Effectiveness of Mind Mapping Strategy on Nurses' Knowledge and Practice regarding Infection Control Measures in Operating Room

Hayah Abou Elazayiem Bayumi[(1)], Ebtesam Aly Abd el Fatah Aly[(2)], Tahani Ali Salem Maharem[(3)], Eman Mohammed Ahmed Mohammed[(4)]

(1) Assistant professor of adult Medical-Surgical nursing, Faculty of nursing, South Valley University, Upper Egypt
(2) Lecturer of Medical Surgical Nursing Faculty of Nursing Minia University
(3) Medical- Surgical Nursing Department, Faculty of Nursing, Alexandria University Egypt & Assistant Professor, Faculty of Applied Medical Science, Al Baha University Saudi Arabia
(4) Lecturer in Medical - Surgical Nursing Department, Faculty of Nursing, Beni-Suef University

Abstract

Background: A mind map is an educational strategy for breaking down a large amount of information into manageable chunks and helping students absorb a huge amount of knowledge. An infection is the invasion of a susceptible host by potentially harmful organisms (pathogens), resulting in disease. **The aim was to** evaluate the effectiveness of the mind mapping strategy on nurses' knowledge and practice regarding infection control measures in the operating room. **Subjects and method: Design**: A quasi-experimental research design was used to conduct this study. **Setting**: the study was conducted in the operating room at Beni-Suef University Hospital. **Subjects**: A convenient sample included all available nurses (60) who are working in the above-mentioned study setting. **Three tools** were used for data collection: Tool (1): A structured interview questionnaire which consisted of two parts; part (I) nurses' demographic characteristics; part (II) nurses' opinions regarding the use of the mind map in training. Tool (2): Nurses' knowledge about infection control (pre/post), Tool (3): Observational checklist (pre/post). **Results**: The study result revealed that there was a highly statistically significant difference and improvement between the pretest and posttest regarding nurses' knowledge and practice. There was a highly statistically significant difference between total knowledge regarding mind mapping & the performance of the nurses. **Conclusion**: The study concluded that using a mind mapping strategy had a positive effect on improving nurses' knowledge & practice in the operating room. **Recommendations**: The study recommended that the mind map strategy should be integrated as an effective method of nurses' training.

Keywords: Infection control, Mind mapping, Nurses' knowledge and practices

Introduction:

Infection is the invasion of a susceptible host by potentially dangerous organisms (pathogens), which results in disease. The surgery will be performed in the operating room or suite. This is a restricted area (**Osborn et al., 2019**). Although modern operating room design and aseptic practice reduce wound contamination, infections do occur (**Burkitt et al., 2017**). Hospital-acquired infection (nosocomial infection) illness acquired during hospitalization that was not present or incubating at the time of admission. In general, infections that occur more than 72 hours after admission and within 10 days are classified as nosocomial or hospital-acquired (**Daman, 2018**).

Infection control is a crucial feature of any nurse's duty, but none more so than in the preoperative environment, particularly in the operation theatre (**Holland, 2020**). Because wound infections continue to be a major source of expenditure, morbidity, and even fatality, the prevention of surgical site infection (SSI) remains a major focus of effort. The relevance of (SSI) is enormous. SSIs are the third most commonly reported nosocomial infection, accounting for 14% to 16% of hospitalized patients' nosocomial infections. Surgical patients account for around 40% of nosocomial infections **(Schlossberg, 2018).**

Postoperative wound infection or surgical site infection is a surgical complication that can have serious repercussions for the patient. Postoperative wound infection adds to extended hospital stays and considerably raises the expenses of care, which can result in delayed recovery, increased patient suffering, and even death. According to the Centers for Disease Control and Prevention (CDC), surgical site infections are the second most common cause of hospital-associated infections, costing an estimated 1.5 billion dollars per year (**Spry, 2019).**

Nurses have a professional and legal responsibility to prevent cross-infection from spreading to patients. Nursing staff members must be taught and trained to improve health care quality and learn new skills (**Elkin et al., 2019**). Educational program are supposed to provide nurses with the theoretical and technical information they require to gain new skills and improve their practice. Assist nurses in taking ownership of their professional development. Infection control knowledge and procedures among nurses were poor. Nurses' knowledge and practices have statistically improved greatly as a result of the implementation of a specially designed curriculum (**Emam et al., 2015).**

New instructional tools in nursing education, such as a concept map, are being used to assist nursing students in dealing with pregnant women in an efficient and structured manner. As an educator, the nurse's responsibilities include seeking to deliver accurate information to pregnant women, attempting to lessen the impact of health problems on their health, ensuring that they are not inactive and isolated, and empowering them to be active agents in their health care plan. Nurses, as educators, have the opportunity to meet pregnant women at MCH centers and speak with them one-on-one to equip them with the information, knowledge, and skills they need to make appropriate choices and decisions about their health care plan (**Pintrich and De Groot, 2015**)

