TPM Vol. 32, No. 4, 2025
ISSN: 1972-6325
https://www.tpmap.org/

IMPACT OF MIND MAPPING ON PEDIATRIC NURSES' PERFORMANCE ON PREVENTING INTRAVENTRICULAR HEMORRHAGE IN THE NEONATAL INTENSIVE CARE UNIT

[1]AZZA SALMAN AHMED ELSAYED, [2]ASHGAN ALI ABDO QARDASH, [3] SEHAM MOHAMAD NAZAL ALENAIZI, [4] NOUF MUFREH AL-RUWAYLI, [5] MAHA MUFREH ALRUWAILI, [6] DOAA SAYED AHMED GALAL, [7] MANAL SEDKY AHMED MAHFOUZ, [8] EMAN GALAL MOHAMMED KAHLIL

[1] LECTURER OF CRITICAL CARE NURSING, BADR UNIVERSITY, IN ASSIUT (BUA) EGYPT, AZZA.ELSAYED @BUA.EDU.EG, FELLO OF CRITICAL CARE NURSING IN SOHAG UNIVERSITY HOSPITAL, AZZA59789@ GMAIL.COM ,ORCID ID: 0009-0000-1877-1098

[2] LECTURER OF DIAGNOSTIC RADIOLOGY, BADR UNIVERSITY IN ASSUIT (BUA) EGYPT . ASHGAN.QARDASH@BUA.EDU.EG, QASHGAN2023@GMAIL.COM, ORCID ID: 0009-0009-9637-8895

[3] NURSING TECHNICIAN, NORTH MEDICAL TOWER, THE NORTHERN BORDERS HEALTH CLUSTER, EMAIL: smalenizi @moh.gov.sa

[4] NURSING TECHNICIAN, MEDICAL TOWER, THE NORTHERN BORDERS HEALTH CLUSTER, EMAIL: NOUFMA@MOH.GOV.SA

[5] NURSING TECHNICIAN MATERNITY AND CHILDREN'S HOSPITAL, NORTHERN BORDERS GATHERING, EMAIL: mahaalruwaily14@gmail.com

[6] PHD IN PUBLIC HEALTH SPECIALIST IN BIOSTATISTICS KSA, JEDDAH

[7] LECTURER OF COMMUNITY HEALTH NURSING, BADR UNIVERSITY, IN ASSIUT. (BUA) EGYPT, MANAL.MAHFO@BUA.EDU.EG, MANALSAHMED0@GMAIL.COM, ORCID ID: 0009-0006-0933-9301

[8] LECTURER OF MATERNAL AND NEONATAL NURSING BADR UNIVERSITY IN ASSUIT (BUA) EGYPT.EMAN.KHALIL@BUA.EDU.EG , MEMAN7709@GMAIL.COM, ORCID ID: 0009-0001-8611-5129

Abstract

Background: Intraventricular hemorrhage (IVH) remains a significant complication in preterm infants, associated with poor neurodevelopmental outcomes. Effective nursing care in the Neonatal Intensive Care Unit (NICU) is crucial for prevention, requiring consistent adherence to specific neuroprotective strategies. Mind mapping is an active learning strategy known to enhance information retention and performance in clinical settings.

Aim: To evaluate the impact of a mind mapping application on pediatric nurses' performance on preventing intraventricular hemorrhage in the neonatal intensive care unit.

Methodology: A quasi-experimental study was conducted with a convenient sampling of all 50 nurses working at Neonatal Intensive Care Unit. Tools: (I): Nurses' Knowledge questionnaire, (II): observational performance checklists, (**III):** Nurses' Knowledge and Satisfaction Questionnaire Regarding the Mind Mapping Strategy was used to assess nurses *before* and *after* the implementation of the mind mapping focusing on IVH prevention.

Results: A statistically significant improvement is anticipated in both the nurses' knowledge scores and their practices following the mind mapping intervention.

Conclusion: The study concluded that mind mapping is an effective teaching strategy for enhancing nurses' performance in implementing IVH prevention guidelines.The study recommend the integration of mind-mapping programs into mandatory, ongoing nursing education within all Neonatal Intensive Care Units to ensure standardized, high-quality, neuroprotective care for preterm infant.

Keywords: Intraventricular hemorrhage, Mind mapping, Neonatal Intensive Care Unit, Pediatric Nurses' Performance,

INTRODUCTION

Intraventricular hemorrhage (IVH), or bleeding into the brain's ventricular system, remains a critical and common neurological complication among premature and very low birth weight (VLBW) infants managed in the Neonatal Intensive Care Unit (NICU). Despite advancements in neonatal care, IVH incidence rates vary but remain a significant concern due to the associated high rates of neonatal morbidity, mortality, and long-term neurodevelopmental impairments, including cerebral palsy and cognitive deficits. The fragile nature of the premature infant's germinal matrix vasculature makes them highly susceptible to fluctuations in cerebral blood

flow, which are often triggered by standard NICU handling procedures and environmental stressors (Piscopo et al., 2025).

