The Impact of Mind Mapping Application on Nurses' Performance regarding Infection Control Precautions at Critical Care Units

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Abstract

Background: Fundamental infection control measures are crucial within the healthcare environment of intensive care units to minimize the incidence of hospital-acquired infections. Mind mapping serves as an active learning technique that enhances learning, boosts natural cognitive abilities, and improves memory retention. **The aim of this study** was to evaluate the impact of mind mapping application on nurses' performance regarding infection control precautions at critical care units. **Subjects and Method: Design:** To achieve the study's objective, a quasi-experimental research design was employed. **Setting**: The research was carried out in the Critical Care Units of Sohag University Hospitals. **Subjects**: A convenient sample comprising 50 nurses was selected for the study. Three tools were utilized for data collection: Tool (1): A structured interview questionnaire divided into two sections; section (I) detailing nurses' demographic information; section (II) nurses' opinion on the use of mind mapping in training. Tool (2): An assessment of nurses' knowledge regarding mind mapping and infection control measures (pre/post), Tool (3): Observational checklists for evaluating nurses' practices related to infection control (pre/post). **Results**: The findings indicated a highly statistically significant difference and enhancement between the pretest and post-test results concerning nurses' knowledge and practices related to mind mapping and infection control measures. A highly statistically significant difference was also observed in the overall knowledge and practices regarding mind mapping among the nurses. **Conclusion**: The current study concluded that the application of mind mapping had a substantial impact on enhancing nurses' knowledge and practices related to infection control measures in critical care units. **Recommendations**: The study suggested that the mind mapping strategy should be implemented and integrated as an effective educational approach in nurses' training.

Keywords: Infection control precautions, Mind mapping , Nurses' performance

Introduction:

Hospitals are high-risk environments for acquiring infections due to the presence of various microorganisms, including antibiotic-resistant strains. HAIs are a leading cause of morbidity and mortality in intensive care units, resulting in increased healthcare costs and resource utilization **(Vinodhini & Bhooma , 2021).**

Nosocomial infections are infections that develop more than 48 hours after admission to a healthcare facility. These infections pose a significant threat to newborns in ICUs, increasing morbidity, mortality, and healthcare costs. Incidence: approximately 14.1 per 1000 patient-days. Global variation was 3.6% to 12% in high-income countries and 5.7% to 19.1% in low- and middle-income countries **(Wang et al., 2019).**

Healthcare-associated infections, also known as nosocomial infections, or HAIs, are closely linked to systemic flaws such insufficient training and compliance as well as physician behaviors like hand cleanliness. Frequent hand washing is essential for lowering the rate of infections in neonates because it successfully lowers pathogenic colonization on hands and stops infections from spreading in intensive care units. Establishing a successful infection control program requires first evaluating nurses' infection control knowledge, attitudes, and practices **(Kabir et al., 2020).**

By following comprehensive infection control procedures, nurses significantly contribute to the decrease in the frequency of nosocomial infections, or HAIs, in intensive care units. Direct care is given by nurses, who are the primary caregivers and have a big influence on patient outcomes. It is imperative that nurses receive infection control education in order to enhance patient care, safety, and results. Many infection control methods, like careful management of intravenous lines, meticulous hand hygiene, appropriate skin care, and the prudent use of antibiotics, are easy and affordable, but they also call for staff accountability, adherence, and education. Another important strategy for reducing infections is to minimize invasive procedures, such as the prompt removal of central venous catheters and the use of mechanical ventilation. As a result, a key element of nursing education and training is knowing the infection process and how to prevent infections. Adherence to infection control measures requires ongoing knowledge and performance evaluations as well as regular in-service training. Good training techniques, like mind mapping, can stimulate participation, generate new ideas, and eventually change nursing staff behavior. **(Dramowski et al., 2022).**

Nurses have a professional and legal obligation to prevent the spread of cross-infection to patients. Providing nurses with training and education is crucial to enhance the quality of healthcare and equip them with

new knowledge and skills. Educational programs play a vital role in developing nurses' theoretical and technical knowledge, improving their skills, and promoting professional advancement. Research has shown that nurses' understanding and practices regarding infection control can significantly improve after implementing a

specially designed curriculum. A well-trained nurse is essential to the success of a well-organized department **(Elkin et al., 2019).** The rapid evolution of technology and science in nursing, combined with increasing consumer demand for high-quality healthcare, necessitates that nurses stay informed. Nurse educators should create learning experiences that foster critical thinking and enhance learning effectiveness. Techniques like mind mapping can be used to improve memory recall and knowledge processing. Innovative instructional tools, such as concept maps, can also assist nursing students in managing care effectively **(Phillips et al., 2019).**

Mind mapping is a visual learning strategy that captures and organizes information in a non-linear manner, promoting critical thinking and knowledge acquisition. Developed by Tony Buzan in the 1970s, mind mapping uses diagrams, images, and colors to illustrate relationships between concepts and support memory retention. In medical education, mind mapping has been recognized as an effective tool for enhancing learning, clarifying thought processes, and promoting meaningful learning. By using mind maps, medical and nursing students can integrate information, comprehend complex subjects, and identify relationships between clinical and foundational sciences. Mind maps can also be used to promote and assess critical thinking, making them a valuable tool in medical education **(Rosciano , 2023).**