The usage of "mind maps" to depict facts in medical information has recently gained popularity in educational materials designed to improve memory. The purpose was to determine how useful mind maps were as a self-study aid. Mind maps can be used to foster and evaluate critical thinking since they are a powerful metacognitive tool for enhancing information acquisition through meaningful learning (**Abdel Hamid, 2017).**

When it comes to mind mapping, Buzan suggests the following: 1. Use at least three colors to center an image or theme. Throughout your Mind Map, include images, symbols, codes, and proportions. 3. Choose keywords and print them in upper or lower case. 4. Each word/image stands alone on its line. 5. Start connecting the lines from the center image. The central lines are thicker, more organic, and more flowing as they radiate out from the center. 6. Make the lines as long as the word/image. 7. Colors—your code—should be used throughout the Mind Map. 8. Create your Mind Mapping style. 9. In a Mind Map, use emphasis and show associations. 10. Using radial hierarchy, keep the Mind Map in clear numerical order, or outlines to embrace your branches (**Buzan and Buzan 2010**).

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

Learners use mind maps to construct a relationship between unknown and known knowledge, which leads to greater comprehension. It is an extremely efficient method of collecting notes and aids in the recall of earlier recollections. This method of teaching and learning does not teach students to think, but rather helps them actively acquire information. Because there is no template or flow chart to direct the nurse's thinking when mind mapping, the mapping represents the nurse's interpretation and integration of ideas, resulting in meaningful learning (**Wilson and Chris, 2019).**

Medical-surgical nurses play an important role in maintaining patients' safety and well-being. Nurses are responsible for a variety of responsibilities, including ensuring that the operating room is properly equipped with the necessary tools and methods for examining tools, linens, medicine administration, and scrape preparations. It is also vital that the nurse provides correct information about the process to the patient to lessen apprehension and provide descriptions of the surgical interventions **(Goodman, & Spry, 2017)**

Significance of the study:

Increased surgical site infections, The researcher wanted to know the cause of the high rate of infection in wounds operations, Nurses are experiencing higher workloads than ever before due to three main reasons: increased demand for nurses, an insufficient supply of nurses, and the supply of nurses is insufficient to meet the current demand, as well as human behavior that is conditioned by education; These factors have an impact on nursing knowledge and practice in terms of infection control in operating rooms.

Nurse educators are under pressure to educate trainees capable of critical thinking, hard effort, being more creative, and problem-solving in a variety of clinical practice settings to adopt infection control concepts. They demand active teaching strategies to generate meaningful learning rather than relying on traditional tactics that promote recall and memorization. According to a review of the current state of the knowledge on mind mapping, this teaching-learning technique can assist nurse educators in educating trainees to think critically in complex healthcare settings **(Abdel Hamid, 2017).** Therefore, the researcher wanted to evaluate the effect of the mind mapping strategy on nurses' knowledge and practice regarding infection control measures in the operating room.

Aim of the study

The aim of this study was to evaluate the effect of the mind mapping strategy on nurses' knowledge and practice regarding infection control measures in the operating room. This aim attained through:

- Assess nurses' knowledge regarding infection control measures in the operating room.
- Assess nurses' practice regarding infection control measures in the operating room.
- Evaluate the effect of the mind mapping strategy on nurses' knowledge and practice regarding infection control measures in the operating room.

Research hypothesis:

The application of the mind mapping strategy will have a positive effect on improving nurses' knowledge and practice regarding infection control in the operating room.

Subjects and Methods:

Research design:

A quasi-experimental research design was used to conduct this study.

Settings:

The study was conducted in the operating room at Beni-Suef University Hospital.

Sample:

A convenient sample included all available nurses (60) who are working in the above mentioned study setting. There were divided into ten subgroups of about 6 nurses who attended the mind mapping training in this study.

Three tools were used for data collection:

Tool (1): A structured Interview Questionnaire:

The researcher created it after examining national and international-related literature. This tool was made up of two pieces, which were as follows:

Part 1: This section contained information regarding nurses' demographic features such as age, gender, education, and years of experience.

Part 2: This section included information on nurses' attitudes toward using mind mapping strategies in infection control training, nurses' knowledge of mind mapping after being lectured on mind maps and how they can be used in infection control training, and nurses' preference for mind mapping in training **(Abdel Hamid, 2017; Wilson and Chris, 2019)**.