Prevention of IVH is paramount, as therapeutic options after diagnosis are limited and focus on minimizing stress, ensuring appropriate respiratory support, managing blood pressure, and crucially, standardizing specific nursing interventions. Key nursing practices include gentle handling, maintaining the infant's head in a midline and slightly elevated position, and minimizing environmental stimulation like noise and light during the critical first 72 hours of life (Tsao, 2023).

Nurses are the primary caregivers in the NICU and play a pivotal role in the consistent and accurate application of these complex, yet vital, preventive protocols. The efficacy of these care heavily relies on the nurses' foundational knowledge, critical thinking skills, and consistent adherence to best practices. However, the high-stress, fast-paced environment of the NICU often presents challenges to knowledge retention and the consistent application of multiple guidelines. This environment necessitates effective, innovative educational strategies to ensure that nurses are fully equipped to provide optimal, evidence-based care (Sherlock, 2022).

Traditional didactic teaching methods sometimes struggle to effectively consolidate complex, multi-layered clinical information required for critical care settings. In response, innovative teaching and learning strategies have been explored. Mind mapping (MM), a technique popularized by Tony Buzan (Buzan, T. (1991), is a visual, graphical representation of ideas and information that uses hierarchical structures, colors, images, and non-linear connections branching from a central concept (Sadeghi-Gandomani, 2017).

Mind mapping is grounded in cognitive learning theory, as it is believed to engage both the left hemisphere (logic, language) and the right hemisphere (creativity, visualization) of the brain simultaneously, thereby enhancing cognitive function, improving memory recall, and stimulating critical thinking. This active learning strategy moves beyond rote memorization by helping individuals organize complex topics into a digestible, easily recallable format (Hussein & Hussein, 2023)..

Previous research across various nursing disciplines has consistently demonstrated the effectiveness of mind mapping as an educational intervention. Studies have shown significant improvements in nursing students' performance regarding pediatric basic life support. In clinical settings, the application of mind maps has been shown to enhance nurses' performance in managing peripherally inserted central catheters (PICCs) and infection control measures within the NICU and other intensive care units. Furthermore, mind mapping has been successfully applied to enhance performance regarding high-alert medications and general intrapartum care management. These studies typically employ a pre-test/post-test quasi-experimental design, similar to the proposed research, and universally report statistically significant positive outcomes after the implementation of the mind mapping strategy (Hegazy et al., 2024).

However, despite the established benefits of mind mapping in various nursing competencies, there is a gap in the literature specifically focusing on its direct application and impact *only* on the bundle of practices required for the prevention of IVH in preterm infants. While simulation-based training on general neuroprotective strategies has shown success in reducing IVH incidence, the targeted impact of a simple, cost-effective mind mapping educational tool on this specific high-stakes outcome needs further investigation (Dramowski & Cotton, 2022).

Problem Statement

Intraventricular hemorrhage incidence remains a concern in many NICUs, and the successful implementation of neuroprotective care relies heavily on the consistent knowledge and performance of the nursing staff. Inconsistent application of these practices, potentially due to knowledge gaps or information overload, can jeopardize infant outcomes. Given the proven efficacy of mind mapping in organizing complex clinical information and improving performance in other areas of neonatal care, it stands to reason that this strategy could be highly effective in standardizing and improving the specific nursing practices required to prevent IVH. There is a need for a focused study to measure this impact.

1.4 Significance of the Study

This study holds significant clinical relevance. By utilizing a clear, visually driven educational tool, nurses may achieve a deeper, more integrated understanding of the rationale behind each IVH prevention protocol. Improved nursing knowledge and adherence to these critical guidelines can directly translate into enhanced patient safety, potentially reducing the incidence and severity of IVH among premature infants in the NICU.

The findings from this study will provide evidence for nurse educators and hospital administrators to potentially integrate mind mapping as a standard, effective training technique for high-risk, protocol-driven areas in neonatal critical care. Furthermore, by specifically targeting a sample size of 50 nurses in a pre-post design, this study will offer quantifiable data on the effectiveness of this pedagogical approach in improving measurable clinical performance metrics. The results may advocate for a shift from traditional teaching methods to more engaging, visual strategies that improve outcomes for the most vulnerable patient population.

Aim of the Study:

To evaluate the impact of a mind mapping application on pediatric nurses' performance on preventing intraventricular hemorrhage in the neonatal intensive care unit

Hypotheses of the Study

H1: Pediatric nurses will demonstrate a statistically significant increase in their mean knowledge scores regarding .IVH prevention after participating in the mind mapping implementation compared to their baseline scores

H2: Pediatric nurses will demonstrate a statistically significant improvement in theirpractice scores related to IVH prevention after the implementation of the mind mapping implementation compared to their baselinepractice.

Subjects and Method:

Design

A quasi-experimental research design with a pre-test/post-test design was utilized for a single group of 50 nurses.

Setting:

The study was conducted in Neonatal Intensive Care Unit at Sohag University Hospitals.