Mind mapping is a powerful graphic technique that enhances learning and promotes clear thinking. This self-directed learning approach helps medical students comprehend complex concepts by organizing, integrating, and retaining information. According to Buzan, effective mind mapping involves several key guidelines: Central image: Place a central image or topic using at least three colors. Visuals and symbols: Incorporate images, symbols, and codes throughout the mind map. Keywords: Use keywords and print them in upper or lower case letters.Single concept per line: Ensure each word or image stands alone on its line. Connected lines: Connect lines extending from the central image, with thicker, organic lines at the center and tapering outward. Line length: Match line length to the word or image. Color coding: Apply colors consistently throughout the mind map. Unique style: Develop a personal style of mind mapping. Emphasis and associations: Use emphasis and illustrate associations within the mind map. Clear structure: Maintain clarity using radial hierarchy, numerical order, or outlines to structure branches (**Buzan &Buzan 2010).**

www.mindmapper.com/knowledge-base/mind-map-elements/

Mind mapping enables learners to connect new and existing knowledge, promoting deeper understanding and effective note-taking. This approach supports active learning, critical thinking, and long-term retention. By creating mind maps, nurses can integrate information, synthesize concepts, and develop declarative and implicit knowledge. Critical-care and medical-surgical nurses play a vital role in patient safety and health, with responsibilities including: Preparing the operating room and equipment , Inspecting tools and linens, Administering medications, and Providing patient education and reducing anxiety **(Goodman, & Spry, 20**22**).**

Significance of the study

Nosocomial infections or healthcare-associated infections (HAIs) affect 5-10% of hospitalized patients in developed countries, while the rate exceeds 25% in developing countries. Infection control is crucial in healthcare settings, particularly in critical care units (Lee et al., 2020). Nurses play a vital role in enforcing infection control measures, requiring active teaching techniques to facilitate effective learning. Mind mapping is an educational approach that can promote critical thinking, meaningful learning, and problem-solving skills in nurses **(National survey shows healthcare facilities implementing PPE crisis standards of care, 2021).** Therefore, the researcher was wanted to evaluate the impact of mind mapping application on nurses' performance regarding infection control precautions at critical care units.

Aim of the study

The study was aimed to evaluate the impact of mind mapping application on nurses' performance regarding infection control precautions at critical care units

Research hypothesis:

Application of mind mapping regarding infection control precautions is expected to improve nurses' performance at critical care units.

Subjects and Methods:

Research design:

 To fulfill the aim of this study quasi-experimental research design was utilized

Settings:

The study was conducted in the Critical Care Units, Sohag University Hospitals.

Sample:

A convenient sample of a total of 50 nurses was recruited in the study.

Three tools were used for data collection:

Tool (1): A structured Interview Questionnaire:

The researcher developed this tool after conducting a thorough review of both national and international literature related to the subject. The tool is divided into two sections as follows:

Part 1: This section gathered information regarding the demographic characteristics of nurses, including their age, gender, education, and years of experience.

Part 2: This section focused on nurses' perspectives on the application of mind mapping in training, following a lecture on mind mapping and its potential use in infection control training, as well as their preference for mind mapping in training **(Wilson & Chris, 2019).**

Scoring system:

The overall satisfaction score for nurses was set at 5 marks. Each affirmative response received one mark, while a negative response was assigned a score of zero.

Tool (II): Assessment of nurses' knowledge regarding mind mapping and infection control precautions (pre/post): This tool was also developed by the researcher after an extensive review of relevant national and international literature **(National survey shows healthcare facilities implementing PPE crisis standards of care, 2021; Alfar et al., 2020; Mansourian et al., 2020; Goodman, & Spry, 2017; Moustafa et al., 2017).**

 The text addressed issues concerning hospital-associated infections and the precautions for infection control, encompassing nurses' understanding of definitions, processes, transmission methods, the infection chain, and prevention strategies for hospital-associated infections, along with the principles of infection control precautions. Regarding mind mapping, it included inquiries about the definition of a mind map, the materials necessary for utilizing mind mapping, and the application of mind mapping in infection control training, in addition to the benefits of employing the mind mapping strategy .

Scoring system for nurses' knowledge:

 Incorrect answer: scored zero

 Correct answer: scored one

The researcher updated **(CDC, 2023)** to evaluate nurses' awareness of infection control precautions in their practice within critical care units.

The overall score for knowledge of infection control precautions was categorized into two groups: satisfactory (≥75%) and unsatisfactory (< 75%). It consisted of 15 questions, with a maximum score of 15, a satisfactory score ranging from 10 to 15, and an unsatisfactory score of less than 10.

Tool (3): Infection control observational checklists for nurses' practices (pre/post).