Tool (II): Nurses' knowledge about infection control (pre/post): It was developed by the researcher after reviewing the national and international related literature (**Goodman, & Spry, 2017 & Elkin et al., 2019**) to assess nurses' knowledge of infection control precautions, such as hand washing, antiseptic for skin, intravenous infusion, a safety box, cleaning of surgical instruments, safe disposal of medical waste, gloves, and acupuncture through needles or other sharp objects.

Scoring system of nurses' knowledge:

Three points were given when nurses provided correct and comprehensive information about infection management, two points when they provided right but partial information, and one point when they provided incorrect information. Score, with 0 being regarded as unacceptable and 70% being rated satisfactory.

Tool (III): an observational checklist (pre/post):

Part I: Operating Room Preparation It includes 96 items: hand washing (16), putting on overshoes (1), wearing a cap (5), wearing a mask (8), surgical hand scrub (28) items, wearing sterile gloves (14) items, wearing sterile gown (11) items, and keeping aseptic technique measure (13) items. Part II: During the procedure, it includes protecting the sterilization equipment, using sterilized linens, preparing the skin on the operating table, opening sterile packages, using solutions, and moving the surgical team from the sterile to the sterile area only sanitized people and sterile materials come into contact with the sterile region. It includes 64 things for managing laboratory specimens and sharps. Part III: Post-Anesthesia Care Unit (Recovery Period). It includes removing restraints and applying a sterile dressing to the incision, checking the patency and connections of all drainage tubes, and monitoring the flow rate of parenteral infusions. The patient's cleanliness and dryness are prioritized, and the gown is changed, which includes removing gloves, removing the cap, removing the mask, removing goggles / Face shields, removing the boot, removing the gown, cleaning, disinfecting equipment, and sterilizing **(Centers for Disease Control and Preventive (CDC), 2016).**

Scoring system:

Each correct answer received one point, while incorrect answers received zero. The practice received a total of 70 points. The total score for infection control precaution practice was divided into two categories: competent (≥70%) and incompetent (< 70%).

The development of booklet guidelines about standards precaution of infection control in the operating room was prepared after an extensive review of related literature to include the standards of infection control in the operating room. It included hand washing, surgical hand scrubbing, correct steps to wearing personal protective equipment, application of aseptic technique principles, opening a sterile package, skin preparation, draping, cleaning, disinfection, and sterilization of surgical instruments.

Administrative and ethical considerations:

The dean of Beni-Suef University's faculty of nursing granted formal approval to the manager of the previously selected setting. Each volunteer nurse who agreed to take part in the trial signed an informed consent form orally. All nurses were informed of the goal and procedures of the study, as well as their

rights to participate or not participate, and their ability to withdraw without explanation.

Procedures:

Preparatory phase:

This phase started with a review of current and previous local and international related literature regarding the study's subjects, including textbooks, papers, journals, and websites to obtain an understanding of the scope of the study, guide and create educational sessions and data collection techniques.

Tool Validity:

The validity was tested for content validity by a jury of five experts in the field of medical-surgical nursing specialty to ascertain relevance and completeness; reviewed the questionnaire and the intervention for content validity. Their comments were reviewed and no modifications were done.

Tool Reliability:

The reliability of test-retest was applied. Cronbach's alpha coefficients were used to determine the tools' internal consistency. The knowledge questionnaire tool had a Cronbach's alpha of 0.89 and the observational checklist tool had a Cronbach's alpha of 0.93, indicating reliability.

Pilot study:

A pilot study was conducted on 10% of the sample (6 nurses) who were involved in the research. The goal of the pilot study was to ensure that the measurements were clear and applicable and that the time required to complete the tools was sufficient. Because the data collection procedures were not changed, nurses who participated in the pilot study were included in the sample.

Fieldwork:

Data were collected over six months, commencing in January 2021 and ending in June 2021. The researcher collected data from 9:00 a.m. to 11:00 p.m. three days a week. During the shifts, the sample was broken into small ten subgroups of six nurses. First, the researcher presented the study's purpose and aims for nurses to get their oral consent to participate in the study.

Assessment phase:

In the first week, the researcher describes the study's purpose (1st day). The data was acquired utilizing a simplified Arabic language and a structured interview questionnaire issued to nurses at work during their lunch break. The material was then gathered and analyzed by the researcher to assess their needs and knowledge gaps. By the end of the first week, all nurses had been evaluated.

Preparation phase:

- The researcher began arranging the lecture room beside the operating room for the theoretical section of the training sessions during the second week. Revise and rebuild the prepared educational sessions, incorporating missing items that fulfill nurses' demands and knowledge gaps. Create a schedule ahead of time that includes the time, place, and number of nurses who will participate in the sessions.

