studied Nurses' Knowledge Scores and Preventive measures Practices regarding Iatrogenic Skin Affliction at NICU throughout the Educational Program Phases.

Total Practice level	Total knowledge level	
	R	P
Levels of total practice before program.	0.187	0.165
Levels of total practice immediate after program.	0.356	0.000*
Levels of total practice one month after program.	0.382	0.006*

* Statistically Significant difference at (P<0.05)

Table (7): Relationship between Changes in Mean of Total Nurses' Knowledge and Practice Scores and their socio-demographic data throughout the educational program phases

Socio-demographic data	Total knowledge score (n =55)				Total practice score (n =55)			
	post than pre		follow up than pre		post than pre		follow-up than pre	
	M±SD	P	M±SD	F value P	M±SD	P	Me an±SD	P
Age in years:								
▪ 18-25 years							35.23±4.54	.113
▪ 25-32 years							35.65±3.83	.894
▪ 33 years or more							36.25±3.50	
	Education level:							
▪ Nursing school	9.00±.816	.587	9.50±1.73	3.000	37.00±2.16	.003	35.75±4.27	.120
▪ Health Technical Institute	9.29±1.75	.560	7.18±2.13	0.058	36.88±4.21	0.997	35.33±3.96	.887
▪ Bachelor of nursing	8.70±2.21		8.33±2.27		36.95±3.43		35.87±3.99	
	Years of experience:							
▪ <10	9.00±1.80	1.369	7.43±2.02	2.205	37.36±3.99	0.693	35.63±3.78	.003
▪ 10-<20	9.27±2.09	.263	8.59±2.44	0.120	36.59±3.01	0.504	35.54±3.90	.997
▪ 20-< 30	7.33±1.15		6.66±2.08		35.00±6.08		35.66±7.02	

*Statistically Significant difference at (P<0.05)

Discussion

The neonatal critical care landscape is experiencing a surge in iatrogenic incidents, signaling a growing need for innovation in care delivery. Heightened awareness and the integration of more robust quality control measures have contributed to an increased recognition of issues related to care practices in

this specialized unit (Bohiltea et al., 2023). The duration of hospital stays and the level of prematurity are correlated with a heightened susceptibility to iatrogenic effects, with drug errors representing a significant portion of these incidents. Beyond pharmaceutical mishaps, other iatrogenic complications encompass skin injuries, environmental hazards, prolonged mechanical

ventilation, invasive procedure insertions, nosocomial infections, and the administration of parenteral nutrition (Dinu et al., 2023). Innovations in care protocols are imperative to address and mitigate these challenges in neonatal critical care, ensuring the well-being of the vulnerable population under consideration. Neonatal nurses can safeguard their legal standing and uphold the established standards of care in their field by adhering to recognized internal and external policies (Kain & Mannix, 2022). In light of this, the present study was undertaken to assess the impact of an educational program on iatrogenic skin afflictions, aiming to enhance pediatric nurses' performance and improve clinical outcomes for neonates.

The current study reveals a notable enhancement in the total knowledge scores of the studied nurses immediately and one month after participating in the educational program, compared to their baseline knowledge. This positive outcome aligns with the findings of Zakzouk et al. (2023), where nurses exhibited improved knowledge scores immediately and three months post the educational program. Similarly, in Salah et al.'s (2021) study, nurses' responses on iatrogenic errors showed significant improvement following the intervention program, underscoring the efficacy of educational initiatives. This observed progress is consistent with Mohamed et al.'s (2019) study at Banha Pediatric Hospital, focusing on preventive measures against pressure ulcers, wherein nurses displayed a noteworthy improvement in knowledge post-program implementation. The collective evidence suggests that continuous education plays a pivotal role in enhancing nurses' knowledge, enabling them to stay abreast of advancements in medical practices.

Nursing education places a strong emphasis on preparing nurses for the dynamic future of healthcare, emphasizing the need for a robust theoretical foundation complemented by hands-on clinical experience (Talsma, 2023). In the specific context of neonatal critical care, nurses showcased significant advancements in general neonatal skin care and the prevention of iatrogenic skin injuries, as evidenced by their overall practice evaluations. This positive outcome resonates with the primary objective of the teaching program, which aimed to enhance nurses' proficiency in newborn skin care. The

observed improvement in overall practices aligns with the findings of Zakzouk et al. (2023), demonstrating enhanced practices immediately and three months post the educational program compared to their pre-program practices. This underscores the effectiveness of educational initiatives in fostering positive changes in nursing practices.

The improvement in nurses' overall practices aligns with Yan et al.'s (2021) meta-analysis, which investigated the impact of training initiatives on nurses' competence in treating patients with pressure injuries. Additionally, Salah et al.'s (2021) findings indicated a significant improvement in nurses' practice scores, with nearly half achieving satisfactory ratings compared to before the program. This positive trend persisted both immediately and one month after the program, consistent with the results of Aloisio et al. (2023), where nurses' overall practice scores showed a notable increase following the adoption of practice guidelines. This collective evidence underscores the effectiveness of educational programs in positively influencing nurses' practices and aligns with broader research trends in healthcare training.

The results of the current study revealed a noteworthy and statistically significant correlation between nurses' practice and knowledge following the implementation of the program. This association underscores the importance of integrating theoretical and practical aspects for comprehensive learning and the enhancement of nursing clinical skills. The parallel improvement in both knowledge and practice signifies that advancing nurses' expertise can lead to an overall improvement in their performance. These findings align with the research conducted by Abdu (2019), who also identified a substantial correlation between nurses' knowledge and practices in immediate infant care, emphasizing the interconnectedness of theoretical understanding and practical application in nursing.