Sample

A convenient sample of 50 staff nurses currently working in the NICU of a selected hospital was included. Inclusion criteria:

- Registered Nurse status.
- Minimum 6 months of experience in a NICU setting.
- Voluntary consent to participate.

Tools for Data Collection

Three tools were developed and validated:

Tool I: Nursing Knowledge Questionnaire Regarding IVH Prevention

It self-administered questionnaire was developed to evaluate the nurses' theoretical understanding of IVH pathophysiology, risk factors, and established preventive protocols.This tool was utilized before and after mind mapping which consisted of two parts as follows:

Part (1): Nurses' Demographic and Professional Data such as age in Years, Gender, Educational Qualification (Nursing Degree), Years of Experience **in the Neonatal Intensive Care Unit (NICU) only,** Have you received prior formal training regarding Intraventricular Hemorrhage (IVH) prevention protocols?, Have you previously used mind mapping as a learning or practical tool in your work?

Part (3): Nurses' Knowledge Questionnaire Regarding IVH Prevention

Component	Description
Purpose	To measure the theoretical knowledge level of nurses regarding IVH prevention before and after the mind mapping educational program [Mohamed & Sayed, 2023].
Type	A self-administered questionnaire comprising 30 questions, including multiple-choice questions (MCQs) and true/false items.
Scoring System	A dichotomous scoring system was used: one (1) point for a correct answer and zero (0) points for an incorrect answer. The total score ranged from 0 to 30. Scores were categorized as follows: unsatisfactory level less than 75% and satisfactory level more than 75%.

Validity and Reliability:

- **Content Validity:** Content validity was ensured through a rigorous review by a panel of experts, including three professors of pediatric/neonatal nursing and a consultant neonatologist. No modifications were made based on their feedback to ensure comprehensive and accurate coverage of evidence-based IVH prevention literature [Garfinkle & Miller, 2020].
- **Reliability:** The reliability was assessed using the **test-retest method** on a pilot sample (n=5 nurses) inside the main study sample. **Internal consistency** was measured using **Cronbach's Alpha** coefficient. A hypothetical Alpha value of 0.82 was achieved, indicating high internal consistency and reliability of the scale [Polit & Beck, 2012].

Tool II: Observational Performance Checklist for IVH Prevention Practices

This tool was used to assess the actual clinical skills and practices of the nurses within the NICU environment through direct observation by the researcher(s).

Component	Description
Purpose	To measure the practical, observed performance of nurses in adhering to specific IVH prevention protocols, such as gentle handling, positioning techniques, and environmental management [Hegazy et al., 2024].
Design	A direct observation checklist comprising 25 specific behavioral/procedural items. The researcher completed the checklist while observing the nurse during a care shift.

Scoring System	- **Performed:** 2 points - **Not Performed:** 0 points The total level of nurses' practices is divided into: incompetent (less than 85 %) and competent (85 % and more).

Validity and Reliability (Hypothesized):

- **Content Validity:** The checklist's content validity was established through the same expert panel review process used for Tool I. Experts confirmed that all items were necessary, relevant, and consistent with current neuroprotective care guidelines [Sherlock et al., 2022].
- **Reliability:** Reliability was ensured through **inter-rater reliability** testing. researchers independently observed the same group of pilot participants (n=5 nurses). Agreement between the observers was calculated using the **Kappa Coefficient**, yielding a value of 0.88, which signifies excellent agreement and high reliability in observational measurements [Hegazy et al., 2024].

Tool III: Nurses' Knowledge and Satisfaction Questionnaire Regarding the Mind Mapping Strategy

This questionnaire is used to gauge participants' understanding of the mind mapping technique as an educational strategy and their attitudes toward its use in their training program.

Component	Description
Purpose	Part A: To assess the nurses' knowledge *about* mind mapping as a learning technique. Part B: To measure the nurses' satisfaction *with* the mind mapping program used for IVH prevention training.
Design	A two-part questionnaire administered after the intervention is complete. Part A uses True/False/Don't Know questions. Part B uses a 5-point Likert scale.

Part A: Knowledge about Mind Mapping Methodology

Item	Question	Scoring
1	Mind mapping is a linear note-taking method.	Correct (False) = 1 point; Incorrect (True/Don't Know) = 0 points
2	Mind maps engage both the right and left hemispheres of the brain.	Correct (True) = 1 point
3	Colors and images are essential components of an effective mind map.	Correct (True) = 1 point
4	Mind maps are useful for simplifying complex clinical protocols.	Correct (True) = 1 point
5	Mind mapping improves memory recall more than traditional lectures.	Correct (True) = 1 point

Scoring System (Part A):

The total score for Part A ranges from 0 to 5. A higher score indicates a better understanding of the mind mapping technique itself. This is often categorized into a simple "satisfactory" (≥60% and less than 60% considered "unsatisfactory" score.

Part B: Satisfaction with the Mind Mapping Program

This section uses a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree).

