

Effect of Mind Map Using on Improving Nurses' Performance Regarding Infection Control at Surgical Departments

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Abstract

Background: A mind map is an educational strategy for breaking down a large amount of information into manageable chunks. The trainer then connects these minor sub notions till the knowledge is fully absorbed. This method can be used in nursing school to help students absorb a huge amount of knowledge. **The aim was to** evaluate the effect of mind map using on improving nurses' performance regarding infection control at surgical departments. **Subjects and method:** **Design:** A quasi-experimental research design was utilized to fulfill the aim of this study. **Setting:** the study was conducted in Medical-Surgical departments, South Vally University Hospitals. **Subjects:** A convenient sample technique of a total of 50 nursing staff in the Medical-Surgical department was recruited in the study. There were divided into subgroups about 6 to 7 nurses have attended that used mind mapping as a study tool. **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' opinion 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 present study concluded that the mind map strategy used had a positive effect on improving nurses' knowledge & practice in medical-surgical departments. **Recommendations:** The study recommended that the mind map strategy should be integrated as an effective method of nurses' training.

Keywords: Mind Map, Nurses' performance, Infection control

Introduction:

Nurses have a professional and legal obligation to ensure that cross-infection does not spread to the patient. Nursing staff employees must be taught and trained to increase the quality of health care and gain new information and abilities (Elkin M, Perry A, Potter P., 2019). Educational program are thought to be a way of giving nurses the theoretical and technical information they need to learn new skills and improve their practice. Assist nurses in accepting responsibility for their professional growth. Nurses' knowledge and practices in the area of infection control were lacking. Nurses' knowledge and practices

have improved statistically significantly as a result of the execution of a specially prepared curriculum (Emam EA, Hassan SA, El-Moghazy D, Mohamed NS, 2015).

The backbone of a well-organized department is a well-trained nurse. Today's technical and scientific breakthroughs in nursing, as well as rising consumer demand for high-quality health care, compelled nurses to stay current in a sector exploding with new material, necessitating the development of nursing staff education (Derrick, S., Inhorn, E., and Cowan, T., 2017).

Nursing and medical schools around the world have seen changes in educational and

training programmes and teaching strategies aimed at increasing students' active participation and responsibility for their learning, with a greater tendency toward self-directed learning and training to ensure lifelong continuing education (**Ponikowski et al., 2016**).

Educators were concerned that students were more likely to memories facts ("rote learning") rather than analyze and apply concepts ("meaningful learning"). Brainstorming, organizing ideas, taking notes, learning collaboratively, presenting, and studying are all approaches used in problem-based learning. Furthermore, critical thinking is becoming increasingly important in nursing education and training, and many instructional ways to apply it have been established (**Elkin, Perry & Potter, 2017**).

Problem-based learning, case-based teaching, didactic learning, and web-based teaching are examples of active learning methods that have been shown to promote students' critical thinking. These methods assist pupils in learning and integrating information. Although the efficiency and applicability of these learning strategies vary, they are all based on the constructivist theory of learning. Learning with understanding occurs when learners integrate new information with their existing knowledge, according to this learning theory. Mind mapping and concept mapping as learning methodologies are based on constructivism, and both are promising concepts in medical education (**Abd El-Hamid, 2017**).

Students' abilities to construct treatment plans and health promotion initiatives, as well as synthesize disease processes and form differential diagnoses, would be enhanced by such innovative techniques. This, however, necessitates active teaching and learning methodologies, posing a new challenge for nurse educators (**Ahmad, Imad, Faeda, & Lubna, 2015**).

Understanding how to support paramedical members in their learning journey through various teaching and learning strategies has grown in popularity in recent years, and as a result, there has been an increase in the publication of learning

strategies used in medical education that may help nurses learn and integrate information (**Wilson and Chris, 2019**).