Conclusion

The current study successfully demonstrated the efficacy of an educational program in elevating neonatal nurses' knowledge and practices concerning iatrogenic skin afflictions within the Neonatal Intensive Care Unit (NICU).

The results revealed substantial enhancements in both knowledge scores and overall practices immediately post-program and one month later. The observed positive correlation between knowledge and practice underscores the necessity for a comprehensive educational approach that seamlessly integrates theoretical concepts with practical clinical experience. These findings align with existing literature, emphasizing the continual need for education in dynamic and critical care environments such as the NICU.

Looking ahead, ongoing educational initiatives and support are crucial for maintaining and further improving nurses' performance in preventing iatrogenic skin afflictions. Subsequent research endeavors may explore the sustained impact of such educational interventions on neonatal clinical outcomes and assess the durability of improved practices over an extended timeframe. Overall, this study contributes valuable insights into the pivotal role of targeted educational programs in enhancing neonatal nursing care, fostering a culture of continuous learning, and ultimately benefiting the well-being of vulnerable neonates in critical care settings.

Recommendations:

Building upon the findings of the study, several recommendations emerge to further enhance neonatal nursing practices and promote the prevention of iatrogenic skin afflictions in the Neonatal Intensive Care Unit (NICU):

1. **Continuous Education Programs:** Institutions should establish regular and tailored educational programs focused on iatrogenic skin afflictions. These programs should encompass both theoretical knowledge and practical skills, ensuring that nurses remain updated on the latest advancements in neonatal care.
2. **Integration of Best Practices:** NICU policies and procedures should incorporate evidence-based guidelines for preventing iatrogenic skin injuries. These guidelines should be readily accessible to nurses, facilitating their implementation in daily practice.
3. **Regular Skills Assessment:** Periodic assessments of nurses' skills and knowledge in neonatal care, specifically related to skin affliction prevention, should be conducted. This can identify areas for improvement and

guide targeted educational interventions.

4. **Multidisciplinary Collaboration:** Foster collaboration between neonatal nurses, pediatricians, and other healthcare professionals involved in neonatal care. This interdisciplinary approach can enhance communication, share best practices, and collectively work towards minimizing iatrogenic effects.
5. **Clinical Mentorship Programs:** Establish mentorship programs within the NICU to pair experienced nurses with those newer to the field. This mentorship can provide practical insights, guidance, and ongoing support, contributing to the professional development of neonatal nurses.
6. **Quality Improvement Initiatives:** Hospitals and NICUs should implement continuous quality improvement initiatives, regularly reviewing and refining protocols for neonatal care. These initiatives should involve input from frontline healthcare providers, ensuring practicality and feasibility.
7. **Research on Long-Term Outcomes:** Future research should explore the long-term impact of educational programs on neonatal clinical outcomes, including the sustained reduction of iatrogenic skin afflictions. Longitudinal studies can provide insights into the durability of knowledge retention and improved practices.
8. **Patient and Family Education:** Extend education efforts to include parents and families of neonates in the NICU. Providing them with information on neonatal skin care practices can create a collaborative environment and empower families to actively participate in their infants' care.

Practical implications:

The practical implications of this study are significant for both healthcare practitioners and healthcare institutions, particularly those operating in neonatal critical care settings. The demonstrated improvements in nurses' knowledge and practices following the educational program highlight the tangible benefits of targeted interventions in enhancing the quality of neonatal care. Healthcare practitioners, especially neonatal nurses, can leverage the insights gained from this

study to advocate for and actively engage in continuous education opportunities. These opportunities, tailored to address the specific challenges of preventing iatrogenic skin afflictions, can serve as a blueprint for ongoing professional development. Furthermore, the positive correlation between knowledge and practice underscores the importance of a comprehensive and integrated approach to nursing education. Institutions can use these findings to guide the development and refinement of educational curricula, ensuring that they encompass both theoretical knowledge and practical skills relevant to the dynamic nature of neonatal care. The study's outcomes also emphasize the need for healthcare institutions to prioritize and invest in evidence-based protocols and guidelines, fostering a culture of continuous quality improvement in neonatal care practices. Ultimately, the practical implications underscore the potential for improved patient outcomes and a safer healthcare environment for neonates in intensive care units.

Limitations:

Several limitations should be acknowledged in interpreting the findings of this study. Firstly, the quasi-experimental design may limit the establishment of a cause-and-effect relationship between the educational program and the observed improvements, as factors beyond the program may have influenced the outcomes. Additionally, the study was conducted in a single Neonatal Intensive Care Unit (NICU) at Aswan University Hospital, limiting the generalizability of the results to other healthcare settings. The convenient sampling technique used to select participants may introduce selection bias, and the relatively small sample size may impact the study's external validity.

Furthermore, the study relied on self-reported data from nurses, introducing the potential for response bias or socially desirable responses. The duration of the educational program and the follow-up period might be considered short, and longer-term assessments could provide a more comprehensive understanding of the program's sustained impact. While efforts were made to ensure the reliability and validity of the tools, the tools themselves, especially the self-administered questionnaire, may have inherent limitations in capturing the

complexity of nurses' knowledge and practices accurately.

Lastly, the study did not explore the perspectives of neonates or their families, which could have provided valuable insights into the holistic impact of the educational program on neonatal care. Despite these limitations, the study contributes valuable insights into the potential effectiveness of educational programs in enhancing neonatal nurses' knowledge and practices related to iatrogenic skin afflictions.

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