Supportive materials:

To educate infection control, the researcher used CD instructions, papers and colored pens, a laptop, colored posters, PowerPoint, and a handout of the design mind map.

Implementation phase:

This study's educational sessions consisted of four sessions in which nurses were divided into small groups of 6 nurses to aid in the learning process. The length of each session varied depending on the topic and answers of the nurses.

The first session focused on teaching methods and mind maps as an innovative training strategy (what does it mean, materials needed to apply mind map, How can be applied in training on infection control applications, and the benefits of its application). This class will take about 45 minutes (11.00 am: 11.45 am).

- The second session will cover how to use a mind map to aid in infection control in the operating room (hand wash, waste management, instruments cleaning, and general principles of infection control).

This class will last about one hour.

- The third session: Second week (first day): beginning at 11.45 a.m. until 12.45 p.m. Begin in the operating room lecture room by asking for comments on prior sessions as well as the objectives of the current topic (mind mapping), bearing in mind that basic and clear language would be appropriate for all levels of nurses. To demonstrate the mind map method, the researcher employs paper, colored pens, and printed samples. The nurses next demonstrated a mind map for half an hour using paper and colored pens.
- The fourth session: Second week (second day): began by gathering comments on previous sessions as well as the objectives of the new topic (infection control themes), which the researcher did in the lecture room with nurses utilizing paper and colored pens as well as a laptop to project a PowerPoint presentation. The nurses then demonstrated how to create a mind map to apply infection control principles using paper and colored markers.
- Apply mind maps to infection control issues in the operating room during the third week (1st day).
- During the third week (2nd day), the researcher applies a mind mapping strategy to infection control themes for each sample group until the end of the week.
- In the fourth week (1st to 4th day), the researcher uses paper and colored pens to create a mind mapping strategy in infection control topics for each group of nurses and answers their questions about infection control precautions and how to apply principles while dealing with a lack of equipment, facilitators, increased patient flow, and an insufficient number of nursing staff, all of which can lengthen session times.

Sessions included two theoretical sessions as follows:

• What is a mind map, exactly? What resources are needed to use a mind map, and how can it be used in infection control training? , as well as the benefits of using it (It will just take one session)

• Infection control precautions in the operating room section (hand wash, waste management, instruments cleaning, and general principles of infection control).

It includes the two practical sessions listed below:

• Using a mind map to explain infection control principles and prevention. (There are two sessions required.)

Evaluation phase:

In this phase, the researcher evaluates the effect of the mind mapping strategy on nurses' knowledge and practice regarding infection control measures in the operating room through the posttest after one-month of educational sessions implementation using the same pretest tools and observational checklist.

Statistical Design:

The data was coded and placed into asocial science statistical software (SPSS Version.23.00). Quality control was carried out at the coding and data entry stages. For categorical data, descriptive statistics in the form of frequencies and percentages were utilized, whereas means and standard deviations were used for continuous quantitative variables. To compare qualitative category data, the Chi-square (X2) test was utilized, with the hypothesis that the row and column variables are independent, but without revealing the degree or direction of the link. To compare qualitative variables, the chi-square test, T-test, and F-test were utilized. Statistical significance was determined when the P-value was less than 0.05 and the difference was $p < 0.001$.

Results:

Table (1) shows that 53.3% of the studied nurses were ≤30 years and 96.7% of them were females. Concerning the qualifications of the studied nurses (63.3%) of them were technical nurses. Regarding years of experience, (40%) of them had experience ≤ 5 years, and (36.7%) had experienced 6-14 years.

The data presented in **Figure (1)** reveals that (88%) of the studied nurses collected the information from classroom teaching.

Figure (2): reveals that all of the studied nurses (100%) of them did not use a mind

mapping strategy in their previous training

Table (2) illustrates that there was a statistically significant improvement and the difference between nurses' knowledge regarding infection control precautions pre and post-using mind mapping strategy (P<0.001).

Figure (3**)** showed that 36% of the studied nurses had an unsatisfactory level of knowledge about infection control precautions in the operating room using mind mapping in the pretest but post-intervention, all of them (100%) had a satisfactory knowledge level.

Table (3) illustrates that there was a statistically significant improvement in nurses' practice regarding infection control precautions (cleaning and disinfection and sterilization of surgical instruments) pre and post-using mind mapping strategy (P<0.001).

Figure (4) shows the total practice scores of the studied nurses' pre and post-using mind mapping strategy. Pre-using the mind mapping strategy, it was revealed that (61%) of the studied nurses had incompetent practice regarding infection control **in the operating room**, which decreased to 5% post using the mind mapping strategy. However, 39% of the studied nurses in the study had competent practice pre-using mind mapping strategy, but post one month of using the mind mapping strategy, 95% of the studied nurses increased their practices with a statistically significant difference.