This tool was developed by the researchers following a review of updated literature to evaluate nurses' practices in implementing infection control precautions in critical care units through various methods, as recommended and modified by the researchers. It encompasses

infection control precautions such as hand hygiene and the proper procedures for donning and doffing Personal Protective Equipment (PPE), as well as the application of infection control measures while conducting various nursing tasks, including intravenous infusion administration, cannulation, blood transfusion, handling oxygen equipment, measuring vital signs, utilizing central lines, umbilical venous catheters, preparing mixed solutions, artificial feeding, and gavage feeding. **(Shrestha et al., 2018; Dramowski et al., 2022)**

Scoring system

The scoring system utilized for evaluating nurses' practice involved an observational checklist, where each item was assigned a score ranging from 0 to 1. A score of 1 was given for actions that were performed correctly and completely, while a score of 0 was assigned for actions that were either not performed or were incomplete. The total nursing practices were divided into two categories based on the classification by **Alfar et al. (2020):** competent and incompetent practice. A practice was deemed incompetent if the nurse's score fell below 80%, whereas it was considered competent if the score exceeded 80%.

Validity of the tools

The content of the tools was reviewed for clarity, comprehensiveness, appropriateness, and relevance by a panel of three expert professors in critical care and Medical-Surgical Nursing, along with two additional professors specializing in critical care nursing, all possessing over ten years of experience. This board confirmed the face and content validity of the tools.

Reliability of the tools

The reliability of the tools was evaluated using Cronbach's alpha reliability test, yielding an α of 0.889%, which indicated that the first tool comprised relatively homogeneous items, as evidenced by its high reliability. The second tool demonstrated a reliability score of α = 0.897%.

A pilot study

A pilot study was conducted involving 10% of the sample after the tool was developed, which included 5 nurses. This study aimed to ascertain the time required for data collection, identify any ambiguities within the tool, and ensure the clarity of the items. It served to clarify and assess the feasibility of the research process. The nurses who participated in the pilot study were subsequently included in the main study.

Administrative and ethical considerations

The ethical committee of Sohag University's Faculty of Nursing granted permission to conduct this study. The researcher informed the nurses before data collection began that their involvement was completely voluntary, that they could quit from the study at any time without giving a reason, and that they could refuse participation at any time. The nurses' oral consent was acquired. Additionally, they received guarantees that their information would be protected and used only for research.

Fieldwork

The Sohag University Hospital's director gave his approval. The research was conducted between early June 2023 and late November 2023. The researcher conducted interviews three days a week from 9:00 a.m. to 11:00 p.m., welcoming each nurse, introducing themselves, and outlining the goal and nature of the study.

Phases of the study:

The study was executed in four distinct phases:

I-Assessment Phase

-Each nurse was interviewed prior to the commencement of the study to gather demographic information and their perspectives on the use of mind mapping, utilizing tool (I) parts (1-2).

-The nurses' knowledge regarding infection control and the mind mapping strategy was evaluated using tool (II).

-The researchers assessed the nurses' practices concerning infection control precautions during their actual work in critical care units, employing tool (III).

II. Planning phase

-         The goals, priorities, and expected results were defined based on the findings from the previous phase, aimed at addressing the practical needs of nurses and their knowledge gaps concerning infection control measures in critical care units.

General Objective

-         -The primary aim of implementing mind mapping was to enhance the performance of nurses in relation to infection control measures within critical care units. In this phase, the researchers organized five sessions for the participating nurses to equip them with knowledge and practical skills pertaining to infection control measures in critical care settings.

III. Implementation Phase

Mind mapping was used in five sessions, each lasting roughly 30 to 45 minutes, to improve nurses' comprehension and implementation of infection control procedures in critical care units.

-- The researchers sought input on the previous session at the beginning of each session and gave a summary at the end of each session.

The study was conducted by the researchers during the morning shift, which ran from 8 a.m. to 12 p.m. on Sunday, Monday, and Tuesday.

--Each nurse was interviewed one-on-one using the aforementioned research instruments.

-- Ten smaller groups, each with seven nurses, were formed from the participating nurses.

--After a review of the pertinent literature based on the assessment of the actual needs of the participating nurses, a simplified booklet covering all facets of knowledge and practice related to infection control measures in critical care units was used as supplemental material and

given to the nurses in Arabic.

A range of instructional techniques were used, such as lectures, brainstorming sessions, small group discussions, demonstrations, and re-demonstrations of the tools required to apply the mind mapping technique. Furthermore, a variety of instructional resources were used, The study utilized various educational materials, including PowerPoint presentations, Printed versions of mind map designs, and Coverage of both theoretical and practical information on infection control procedures.

The theoretical and practical sessions were carried out as follow

First Session (Theoretical): The researchers Introduced themselves and thanked nurses for participating, explained the purpose of the training sessions, and covered key themes regarding introduction to mind mapping, requirements for using mind mapping, application of mind mapping in infection control training, and benefits of mind mapping technique

The second (theoretical) session covered the definition, procedures, modes of transmission, chain, and prevention techniques of hospital-associated infections, along with the fundamentals of infection control measures.

The third session, which was theoretical in nature, concentrated on the nurse's role in infection control and the prevention of problems in patient care.

The fourth (practical) session started by getting input on the other sessions and answering any questions about infection control. Clinical demonstrations and re-demonstrations of hand hygiene and the correct methods for putting on and taking off personal protective equipment (PPE) were provided by the nurses.