Nurse educators and trainers should design learning experiences that encourage nurses to think critically and learn more effectively. Nurses can use mind mapping to engage in a unique type of learning that can help them broaden their memory recall and create a new environment for processing knowledge. In the early 1980s, this method was devised (**Phillips, Heneka, Bhattarai, Fraser, & Shaw, 2019**).

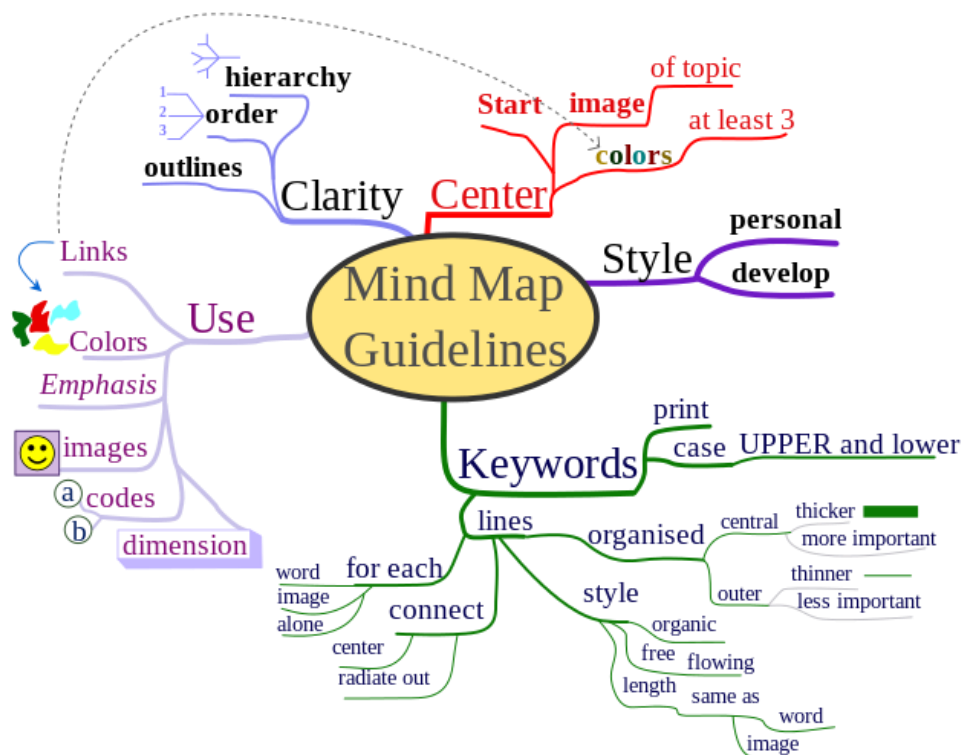
New instructional tools in nursing education, such as a concept map, are employed to help nursing students deal with pregnant women efficiently based on scientific and organized knowledge. The nurse's duty as an educator includes attempting to provide accurate information to pregnant women, striving to reduce the impact of health problems on their health, ensuring that they are not inactive and isolated, and enabling them to be active agents in their health care plan. Nurses as educators have the chance to meet pregnant women at MCH centers and talk with them one-on-one to provide them with the information, knowledge, and skills they need to make acceptable choices and decisions for their health care plan (**Pintrich and De Groot, 2015**).

The use of "mind maps" to portray facts in medical information has lately become popular in educational materials aimed at improving memory. The goal was to see how effective mind maps were as a self-study tool. Because mind maps are a potent metacognitive tool for facilitating knowledge acquisition through meaningful learning, they can be utilized to encourage and evaluate critical thinking (**Abdel Hamid, 2017**).

The mind map (MM) is a powerful graphic technique that can be applied to improve learning and clearer thinking. the mind map can be used as a self-learning method that facilitates the understanding of difficult concepts. A learning strategy underutilized in medical education is MM. MMs are multisensory tools that may help medical students organize, integrate, and retain information (**Buzan and Buzan 2010**).