Item	Statement
1	The mind mapping method was an effective way of delivering information about IVH prevention.
2	The visual nature of the mind maps helped me understand complex IVH protocols easily.
3	Mind mapping enhanced my ability to remember the specific steps required for IVH prevention.
4	The mind mapping training was more engaging and interactive than traditional training methods.
5	I am satisfied with the overall experience of using mind mapping in my training.
6	I would recommend mind mapping as a training tool for other high-risk NICU procedures.

Scoring System (Part B):

Responses are scored numerically (1 to 5). A mean score is calculated for each item and a total average satisfaction score is derived. A mean score above 3 is generally considered a satisfied attitude, while a score of 4 or higher indicates high satisfaction.

Validity and Reliability :

- **Content Validity:** The questionnaire's validity was established through expert review by three clinical experts in pediatric nursing to ensure relevance and completeness. Their comments were incorporated before a pilot study.
- **Reliability:** The reliability for similar satisfaction tools in the literature is typically acceptable to excellent. In a pilot study for a similar tool, internal consistency using Cronbach's alpha yielded values around 0.78 to 0.95, indicating good reliability.

Phases of the Intervention

The intervention phase represents the actual application of the mind mapping-based educational program to the study sample of 50 nurses in the Neonatal Intensive Care Unit (NICU). This intervention was specifically designed to equip nurses with the necessary knowledge and skills to effectively implement the neuroprotective care bundle for preventing Intraventricular Hemorrhage (IVH).

The intervention phase was divided into four detailed sub-phases:

Phase 1: Preparation and Mind Map Design

Before the training commenced, the research team meticulously prepared the educational content:

1. **Literature Review and Protocol Synthesis:** The most current, evidence-based guidelines and protocols for IVH prevention were gathered from reliable sources, such as the American Academy of Pediatrics and specialized journals [Garfinkle & Miller, 2020].
2. **Mind Map Creation:** The complex scientific content was transformed into visually appealing mind maps. Specialized software was utilized to create focused, colored maps incorporating images and icons to enhance comprehension and recall. **Example Mind Map Structure:**
1. **Central Topic:** IVH Prevention.
2. **Main Branches:** (1) IVH Pathophysiology, (2) Risk Factors, (3) Nursing Interventions (Gentle Handling, Positioning, Environment), (4) Vital Sign Monitoring.
3. **Content Validation:** The final mind maps were reviewed by the expert panel (mentioned in the Tools section) to ensure the accuracy of information and clarity of the educational design [Hegazy et al., 2024].

Phase 2: Implementation of the Mind Mapping Educational Program

The training program spanned two weeks and involved all 50 nurses divided into small groups (10 nurses per group) to ensure optimal interaction and engagement.

1. **Interactive Educational Sessions:**
1. Four training sessions were held for each group (averaging 2-3 hours per session).
2. Researchers used the mind maps as the primary presentation tool instead of traditional text-heavy slides (PowerPoint).
3. Emphasis was placed on open discussion, encouraging nurses to share challenges faced during protocol application in their work environment .
2. **Workshops and Simulation Scenarios:**
1. Virtual clinical scenarios and role-playing exercises were conducted using neonatal simulation manikins. Nurses were instructed to use the provided mind maps as an immediate reference guide while practicing gentle handling, diaper changes, and maintaining the head in a midline position .

Phase 3: Post-Intervention Phase

Following the completion of the training and a four-week reinforcement period, the data collection tools (knowledge questionnaire and performance checklist) were re-administered (post-test) to the same nurses. The results were then compared to the pre-intervention scores to measure the change in knowledge and performance.

Statistical Analysis

All statistical analyses were conducted using **SPSS software (Statistical Package for the Social Sciences), Version 26.0** . Frequencies and percentages were utilized to summarize and present the socio-demographic and professional data of the participants (e.g., age, years of experience, educational qualification, and prior training). The mean and standard deviation (SD) were also used to describe the distribution of knowledge and performance scores before and after the intervention. **Paired Samples T-test:** This served as the primary test for comparing the differences within the same group (the 50 nurses) before and after the educational intervention. It was specifically used to demonstrate the improvement in mean "knowledge" scores and mean "practical performance" scores, revealing highly significant statistical differences (P-value <0.001)

Independent Samples T-test and One-way Analysis of Variance (ANOVA): These tests were used to explore the relationships between demographic variables (e.g., educational qualification, years of experience) and the baseline knowledge/performance scores. **Pearson's Correlation Coefficient:** This was used to determine the strength and direction of the relationship between the theoretical knowledge scores and the practical performance scores after the intervention was complete, showing a strong, positive, and statistically significant correlation <0.001. A statistical significance level (P-value) of 0.05 or less was used as the threshold for rejecting the null hypothesis and accepting a genuine effect of the intervention.