The fifth practical session focused on showing how to apply infection control measures when performing a variety of nursing tasks, such as administering intravenous infusions, cannulation, transfusions, handling oxygen equipment, taking vital signs, managing waste, cleaning instruments, and using central lines. A mind mapping teaching approach was used in each of the five instructional sessions, as shown in **the following example map.**

An example of mind map that used in the current study

IV-Evaluation phase

Using the same pretest instruments and observational checklist, the researchers conducted a post-test two months after the sessions were implemented to reevaluate the impact of the mind mapping application on nurses' performance with regard to infection control measures in critical care units.

Statistical Design

The collected information was coded and entered into SPSS Version 23.00, a statistical program for social research. Under the assumption that the row and column variables are independent, quality control was upheld during the coding and data entry stages without revealing the strength or direction of the relationship. To compare qualitative variables, the chi-square, T-, and F tests were used. The difference was p 0.001 and the P-value was less than 0.05 to be considered statistically significant.

Results:

According to **Table 1,** 74% of the nurses in the study were female, and more than half (56%) were under 30 years old, with an average age of 36.5 ± 7.5 years. Approximately half of the nurses in the study (52%) were technical nurses, and 34% were highly qualified nurses. In terms of years of experience, half of them (52%) had between 6 and 14 years of experience.

Figure 1 shows that about half (46%) of the nurses in the study had excellent opinions about the use of mind maps in training on infection control measures, while just 2% thought it was unacceptable.

A sizable majority (82%) of the nurses polled supported the use of mind maps in training or educational settings, as seen in **figure (3).**

Before to the intervention, more than half of the nurses who participated in the survey gave inaccurate answers about hospital-associated infection control measures, as seen in **Table (2).** The majority of nurses' knowledge improved after using mind mapping.There was a highly statistically significant difference in their awareness of infection control precautions before and after the application (P<0.001).The mean overall knowledge score showed a highly significant improvement on the post-test (p<0.000).These findings suggest that mind mapping is an effective tool for enhancing nurses' knowledge of infection control precautions.

According to **Table (3),** nurses' knowledge of mind mapping differed significantly before and after its implementation (P<0.001). Furthermore, the post-test mean total knowledge score showed a highly significant improvement (p<0.000) in this table.

Figure 4 demonstrates that while 90% of the nurses in the study had inadequate knowledge on the pretest, 98% of them had satisfactory knowledge after using mind mapping.

Table 4 shows that compared to before mind mapping was used, there were highly statistically significant improvements in practical levels and all principles utilized in various nursing activities within the intensive care unit regarding infection control precautions (p≤0.001).

According to **Figure (5),** there was a statistically significant decrease in the percentage of nurses who practiced incompetent infection control in the intensive care unit (ICU) from 46% to 10% following the mind mapping program.

Table (5) demonstrated that there is no statistically significant relationship between the total knowledge and demographic traits of the nurses under study before and after mind mapping. The expertise, gender, years of experience, and qualifications of nurses at the pre-mind mapping application are significantly correlated.

According to **Table (6)**, there is a slight correlation among age, gender, and years of experience before and after mind mapping. In the meantime, there is a mildly significant association with regard to nurses' qualifications once mind mapping is applied, and there is a substantial correlation with regard to gender (p.>0.05) prior to intervention.

Table (7) illustrates the relationship between the total scores of nurses' knowledge and practice before and after the implementation of mind mapping; a significant positive correlation was found between the knowledge score and the practice score statistically significant difference at (p≤0.001).

Table (1): T he studied nurses distribution regarding to their demographic characteristics (n= 50)

Demographic characteristics	N0.	%
Age (Years)		
≤ 30 years	28	56
>30years	22	44
Mean ± SD	**36.5 ± 7.5**	
Gender:		
Male	13	26
Female	37	74
Qualification:		
Nursing diploma	7	14
Institute of technical health	26	52
Bachelor of nursing	17	34
Years of experience:		
≤ 5 years	13	26
6 – 14 years	26	52
15 - 25 years	11	22
Mean ± SD	**18.14± 4.54**	