Table (4) demonstrates that there was a significant positive correlation between nurses' knowledge and practice pre and post-using mind mapping strategy at (p <0.05**).**

Table (5) reveals that 40% of nurses' opinions about using mind mapping strategy in training, regarding infection control precautions after training were reported as excellent and 90% of them prefer using mind mapping strategy in training.

Table (1): Frequency and percentage distribution of the studied nurses according to their demographic characteristics (N = 60)

Demographic characteristics	N0.	%
Age (Years)		
≤ 30 years	32	53.3
≥30 years	28	46.7
Gender:		
Male	2	3.3
Female	58	96.7
Qualifications:		
Technical	38	63.3
-Diploma in Nursing	22	36.7
Years of experience:		
≤ 5 years	24	40
6 – 14 years	22	36.7
15 - 25 years	14	23.3

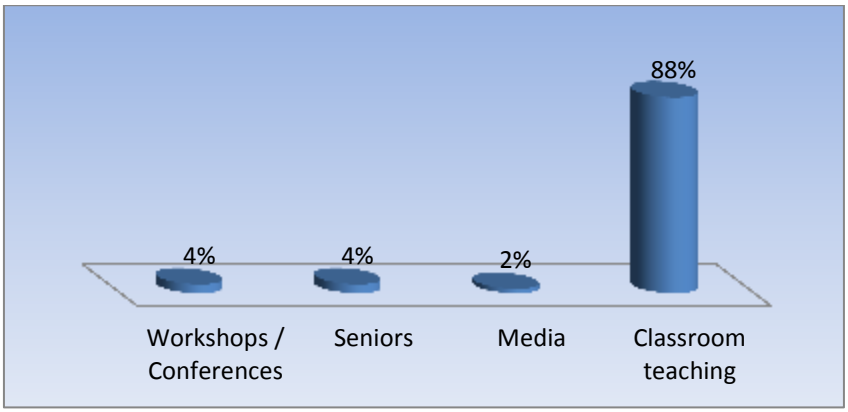

Figure (1): Percentage distribution of the studied nurses regarding their source of information about infection control precautions (N = 60)

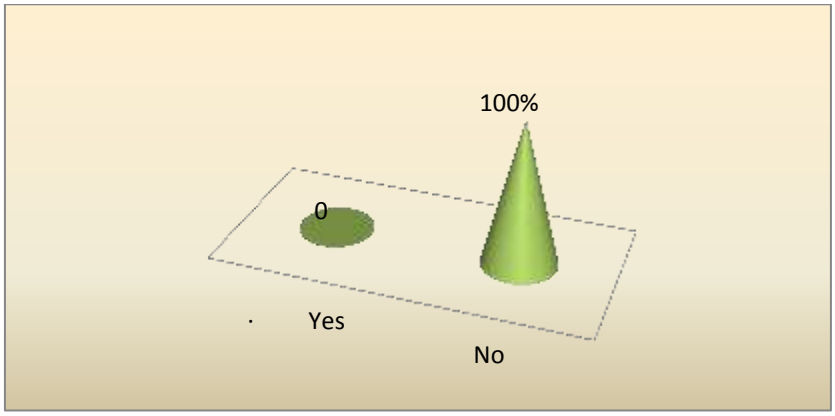

Figure (2): Distribution of the studied nurses regarding previous using mind mapping strategy in the operating room (N=60)

Table (2): Frequency and percentage distribution of the studied nurses according to their correct knowledge about infection control precautions in operating room pre and post-using mind mapping (N = 60)

Nurses' knowledge about the infection control precautions	Study Group (n= 50)				X2	P-value
	Pre- using mind mapping		Post- using mind mapping			
	No	%	No	%		
Infection controlprocess.	46	76.7	60	100.0	148.73	0.001
Methods of prevention of infection control	52	86.7	60	100.0	172.54	0.001
Knowing standard universal precautions	54	90.0	60	100.0	148.67	0.001
Knowing transmission-based universal precautions	50	83.3	60	100.0	112.23	0.001
Hand washing and scrubbing	52	86.7	60	100.0	143.38	0.001
Wearing a sterile gown in operations	46	76.7	60	100.0	84.13	0.001
Wearing sterile gloves	30	50.0	60	100.0	58.47	0.001