Buzan makes the following recommendations when mind mapping (<http://www.mindmapexample.com/samples.php>, **Buzan and Buzan 2010**). 1. Place an image or topic in the center using at least 3 colors 2. Use images, symbols, codes, and dimensions throughout your Mind Map. 3. Select keywords and print using upper or lower case letters. 4. Each word/image is alone and sitting on its line. 5. Connect the lines starting from the

central image. The central lines are thicker, organic, and flowing, becoming thinner as they radiate out from the center. 6. Make the lines the same length as the word/image. 7. Use colors-your code-throughout the Mind Map. 8. Develop your style of Mind Mapping. 9. Use emphasis and show associations in \Mind Map. 10. Keep the Mind Map clear by using radial hierarchy, numerical order, or outlines to embrace your branches.



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

Learners create a relationship between unknown and known knowledge through mind maps, which leads to deeper comprehension. It is a highly effective method of taking notes and aids in the recollection of previous memories. This style of teaching and learning does not teach students to think, but rather assists them in actively acquiring information. Because the nurse does not utilize a template or flow chart to guide their thinking when mind mapping, the mapping represents the nurse's interpretation and integration of ideas, resulting in meaningful learning. A richer and deeper integration of information can develop both declarative (explicit) and implicit knowledge

linked with critical thinking and long-term learning (**Wilson and Chris, 2019**).

Medical-surgical nurses serve a critical role in ensuring the safety and well-being of patients. Nurses have several tasks, including ensuring that the operating room is equipped with the correct devices and processes for inspecting tools, linens, medicine administration, and scraping preparations. It is also critical that the nurse provides the patient with accurate information about the procedure to alleviate fear and provide descriptions of the surgical interventions (**Goodman, & Spry, 2017**)

Significance of the study:

Infection control has recently gained a lot of media attention. Infection control standards must be followed by all employees in any setting, notably medical-surgical departments, to maintain a safe atmosphere free of the risk of disease spreading to patients and coworkers. The initial infection control orientation and reprocessing competencies should be completed by everyone who reprocesses instruments. Validation and documentation of competency reviews and infection control updates should be done on an annual basis (**National survey shows healthcare facilities implementing PPE crisis standards of care, 2021**).

Nurse educators are under pressure to develop trainees, who are capable of thinking critically, working hard, being more creative, and solving problems in a range of clinical practice settings to implement infection control principles. Instead of depending on traditional approaches that promote recall and memorization, they require active teaching practices to foster meaningful learning. According to a review of the present state of the science on mind mapping, this teaching-learning strategy can help nurse educators educate trainees to think critically in the complicated healthcare setting (**Abdel Hamid, 2017**). Therefore, the researcher was wanted to evaluate the effect of mind map using on improving nurses' performance regarding infection control at surgical departments.

Aim of the study

The study was aimed to evaluate the effect of mind map using on improving nurses' performance regarding infection control at surgical departments through:

- Assessing nurses' knowledge regarding infection control by using mind map strategy.
- Assessing nurses' practice regarding infection control by using mind map strategy.
- Determine the effect of using mind map strategy improving nurses' performance regarding infection control at surgical departments.

- Assess level of nurses' satisfaction regarding mind map using at surgical department

Research hypothesis:

Using mind mapping will have a positive effect on improving nurses' performance regarding infection control at surgical departments.

Subjects and Methods:**Research design:**

A quasi-experimental research design was utilized to fulfill the aim of this study.

Settings:

The study was conducted in the Medical-Surgical departments, South Vally University Hospitals.

There was a lecture room which involved an adequate number of seats, and data show where the researchers interviewed the recruited nurses to conduct this study. This unit was composed of five rooms which contained 12 beds. These settings were selected because of the high prevalence of patients in the selected settings and also, it serves the biggest region of the population.

Sample:

A convenient sample included all nurses working of 50 nurses in the Medical-Surgical department were recruited in the study. There were divided into subgroups about 6 to 7 nurses have attended that used mind mapping as a study tool.