Figure 1: Nurses' opinion distribution after application of mind mapping in training regarding infection control precautions (N=50)
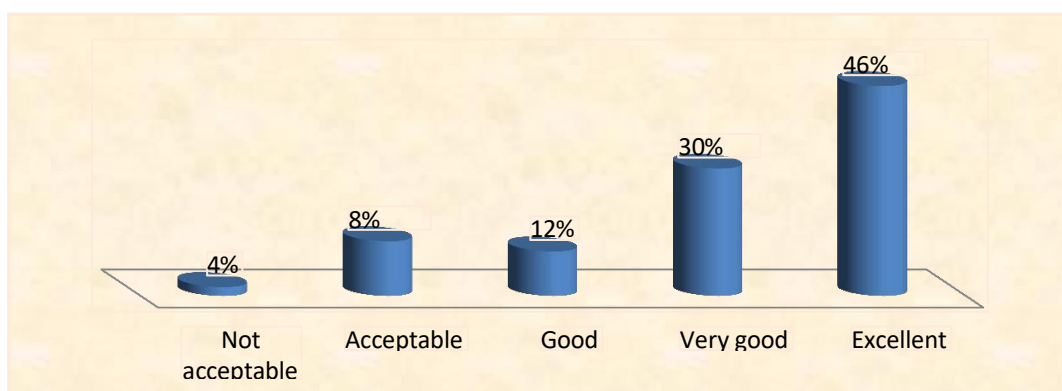
Figure 2: The studied nurses' distribution regarding previous training about mind mapping application (n=50)
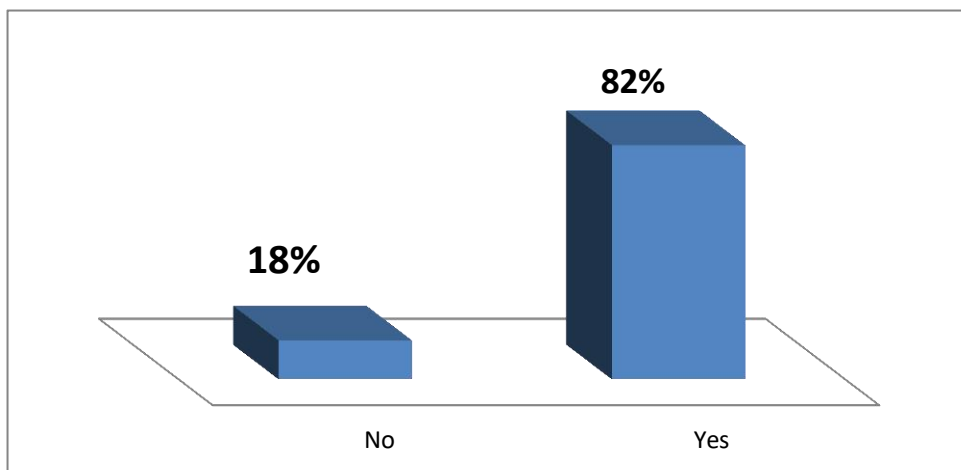

Figure 3: The studied nurses' opinion distribution regarding preferring mind mapping application in training (n=50)

Table (2): Comparison between nurses ' knowledge regarding infections control precautions pre and post-mind mapping application (n = 50)

Nurses' knowledge about infections control precautions	Study Group (n= 50)				X2	P-value
	Pre- mind mapping application		Post- mind mapping application			
	No	%	No	%		
Definition of hospital associated infections						
-Incorrect answer.	26	52	0	0		
-Correct answer.	24	48	50	100	67.73	0.0001**
Chain of hospital associated infections						
-Incorrect answer.	31	62	0	0	88.54	0.0001**
-Correct answer.	19	38	50	100		
Methods of prevention of hospital associated infections						
Incorrect answer.	28	56	1	2	96.23	0.0001**
Correct answer.	22	44	49	98		
Methods of transmission of hospital associated infections						
Incorrect answer.	27	54	4	8	79.38	0.0001**
Correct answer.	23	46	46	92		
Principles of hospital associated infections control precautions	24	48	2	4	69.67	0.0001**
Incorrect answer	26	52	48	96		
Correct answer						
Role of the nurse						
Incorrect answer.	21	42	3	6	89.43	0.0001**
Correct answer	29	58	47	94		
Mean Knowledge total score	8.2±2.3		12.4±1.7		F=36.3 P=0.000**HS	

High statistical significant at **** p value <0.001**

Table (3): C o m p a r i s o n between nurses' knowledge regarding mind mapping pre and post application (n = 50)

Nurses' knowledge about mind mapping	Pre- mind mapping application		Post- mind mapping application		X2	P-value
	No	%	No	%		
Definition of a mind map	35	70	5	10	131.45	0.0001**
- Incorrect.	15	30	45	90		
- Correct						
Materials required when use a mind mapping					119.09	0.001**
- Incorrect.	40	80	3	6		
- Correct	10	20	47	94		
How mind mapping be used in infection control training					125.53	0.001**
- Incorrect.	39	78	2	4		
- Correct	11	22	48	96		
Advantages of using mind mapping strategy					118.82	0.001**
- Incorrect.	45	90	0	0.0		
- Correct	5	10	50	100		
Mean Knowledgetotal score	6.5±1.4		10.3±1.7		F=23.7 P=0.000HS	

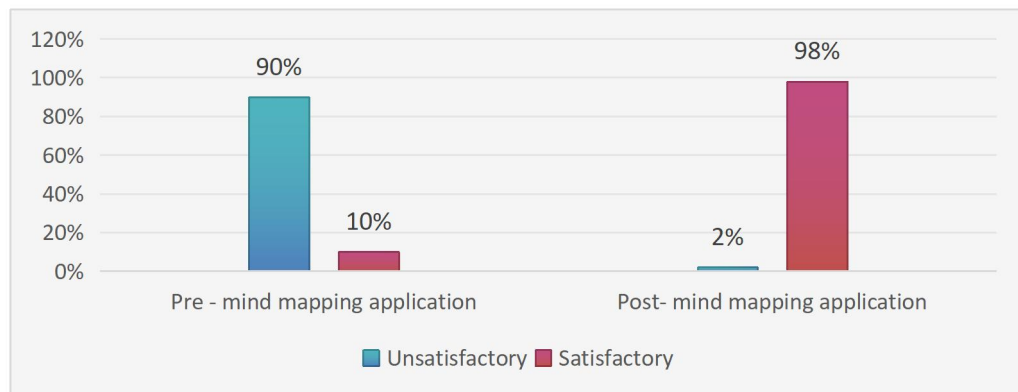**High statistical significant at   ** p value <0.001**