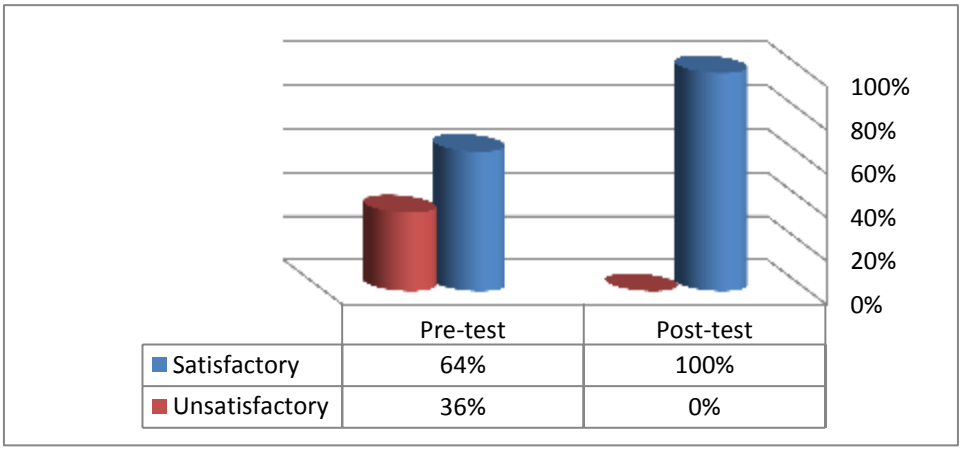

Figure (3): Percentage distribution of the studied nurses according to their total knowledge level about infection control precautions in operating room pre and post- using mind mapping strategy (N = 60)

Table (3): Frequency and percentage distribution of the studied nurses according to their practice about infection control precautions in operating room pre and post- using mind mapping strategy (N = 60)

Nurses‟ practice regarding infection control precautions	Pre				Post				X^2	P-value
	Done		Not done		Done		Not done			
	No	%	No	%	No	%	No	%		
Cleaning	24	40.0	36	60.0	60	100.0	0	0.0	46.53	<0.001
Disinfection and sterilization of surgical instruments in the operating room	22	36.7	38	63.3	60	100.0	0	0.0	39.45	<0.001

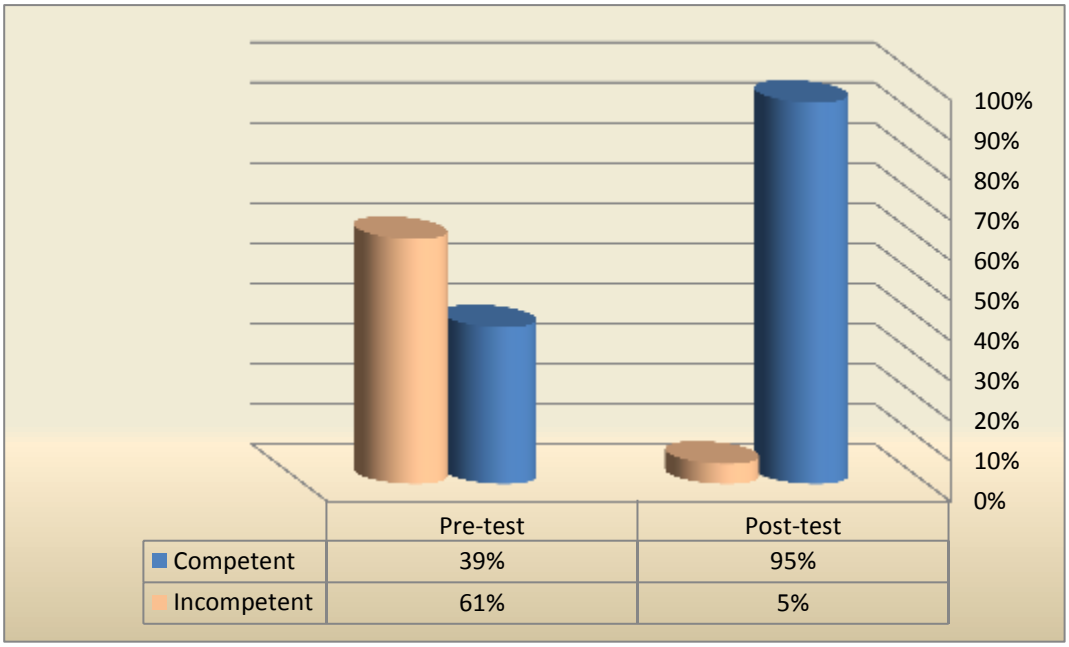

Figure (4): Percentage distribution of the studied nurses according to their total practice level about infection control precautions in operating room pre and post- using mind mapping strategy (N = 60)

Table (4): Correlation Co-efficient between the knowledge and practice pre and post-using mind mapping strategy

Correlation	practice	
	R	P
Knowledge		
Pre-using a mind mapping strategy	0.176	0.363
Post using mind mapping strategy	0.374	0.048*

Correlation is significant at the 0.05 level **.