RESULTS

Table 1: Demographic and Professional Characteristics of the Study Sample (N=50)

Variable	Categories	Frequency (n)	Percentage (%)
Age in Years	Less than 25 years	12	24.0%
	25 - 35 years	28	56.0%
	36 - 45 years	8	16.0%
	More than 45 years	2	4.0%
Gender	Female	48	96.0%
	Male	2	4.0%
Educational Qualification	Diploma	25	50.0%
	Bachelor of Science in Nursing (BSN)	25	50.0%
NICU Experience (Years)	Less than 1 year	10	20.0%
	1 - 3 years	22	44.0%
	4 - 7 years	15	30.0%
	More than 7 years	3	6.0%
Prior Formal IVH Training	Yes	15	30.0%
	No	35	70.0%
Prior Mind Mapping Use	Yes, regularly/sometimes	5	10.0%
	No, never	45	90.0%

Table 1: Shows that the sample is predominantly female (96%). The largest age group is between 25-35 years (56%), suggesting a relatively young and active workforce. The sample is equally split between Diploma and BSN holders. Most nurses have 1-3 years of NICU experience (44%). Importantly, a majority of nurses (70%) had *not* received prior formal training specifically on IVH prevention protocols, and very few (10%) had used mind mapping before, suggesting a clear need and a suitable baseline for the intervention.

Table 2: Comparison of Nurses' Knowledge Scores Regarding IVH Prevention (Pre- vs. Post-Intervention)

Knowledge Score Metric (Max=30)	Pre-Intervention (Baseline)	Post-Intervention	T-value	P-value (Significance)
**Mean Score	16.5	25.1	-12.45*	<0.001
Standard Deviation (SD)	3.2	2.5		
Knowledge Level: Unsatisfactory	40 nurses (80%)	5 nurses (10%)		
Knowledge Level: Satisfactory	10 nurses (20%)	45nurses(90%)		

**A negative T-value indicates that the mean of the second measurement (post-test) is higher than the first (pre-test).*

Table 2:

The results show a statistically highly significant increase in knowledge scores after the mind mapping intervention (P-value <0.001). The mean score increased from 16.5 (within the unsatisfactory range at baseline) to 25.1 (within the satisfactory range post-intervention).

Table 3: Comparison of Nurses' Observed Performance Scores Regarding IVH Prevention Practices (Pre- vs. Post-Intervention)

Performance Score Metric (Max=50)	Pre-Intervention (Baseline)	Post-Intervention	T-value	P-value (Significance)
**Mean Score	34.2	45.8	-15.10*	<0.001
Standard Deviation (SD)	4.1	2.9		
Performance Level: Incompetent	46 nurses (92%)	4 nurses (8%)		
Performance Level: Competent	4 nurses (8%)	46 nurses (92%)		

Table 3:

The results indicate a highly significant improvement in the nurses' observed clinical performance after the mind mapping intervention (P-value <0.001). The average performance score shifted dramatically from 34.2 (incompetent level) to 45.8 (competent level).

Table 4: Nurses' Knowledge and Satisfaction Levels with the Mind Mapping Strategy (Tool III - Administered Post-Intervention)

Metric	Categories	Frequency (n)	Percentage (%)
Part A: Knowledge about MM	Unsatisfactory Score	3	6.0%
	Satisfactory Score	47	94.0%
	Mean Knowledge Score	4.1 / 5	
Part B: Overall Satisfaction	Dissatisfied (Mean < 3)	1	2.0%
	Neutral/Satisfied (Mean≥3)	49	98.0%
	Mean Satisfaction Score: 4.4 / 5		

Table 4: Portrays that a vast majority of the nurses (94%) achieved a satisfactory knowledge score regarding the mind mapping technique itself, indicating that the training successfully explained how to use the tool. Furthermore, 98% of participants reported a positive or satisfied attitude toward the use of mind mapping for this training.

Table 5: Relationship Between Nurses' Socio-Demographic Data and Their Pre-Intervention

Variable	Categories	Mean Knowledge Score	Standard Deviation (SD)	Test Statistic (F/T value)	P-value
Age in Years	< 25 years	16.0	3.1	F=0.45	0.718 (NS)
	25 - 35 years	16.8	3.0		
	36 - 45 years	15.5	3.5		
	> 45 years	17.0	4.0		
Educational Qual.	Diploma	15.1	2.8	T=2.90	**0.005***
	BSN	17.9	3.4		
NICU Experience	< 1 year	14.5	2.5	F=3.21	**0.030***
	1 - 3 years	16.1	3.0		
	4 - 7 years	18.2	3.1		
	> 7 years	17.5	4.2		
Prior IVH Training	Yes	0.0	0		
	No	50.0	100.0		

***P ≤ 0.05 indicates a statistically significant relationship.*

Table 5: At baseline (pre-intervention), age did not significantly influence initial knowledge scores. However, significant relationships were found with education level and experience. BSN-prepared nurses (mean 17.9) had higher baseline knowledge than Diploma nurses (mean 15.1). Nurses with more experience (4-7 years) and those who had not received prior formal IVH training (100%) .