Figure (4):   Total knowledge level pre and post- mind mapping application among the studied nurses (n = 50)

Table (4): Comparison between nurses' practices regarding infection control precautions pre and post- mind mapping application (n=50)

Nurses" practice regarding infection control precautions	Pre				Post				X2	P-value
	Done		Not done		Done		Not done			
	No	%	No	%	No	%	No	%		
Hand hygiene	32	64	18	36	50	100	0	0.0	33.68	<0.001**
Personal protective equipment	33	66	17	34	50	100	0	0.0	56.44	<0.001**
Applying infection control principles while performing various nursing tasks	29	58	21	42	50	100	0	0.0	49.57	<0.001**
Disposal of patient wastes	13	26	37	74	50	100	0	0.0	28.45	<0.001
Operating and dressing room	21	42	29	58	50	100	0	0.0	44.49	<0.001
Medication room and handling of files)	16	32	34	68	50	100	0	0.0	53.28	<0.001

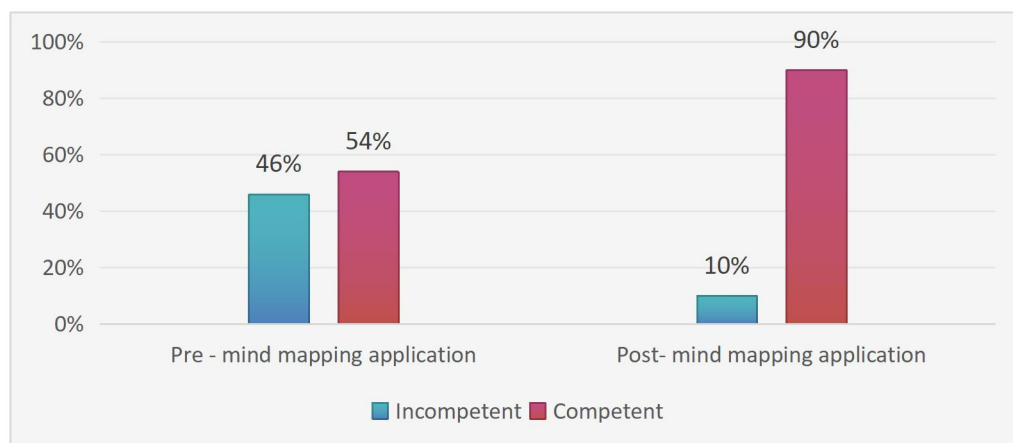**High statistical significant at   ** p value <0.001**

Figure (5): Total practices about the infection control precautions of the studied nurses pre and post- mind mapping application, (n= 50)

Table (5): Correlation between nurses' demographic data and their total knowledge (n=50)

Demographic data	Total knowledge			
	Pre		Post	
	R	P	R	P
Age (years)	-0.004	0.9	-0.01	0.9
Gender	-0.47	0.001*	-0.23	0.2
Qualification	0.40	0.001*	0.37	0.02*
Years of Experience	0.42	0.001*	0.35	0.02*

Table (6): Correlation between nurses' demographic data and their total infection control practice (n=50)

Demographic data	Total infection control practice			
	Pre		Post	
	R	P	R	P
Age (years)	0.32	0.05	-0.25	0.1
Gender	-0.47	0.001*	-0.21	0.2
Qualification	-0.44	0.001*	0.03	0.7
Years of Experience	0.39	0.001*	0.04	0.7

Table (7): Correlation between nurses' total knowledge and practice scores pre and post application of mind mapping

	Total practice	
Total Knowledge	Pre application of mind mapping	Post application of mind mapping
R	0.879 **	0.843**
P	0.001	0.001

Correlation is significant at the 0.05 level

Discussion:

Intensive care unit (ICU) nosocomial infections continue to be a major global health problem in spite of strict surveillance and prevention efforts. Compared to pediatric wards in general hospitals, the incidence rates are noticeably greater in pediatric hospitals, critical care units, and intensive care units. According to estimates, the risk of illnesses linked to healthcare is two to twenty times higher in developing countries than in industrialized ones. Extended hospital stays, intensive care unit transfers, the need for antibiotic therapy, the implantation or replacement of invasive devices, and surgical procedures are all consequences of these infections. As a result, continuous educational training is essential for ICU nurses to understand and use infection control strategies while delivering nursing care (Hassan et al., 2021).

Education is vital for individuals, and acquiring knowledge efficiently is crucial. However, retaining large amounts of information can be challenging. Fortunately, modern technologies have emerged to address these challenges. Mind mapping is a valuable study tool that helps create clear connections and relationships between topics, enabling trainees to deliver more effective instruction (Eshwar et al., 2021). The aim of this study was to evaluate the the impact of mind mapping application on nurses' performance regarding infection control precautions at critical care units.