Table (5): Distribution of the studied nurses' opinions after using the mind mapping strategy (N=60)

Nurses' satisfaction with Mind mapping	N0.	%
Nurses' satisfaction with using mind mapping strategy in training, regarding infection control precautions after explanation		
• Excellent	24	40
▪ Very Good	22	36.7
▪ Good	12	20
▪ Acceptable	2	3.3
Preferring use a mind mapping strategy after training?		
• Yes	54	90
▪ No	6	10

Discussion:

Mind maps are used to organize the interactions and connections between ideas and information. To help solve this, various new technologies have evolved in the modern era. As a result, using mind mapping as a study tool to develop obvious links and relationships between topics may help trainees deliver more effective training **(Eshwar et al., 2019).**

In terms of the features of the nurses analyzed, the current study found that the majority of them are female. This finding is consistent with **Malan (2019) and Labrague et al. (2018),** who claimed that two-thirds of the population is female. This conclusion is related to the fact that the majority of nurses are females. There has recently been an upsurge in the number of male nurses.

The current study found that more than half of nurses were between the ages of 30 and 40. According to the years of experience, fewer than half of the nurses have less than 5 years of experience, and half of the nurses have technical nursing education. This finding is consistent with **Khalifa (2018**), who conducted a study on "Assessment of nurse's performance regarding reducing or prevention of nosocomial infection for patients with cancer suggested nursing" and found that more than half of nurses were under the age of 25, and less than half had less than 5 years of experience.

This finding was consistent with the findings of **Mohammed et al., (2019**), who examined the "Effect of Teaching Program on Nurses' Performance Regarding Drugs that Affect Blood Coagulation in Coronary Care Unit" and discovered that the majority of the nurses studied were between the ages of 20 and 30, females, from a technical nursing institute, and had less than five years of experience. Furthermore, **Shorofi and Arbon (2017**) discovered that the majority of nurses working in ICUs were between the ages of 20 and 40, married, female, and held a diploma in nursing, with more than half having more than 5 years of experience.

The finding of the present study indicated that all of the studied nurses did not use a mind mapping strategy in their previous training. From the researchers 'point of view, these results reflect the need of the studied nurses for mind mapping strategy application.

This conclusion contradicts the findings of **Khalifa (2018**), who claimed that less than half of the nurses included in the study did not attend training courses, and of those who did attend training courses, the majority of them did not attend infection control training courses. This finding is consistent with the findings of **Alaaa-Eldeen et al., (2017**), who studied "General Nursing Measures Implemented for Control & Prevention of Nosocomial Infection in The General" and reported that all nurses had no training program related to anesthesia and patient safety, as stated by **Marquis & Huston, (2019**). The better trained and more skilled the personnel, the less staff required, saving the company money and increasing reproductive capacity.

Regarding the nurse's knowledge, the results showed that there was a statistically significant improvement and the difference between nurses' knowledge regarding infection control precautions pre and post-using mind mapping strategy.

The current study found that more than one-third of the nurses tested had an unacceptable level of knowledge of infection control precautions in the operating room using a mind mapping approach in the pretest, but after the intervention, all of them had a sufficient level of knowledge. According to the researchers, this could be because nurses did not undergo prior infection control training since there was no pre-employment orientation program, there were not enough nurses, and there was a lack of understanding. This could also be attributed to a lack of up-to-date information, as fundamental education was not included in either diploma or degree curriculum. On the other hand, Egyptian nurses, particularly those who engage in bedside care, are overworked as a result of the nursing shortage in the nursing staff. Therefore, they have limited time to enhance their knowledge.

This finding reported that give the incorrect answer about hand washing, agrees with **Hassan et al., (2017**), who studied " Assessment of existing practices in the operating theatre in the Khartoum North Teaching " and mentioned that one-third of the nurses incorrectly answered the question about the proper routine and surgical hand washing, one-third of nurses give the incorrect answer about the need to wash hands after take-off glove, one-third of nurses give the incorrect answer about the need to wash hands after take-off glove

Similarly, **Abdel Hamid (2017**) did a study on "Mind maps as a novel teaching technique for medical students" and reported that in medical education, utilizing a mind mapping strategy allows students to better integrate information and organize it. As a result, information is more easily remembered.