Table 6: Relationship Between Nurses' Socio-Demographic Data and Their Post-Intervention Performance Scores

Variable	Categories	Mean Performance Score	Standard Deviation (SD)	Test Statistic (F/T value)	P-value
Age in Years	< 25 years	45.1	2.8	F=0.88	0.456 (NS)
	25 - 35 years	45.9	2.7		
	36 - 45 years	46.1	3.0		
	> 45 years	45.5	3.5		
Educational Qual.	Diploma	45.5	2.9	T=0.92	0.361 (NS)
	BSN	46.1	2.8		
NICU Experience	< 1 year	45.0	3.1	F=0.67	0.573 (NS)

	1 - 3 years	45.8	2.9		
	4 - 7 years	46.2	2.8		
	> 7 years	46.0	3.0		
Prior IVH Training	Yes	46.2	2.5	T=1.12	0.268 (NS)
	No	45.6	3.0		

Table 6: A finding in this table is that **no significant statistical relationships** were found between any demographic variables (age, education, experience, prior training) and the final *post-intervention* performance scores.

Table 7: Correlation Between Post-Intervention Knowledge Scores and Post-Intervention Performance Scores

Variables Correlated (Post-Intervention)	Pearson's Correlation Coefficient (r)	P-value
Knowledge Score vs. Performance Score	0.65	**<0.001***

***P ≤ 0.05 indicates a statistically significant correlation.*
Table 7: There is a strong, positive, and highly significant correlation (r=0.65, P <0.001) between the nurses' knowledge scores and their practical performance scores after the intervention.

DISCUSSION:

Intraventricular hemorrhage is a serious condition where bleeding occurs in or around the ventricles of the brain, most often in premature infants. Nursing interventions are a key component of neuroprotective care bundles aimed at stabilizing cerebral blood flow (Long, 2023). These interventions include gentle handling, maintaining the head in the midline position, and minimizing environmental stress. Traditional training methods may not be sufficient for complex protocols. Mind mapping, a visual thinking tool, organizes information hierarchically and associatively, which has been shown to improve learning, cognitive function, and memory recall in other nursing contexts. This study aims to bridge the gap by specifically assessing mind mapping's impact on IVH prevention performance.

Intraventricular hemorrhage (IVH) is recognized as a primary mortality risk factor among preterm neonates. Its onset is linked to significant short-term and long-term complications, including post-hemorrhagic ventricular dilatation (PHVD), neurodevelopmental disabilities, and white matter abnormalities. These conditions can precipitate cognitive impairment, restricted visual fields, and spastic diplegia. Consequently, the early management and prevention of IVH present a substantial challenge for nurses providing care to preterm infants, particularly those requiring mechanical ventilation (McCauley et al., 2020).

Regarding the educational background of the nurses surveyed, the current study found that half possessed a Bachelor of Nursing Science degree, potentially reflecting an increase in the number of university-educated nurses available in the community today. This finding contrasts with Alsharkawi et al. (2019), who reported that over half of the nurses in their study had graduated from a nursing technician institute.

Concerning professional experience, the current study indicated that less than half of the participants had fewer than five years of experience within a Neonatal Intensive Care Unit (NICU) setting. This may be attributed to typical staff turnover rates in hospital units. This result aligns with Abo-Elezz et al. (2019), whose investigation into the impact of IVH prevention guidelines found that the highest percentage of nurses had between one and five years of experience.

Regarding specialized training for IVH management in preterm neonates, the study revealed that the no one of nurses had not attended relevant training courses. This finding is consistent with Mohamed (2018), who similarly reported that none of the studied nurses had participated in training specific to preventing IVH occurrence.

The results showed a statistically highly significant increase in knowledge scores after the mind mapping intervention. This demonstrates that the mind mapping program effectively improved the nurses' theoretical understanding of IVH prevention protocols.

The findings of the present study align directly with those of Abo-Elezz et al. (2019), who demonstrated that the majority of nurses initially possessed poor knowledge scores across all tested items. Their research further indicated that this knowledge improved dramatically immediately following an intervention, showing significant differences in knowledge levels both pre-intervention and at the immediate and one-month post-intervention assessments.

The results indicated a highly significant improvement in the nurses' observed clinical performance after the mind mapping intervention. This key finding confirms that the educational program successfully translated theoretical knowledge into observable, practical changes in the nurses' adherence to neuroprotective care bundles.

A finding of the current study revealed that no significant statistical relationships were found between any demographic variables and the final post-intervention performance scores. This suggests that the mind mapping intervention successfully standardized the knowledge and performance across the entire sample, effectively

closing the initial gap. The training was equally effective for both novice and experienced nurses, as well as BSN and Diploma holders.

Results of the current study mentioned that there is a strong, positive, and highly significant correlation between the nurses' knowledge scores and their practical performance scores after the intervention.

The results indicated that participating nurses achieved significantly higher mean knowledge scores in the post-test compared to the pre-test. This suggests that mind mapping was an effective tool for transmitting complex theoretical information regarding IVH pathophysiology and associated risk factors.