According to the current study's findings, more than half of the nurses who participated were under 30 years old. This result is consistent with another study by Goodman T., & Spry, (2022) which found that fewer than two-thirds of the nurses were between the ages of 20 and 30. Therefore, when it comes to research engagement, younger employees are more cooperative than their older counterparts. A different viewpoint was offered by Mahmoodi et al. (2023) who found that nurses ranged in age from 27 to 40.

Additionally, the current study found that a sizable percentage of the nurses were female, with almost two-thirds having advanced credentials and nearly half having technical nursing education. The majority of the nurses in the study had earned a bachelor's degree, according to the Mansourian et al. (2020) report , which conflicts with this conclusion.

The study's findings about the nurses' characteristics aligned with the findings of Mohammed et al.'s (2022) They found that most of the nurses were female, between the ages of 20 and 30, had completed a technical

nursing program, and had less than five years of experience. Furthermore, the majority of ICU nurses were married, female, between the ages of 20 and 40, had a nursing degree, and more than half had more than five years of experience, according to **Shorofi & Arbon (2023).** Since the older generation of Egyptian nurses were all female, the researcher ascribed this trend to the historical perception that women make up the majority of the nursing profession. When asked about their years of experience, half of the nurses had 6 to 14 years of experience, which aligns with **Ibeid et al.'s (2021)** study that showed two-fifths of nurses had similar experience ranges.

Fayed et al. (2020) discovered that this finding contradicted their data. The analysis A study found that over half of the nurses had less than 5 years of experience and none of the nurses had prior knowledge or experience with mind mapping. The researchers suggest that the lack of familiarity with mind mapping highlights its potential value in nursing education, potentially enhancing knowledge retention and practice.

The present study's findings showed that the majority of the nurses stated a preference for utilizing mind maps after explanations, and none had previously used mind mapping in their training. This emphasizes how important it is to carry out the study, according to the researchers.

After using mind mapping in their training on infection control measures, nearly half of the nurses in the study showed good results, according to the current study. This conclusion was supported by **Wu H and Wu Q (2020)** in their investigation into how mind mapping affected clinical nursing students' critical thinking abilities. According to their findings, most nursing students found mind mapping to be enjoyable and indicated that they would be open to using it in their future careers. **Atia, (2022)** further supported the present findings by seeing a high degree of student satisfaction and a favorable opinion of mind mapping as a teaching technique. The importance of this study and the value of applying a mind mapping technique were emphasized by the researchers. Since mind maps are thought to be the best method for information transfer and retention. Maps are

very rich in pictures, sketches, and shapes with a wide range of eye-catching hues, which is why. It is interesting to remember that 90% of the inputs received by the brain are visual, and the brain has an innate sensitivity to images and symbols that significantly affects concept recall.

According to the current study, more than half of the participants gave inaccurate answers about infection control measures related to hospitals before mind mapping was used. But after using this tool, nurses' expertise significantly increased. This implies the possibility of enhancing nurses' expertise through continuous education. The significant improvement can also be ascribed to the use of mind mapping in conjunction with other conventional teaching strategies including brainstorming sessions, lectures, and small group discussions. In their investigation of nurses' knowledge and practices regarding standard precautions for infection control, **Eskander et al. (2019)** agreed with this conclusion, finding that critical care nurses performed satisfactorily in infection control procedures but lacked sufficient knowledge. Therefore, it is essential for nurses to adopt new teaching strategies, such as mind mapping, to enhance information retention, thereby validating its use in this study.

According to the results of this study, just five percent of the nurses evaluated had satisfactory knowledge before mind mapping was used. The researchers hypothesized that this might be due to a lack of current information about infection control measures. On the other hand, almost all participants attained a satisfactory level of knowledge after mind mapping was applied. The results of the present study were corroborated by **Bayumi et al., (2022)** who observed that the nurses assessed had unsatisfactory knowledge of operating room infection control measures at the pretest. All participants did, however, reach a good level of understanding after the intervention. The researchers claim that this result demonstrates how mind mapping improves comprehension of infection control measures.

The current study's findings showed that nurses' knowledge of the mind mapping technique before and after its use differed in a highly statistically significant way. This research highlights the advantages of using mind mapping in infection control-related nurse education and training. In order to improve nurses' knowledge and practice, the results of this study support the use of mind maps in infection control continuing education.

The present study's findings were supported by a study by **Elasrag & Elsabagh (2020)** that showed the same results. Additionally, **Wenjun et al.'s (2020)** found that mind mapping enhances medical students' understanding and practical skills related to nosocomial infection prevention and control. It also boosts their satisfaction and hand hygiene adherence.

According to the current study's findings, nurses' knowledge and practices of infection control were greatly improved by the use of mind map-based infection control software. Additionally, after the implementation, all participating nurses attained a satisfactory level of knowledge, which the researcher believed showed a significant improvement in the nursing staff's comprehension of infection control applications through the usage of mind maps. Establishing standards and goals that direct individuals and practitioners in providing safe and effective care is crucial for any organization and profession, claim **King & Shell (2019).** Furthermore, it's not enough for standards to exist; managers and leaders also need to make sure that their staff members understand and are aware of them while employees should recognize that their performance will be evaluated based on their ability to meet the established criteria.