Supporting previous findings by **Bawaneh (2019**), who investigated "The Effects of Herrmann Whole Brain Teaching Method on Students' Motivation towards Science Learning" and recommended using mind mapping as the majority recommend integrating using mind mapping strategy during their training and using it in workshops, as well as taking part in clinical work, while a small number of the sample recommends using exciting teaching methods to obtain information.

These findings are congruent with those of other investigations. **Akinoglu and Yasar (2017)** studied "The effects of note-taking in science education through the mind mapping technique on students' attitudes, academic achievement, and concept learning" and **Balm (2016**) studied "Use of technology-assisted techniques of using mind mapping strategy and concept mapping in science education: a constructivist study" and emphasized the importance of using mind mapping strategy in improving studied sample's achievement and unintended consequences.

The current study's findings supported the introduction of infection control applications utilizing a mind mapping technique to increase nurses' knowledge and infection control practices. Furthermore, all of the nurses evaluated had a good level of knowledge after implementation, which, according to the researcher, represented a considerable improvement in nursing staff knowledge after using the mind mapping approach for infection control application.

The result of the current study showed that most of the studied nurses had satisfactory levels of knowledge post-intervention. This is reflected in the positive effects of using the mind mapping strategy.

In terms of nurses' practice, the current study found that there was a statistically significant improvement in nurses' practice regarding infection control precautions in operating rooms before and after applying the mind mapping approach. This validated the mind mapping concept as a method for quickly organizing staff education while assessing learners' comprehension of essential material (**Kalyanasundaram et al., 2020).** This highlighted the significance of mind maps in boosting the attainment and comprehension of the tested sample.

This finding contradicts **Kabir (2018**). They investigated "Nurses' knowledge and practice about surgical site infection prevention in Bangladesh" and discovered that the nurses had a high degree of practice.

Spoorthi et al. (2019) found that the

"mind mapping approach helped them understand concepts and ideas in science." It enables employees to connect tales using patterns, keywords, or symbols. Furthermore, the mind mapping approach can be utilized in self-learning; it increases conceptual understanding of a large quantity of information, integrates concepts, promotes inquiry and reflection, and helps bridge the gap between theory and clinical competence (**Wilson et al., 2016**)

Similarly, **Farrand et al. (2020**) discovered that spider diagrams (similar to mind maps) had a substantial impact on memory recall in undergraduate students when compared to preferred study methods in their study "The efficacy of the mind map' study approach." For those in the diagram group, the improvement was only strong after a week, and there was a considerable loss in motivation when compared to the individuals' preferred ways of note-taking. According to a meta-study on the mind mapping approach, it is more effective than "reading text passages, attending lectures, and engaging in class discussions."

The same study, also titled "Mind mapping: An efficient technique for note-taking," conducted by **Tee et al., (2020**), indicated that mind mapping is marginally more beneficial "than other constructive activities such as writing summaries and outlines." The authors noted that "substantial heterogeneity was detected in most subsets," yet the results were inconclusive. Furthermore, they concluded that low-ability kids may gain more from mind mapping than high-ability children.

The current study found a substantial beneficial link between nurses' knowledge and practice before and after employing a mind mapping approach. This relationship describes how more information leads to more practice. Furthermore, when the nurses in the study gained adequate knowledge, they were able to practice effectively. This finding was consistent with the findings of **Eshwar et al., (2019**), who conducted a study titled "Comparison of mind mapping and lecture-based teaching-learning method among dental undergraduates using solo taxonomy in Bangalore." The study stated that active learning methods and models are frequently used in educational sciences. Although the usage of these strategies in nursing education has lately expanded, the number of studies is insufficient.

According to the findings of the current study, two-fifths of nurses' thoughts on using mind mapping strategy in training, regarding infection control precautions after training, were rated as outstanding, and the majority of them preferred using the mind mapping method in training. According to the researchers, this demonstrates the significance of using a mind mapping approach in the study. Because maps are believed to be particularly rich in images, drawings, and shapes with various and appealing colors, a mind map creates the greatest methods for transferring and remembering knowledge and information. 90% of the brain's inputs come from visual sources, where the brain has an innate response to symbols and images that have a substantial influence on retaining concepts and information.

Conclusion:

Based on the findings of the present study concluded that using the mind mapping strategy had a positive effect on improving nurses' knowledge & practice in the operating room.

Recommendations:

In the light of the findings of the study, the following recommendations are suggested:

- The study recommended that the mind mapping strategy should be integrated as an effective method of nurses' training.
- It is critical to provide an initial workshop on the theoretical and technical aspects of mind mapping for infection control committee members from doctors and nursing supervisors, as well as regular formative and summative feedback.
- Further studies and replication of the

current study with a larger sample of nurses in different settings are required for generalizing the results.

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