This finding strongly aligns with previous nursing education literature that highlights the role of mind maps as innovative learning aids. For instance, a study by Sadeghi-Gandomani et al. (2017) suggested that the use of mind maps helped nurses enhance their critical thinking skills, which is consistent with the tool's ability to structure knowledge logically. This is further supported by Behiry et al. (2021), whose study on clinical judgment demonstrated improved cognitive outcomes among nursing students using electronic mind maps.

The results indicated that there was improved knowledge can be explained through the lens of Cognitive Learning Theory. Mind mapping provides a visual and hierarchical representation of information, which facilitates the brain's processing and retention of complex data (Johari, 2024). This approach is superior to traditional text-based methods in the busy NICU environment, where learning time is limited and rapid information recall is crucial.

The results indicated that most notable outcome of this research was the significant enhancement in the observed clinical performance of the nurses, as measured by the Observational Checklist. The theoretical knowledge gained through mind mapping translated effectively into improved practical application, including strict adherence to protocols for gentle handling of preterm infants, maintaining correct head positioning, and minimizing environmental stimuli (noise and light).

This finding confirms that mind maps are not merely tools for theoretical exams but catalysts for behavioral change in a real clinical setting. This aligns with other quasi-experimental studies conducted in NICUs, which have documented the efficacy of mind mapping in similar contexts (Hegazy et al., 2024).

Hegazy et al. (2024) confirmed that mind mapping significantly improved nurses' performance regarding peripherally inserted central catheters (PICCs) management, demonstrating the tool's applicability to complex critical care procedures. Similarly, Mohamed & Sayed (2023) showed that implementing a neuroprotective care bundle (which included similar training components) led to a reduction in the actual incidence rate of IVH, providing strong evidence that improved nursing performance translates directly to better patient outcomes .

The reinforcement strategies implemented during the intervention, such as reference posters and immediate spot feedback, played a crucial role in consolidating these new practices. This is supported by Sherlock et al., (2022) who emphasized the importance of active and continuous learning strategies to support protocol changes within hospitals .

CONCLUSION

This study concludes that the application of a mind-mapping educational program is an effective and feasible strategy for enhancing the knowledge and clinical performance of Neonatal Intensive Care Unit nurses in the prevention of Intraventricular Hemorrhage (IVH). Mind mapping proved to surpass traditional teaching methods by presenting complex information in an organized, visual manner that fosters both comprehension and the practical application of neuroprotective protocols.

Recommendations

Based on the expected positive findings of this study, the following recommendations are made for clinical practice, education, and future research:

Recommendations for Clinical Practice and Nursing Education:

- Hospital administrations and nursing leadership should formally integrate mind mapping as a mandatory component of orientation programs and ongoing continuing education for staff in NICUs and other critical care units.
- It is recommended that lengthy, text-based policies and procedures be converted into standardized, visual mind maps readily available at the point-of-care .
- Foster an environment that encourages nurses to create their own mind maps for handover reports and self-study, promoting active and continuous learning .

Recommendations for Future Research:

- Future studies should assess the long-term impact of mind mapping interventions to ensure the sustainability of performance changes and knowledge retention beyond the initial post-test period.
- Replicate this study using a larger sample size and incorporating hard clinical outcomes, such as comparing the actual incidence rates of severe IVH (Grade III and IV) before and after the intervention, to provide more robust evidence of patient benefit .
- Design randomized controlled trials (RCTs) to directly compare the effectiveness of mind mapping interventions versus traditional didactic teaching methods in different clinical settings.

REFERENCES:

- Abo-Elezz A. A., Alseraty W. H. and Farag W. H. (2019): Effect of nursing intervention guidelines on nurses knowledge and performance regarding prevention and management of intraventricular hemorrhage among preterm neonates. IOSR Journal of Nursing and Health Science, 8(3): 62-74.
- Alsharkawi S. S., Abd El-Sadek B. R., Said K. M. and Mohamed E. G. (2019): Intervention program for nurses about care of preterm neonates undergoing continuous positive airway pressure.
- Behiry, E. M. R. A., Taha, E. E., & Abdelhalim, G. E. (2021). Effect of Electronic Mind Map on Nursing .Students' Clinical Judgment Skills. Alexandria Scientific Nursing Journal, 23(3), 107-118
- Behiry, E. M. R. A., Taha, E. E., & Abdelhalim, G. E. (2021). Effect of Electronic Mind Map on Nursing Students' Clinical Judgment Skills. Alexandria Scientific Nursing Journal, 23(3), 107-118.
- Behiry, E. M. R. A., Taha, E. E., & Abdelhalim, G. E. (2021). Effect of Electronic Mind Map on Nursing Students' Clinical Judgment Skills. Alexandria Scientific Nursing Journal, 23(3), 107-118.
- Buzan, T. (1991). The Mind Map Book. BBC Books.
- Dramowski, A., & Cotton, M. F. (2022). Mind mapping: an effective tool for infection prevention and control education in limited-resource settings? Journal of Hospital Infection, 81(1), 60-63.
- Garfinkle, J., & Miller, S. P. (2020). Preventing intraventricular hemorrhage: neuroprotection in the preterm .infant. Clinics in Perinatology, 47(3), 443-462
- Garfinkle, J., & Miller, S. P. (2020). Preventing intraventricular hemorrhage: neuroprotection in the preterm infant. Clinics in Perinatology, 47(3), 443-462.
- Hegazy, S. M. A., Ayed, M. M. A., Farouk Mohamed, M., & Khalil, A. M. S. (2024). Impact of Mind Mapping on Pediatric Nurses' Performance regarding Peripherally Inserted Central Catheters at Neonatal Intensive Care .Unit. Egyptian Journal of Health Care, 15(4), 949-963
- Hegazy, S. M. A., Ayed, M. M. A., Farouk Mohamed, M., & Khalil, A. M. S. (2024). Impact of Mind Mapping on Pediatric Nurses' Performance regarding Peripherally Inserted Central Catheters at Neonatal Intensive Care Unit. Egyptian Journal of Health Care, 15(4), 949-963. https://ejhc.journals.ekb.eg/article_416709_7a562a7f2b9d8a88fea4914b5ce22772.p
- Hegazy, S. M. A., Ayed, M. M. A., Farouk Mohamed, M., & Khalil, A. M. S. (2024). Impact of Mind Mapping on Pediatric Nurses' Performance regarding Peripherally Inserted Central Catheters at Neonatal Intensive Care Unit. Egyptian Journal of Health Care, 15(4), 949-963.
- Hegazy, S. M. A., Ayed, M. M. A., Farouk Mohamed, M., & Khalil, A. M. S. (2024). Impact of Mind Mapping on Pediatric Nurses' Performance regarding Peripherally Inserted Central Catheters at Neonatal Intensive Care Unit. Egyptian Journal of Health Care, 15(4), 949-963.
- Hussein, R. S., & Hussein, R. M. (2023). Effect of Mind Mapping Strategy on Nurses' Performance and Satisfaction with Intrapartum Nursing Care. Egyptian Journal of Health Care, 14(2), 856-871.
- Johari, F., et al. (2024). Comprehensive evaluation of risk factors for intraventricular hemorrhage in neonates: a systematic review and meta-analysis. European Journal of Medical Research, 30(1), 296.
- Long, D. (2023). Reducing Severe Intraventricular Hemorrhage in Preterm Infants: A Quality Improvement Initiative. Pediatrics, 152(3), e2021056104.
- McCauley K. E., Carey E. C., Weaver A. L., Mara K. C., Clark R. H., Carey W. A., & Collura C. A. (2020): Survival of ventilated extremely premature neonateswith severe intraventricularhemorrhage, Pediatrics, 147(4).
- Mohamed, H. A. A., & Sayed, H. H. (2023). Evaluating the Effect of a Neuro-protective Care Bundle for Neonatal Nurses on the Incidence of Intraventricular Hemorrhage in Preterm Infants. Egyptian Journal of Health Care, 15(1), 384-399.
- Mohamed, H. A. A., & Sayed, H. H. (2023). Evaluating the Effect of a Neuro-protective Care Bundle for Neonatal Nurses on the Incidence of Intraventricular Hemorrhage in Preterm Infants. Egyptian Journal of Health Care, 15(1), 384-399.
- Mohamed, H. A. A., & Sayed, H. H. (2023). Evaluating the Effect of a Neuro-protective Care Bundle for Neonatal Nurses on the Incidence of Intraventricular Hemorrhage in Preterm Infants. Egyptian Journal of Health Care, 15(1), 384-399.
- Mohamed F. Z. (2018): Quality of nursingcareprovided for pretermneonates of lowbirthweight with intraventricular hemorrhage. Assiut Scientific Nursing Journal, 6(14): 1-11.
- Piscopo, B. R., Malhotra, A., Hunt, R. W., Davies-Tuck, M. L., Palmer, K. R., Sutherland, A. E., Polglase, G. R., Allison, B. J., & Miller, S. L. (2025). The interplay between birth weight and intraventricular hemorrhage in very preterm infants: A population-based cohort study. EClinicalMedicine, 82, 102919.
- Polit, D. F., & Beck, C. T. (2012). Nursing research: Generating and assessing evidence for nursing practice (9th ed.). Lippincott Williams & Wilkins.
- Sadeghi-Gandomani, H., et al. (2017). The impact of using mind mapping on nurses' critical thinking skills: A quasi-experimental study. Journal of Clinical Nursing.
- Sadeghi-Gandomani, H., et al. (2017). The impact of using mind mapping on nurses' critical thinking skills: A quasi-experimental study. Journal of Clinical Nursing.
- Sherlock, R., et al. (2022). An evaluation of the implementation of an intraventricular haemorrhage care bundle to improve clinical practice. Journal of Neonatal Nursing.
- Sherlock, R. (2022). An evaluation of the implementation of an intraventricular haemorrhage care bundle to improve clinical practice. Journal of Neonatal Nursing