The researchers attribute this to the use of different colors and images in mind mapping, which helps move information from short-term to long-term memory, improves recall, makes information more accessible more quickly, and ultimately encourages creativity **(Antoni et al. 2019).** Additionally, **Chin , (2021)**, who came to the conclusion that mind maps help cancer patients go through their prior experiences more efficiently by combining words and visuals to visually

categorize and arrange information, confirmed earlier findings. **Balım (2023)** provided results, however, that ran counter to the present investigation.

The recent study found that more than two-fifths of nurses demonstrated insufficient infection control procedures in intensive care units (ICUs) before the application of mind mapping.

Nonetheless, most showed a proficient level of practice when mind mapping was implemented. In a similar spirit, **Hus et al. (2021)** found that in their study,the mean nursing competency scores increased significantly in the post-test. **Ibeid et al. (2021)** concurred with these results, observing that all nurses in the study attained a good degree of practice following the hand washing-focused mind map instruction program. The usefulness of mind maps in improving nurses' understanding and, in turn, their performance in relation to infection control in obstetrics and gynecology departments was also highlighted.

The current research findings were further supported by **Mohammed et al. (2022)**, who found that most nurses had poor infection control practices in intensive care units before to the implementation of mind maps. After the intervention, this number dropped to 2%. In order to help study participants remember concepts and knowledge for both short-term success and long-term retention, mind maps also make it easier to organize the relationships and connections between ideas and information. By using visual representations, mind maps help people with memory problems recall specifics.

Regarding the practices of the nurses, it was found that the majority of them adhered to infection control principles to an incompetent degree, with highly statistically significant differences observed in the practices pertaining. This emphasizes how mind maps can be used to quickly plan staff and patient education while gauging learners' comprehension of important material **(Kalyanasundaram et al., 2020).**

Parallel to this, **Farrand et al. (2020)** discovered that spider diagrams, which

resemble mind maps, significantly enhanced undergraduate students' memory recall in comparison to their chosen study techniques in their study titled "The efficacy of the 'mind map' study technique. After a week, this improvement was largely sustained for those in the diagram group, however motivation dramatically declined as compared to the participants' preferred note-taking methods. In a meta-analysis, mind mapping was found to be more effective in class discussions.

The same study by **Tee et al. (2020)** suggested that mind mapping is only marginally more effective than other constructive activities like writing summaries and outlines. However, the findings were inconsistent, with significant heterogeneity found in most subsets.

Comparable results are found in the study by **Akinoglu & Yasar (2019)** which emphasizes the importance of mind maps in improving the performance and comprehension of the sample under study.In addition, **Kalyanasundaram et al. (2020)** found that this approach is novel and provides better memory retention than conventional reading methods.

Furthermore, mind maps are excellent teaching tools that improve students' capacity to generate thoughts, evaluate information, and link ideas while understanding their connections. According to **Alsuraihi (2022),** this approach entails the visual reconstruction of knowledge, which makes it more approachable and captivating than conventional verbal and written formats .

The results of the current study showed that knowledge scores and practice scores showed a substantial positive association after mind mapping, with statistically significant differences. This association shows that as knowledge grows, so does practice; the nurses in the study were able to use their abilities successfully after providing them with sufficient information.

According to the current study, there is a slight correlation between years of experience, gender, and age before and after the intervention. Additionally, a weakly significant link was seen after the intervention with regard to nurses' qualifications. In particular, even though both groups received the same training approach, nurses with a bachelor's degree in nursing who work as highly qualified nurses or nursing supervisors and use the mind mapping method performed better than those who graduated from nursing technical institutes and are bedside nurses. This result is in line with research by **Considine et al. (2019),** which indicates that nurses' knowledge improves when their experience and credentials grow or if they take training programs.

On the other hand, **Ahmad et al. (2015)** found no relationship between infection control knowledge or practice and variables including age, years of experience, and training programs within the group under research, which contradicted the current findings. In this regard, **Abdel Hamid et al. (2017)** found that age and years of experience had no bearing on learning about blood-borne infections or improving infection control practices.

The current study showed a statistically significant correlation between the total score that represented nurses' performance and knowledge before and after the mind map was implemented. This correlation clarifies the idea that better performance is correlated with more knowledge. Additionally, when the nurses in the study had enough expertise, they could practice effectively.

The results of this study showed a statistically significant correlation between nurses' performance and their use of mind mapping. These findings align with those of **Davies (2020)**, who investigated the relationship between staff nurses' performance and their understanding of mind mapping. A high degree of statistical significance was demonstrated by the study sample's performance, which included theoretical understanding of mind mapping. This is because nurses are more likely to actively participate in their training when they have a firm grasp of the mind mapping technique.

Conclusion:

In light of the findings, the current study concluded that the application of mind mapping had a substantial impact on enhancing nurses' knowledge and practices related to infection control measures in critical care units.

Recommendations:

Based on the study's findings, the following recommendations are proposed:
1. Implement in-service training on infection control using mind mapping for pediatric nurses.
2. Offer workshops and seminars on mind mapping for nurses and infection control committee members.
3. Conduct further research to validate the results in different settings and with larger sample sizes.

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