Three tools were used for data collection:**Tool (1): A structured Interview Questionnaire:**

It was developed by the researcher after reviewing the national and international related literature. This tool consisted of two parts as the following:

Part 1: This part included data about nurses' demographic characteristics as nurses' age, gender, education, and years of experience.

Part 2: This section included information on nurses' satisfaction after using mind map in previous training regarding infection control precautions, nurses' knowledge

about mind maps after being lectured on mind maps and how they can be used in infection control training, and preferring mind map in training (Abdel Hamid, 2017; Wilson and Chris, 2019).

Scoring system:

The total nurses' satisfaction score was 5 marks. Each reported yes response received one mark, while no answer received a zero mark.

Tool (II): Nurses' knowledge about infection control (pre/post): It was developed by the researcher after reviewing the national and international related literature (National survey shows healthcare facilities implementing PPE crisis standards of care, 2021; Goodman, & Spry, 2017; Ahmad, Imad, Faeda, & Lubna, 2015).

To meet the study's objectives, it was designed to assess nurses' knowledge of infection control precautions, such as hand washing, appropriate isolation precautions, 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. Infection control also employs a mind map technique to improve nurses' knowledge and performance when it comes to infection control precautions.

Scoring system of nurses' knowledge:

- Incorrect answer: scored zero
- Correct answer: scored one

The researcher updated (CDC, 2016) to measure nurses' awareness of infection control precautions in their practice in medical-surgical units. It has 15 questions, with a total score of 15, a satisfactory score of 10 to 15, and an unsatisfactory score of less than 10.

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

It was designed to assess nurses' performance in providing infection control precautions to patients via various methods, as recommended by (APIC, 2017) and modified by the researcher. It covers infection control procedures such as hand hygiene and how to put on and take off personal protective

equipment (PPE), as well as applying and removing infection control principles while performing various nursing tasks such as wound care, sterilization, wound dressing, emergency medications, and intravenous infusion administration, cannulation, blood transfusion, handling oxygen equipment, vital signs assessment, handling and brushing surgical instruments, and care and dressing. For all of the nurses who participated in the study at their workplaces, the researcher created a checklist (Operating and dressing room, surgical and medical unit, Medication room, and handling of medical files)

Scoring system:

Each correct answer received one point, while incorrect answers received zero. The performance received a total of 70 points. The total score for infection control precaution performance was divided into two categories: satisfactory ($\geq 70\%$) and unsatisfactory ($< 70\%$).

The Educational Sessions was developed through four phases as following:

(I) Assessment phase:

The nurse's performance was evaluated in part during the teaching session. After describing the study's aim and gaining their consent to participate, the evaluation was undertaken before the execution of the educational program by interviewing nurses to measure knowledge (pretest) using tools 1 and 2. This phase started shortly after gaining approval. After being identified, the nurses were discovered in in-hospital medical and surgical departments, operating rooms, dressing rooms, and surgical units. Nurses fill out the questionnaire sheet throughout their morning shift. The questionnaire form takes anything between 10-15 minutes to complete. The procedures of the nurses were also scrutinized.

Planning phase

(II) The researcher created the training sessions using the results of the interview sheet and observational checklist (from the pilot study and evaluation phase), as well as a review of the relevant literature. The goal and objectives of the instructional

sessions were generated from the stated needs, requirements, and shortcomings. The content was picked depending on the needs that were established. Laptop lectures, group discussions, demonstrations, colored posters, and a handout of the design mind map contents accompanied by the researcher's images were among the materials used in the sessions, which encompassed theoretical and practical information.

Implementation phase:

This study's educational sessions consisted of five sessions in which nurses were divided into small groups of nine to ten nurses to aid in the learning process. The length of each session varied depending on the topic and answers of the nurses. It lasted between 30 and 45 minutes. The first session covered mind map strategy, the second and third sessions covered infection control precautions, and the fourth and fifth sessions covered using mind maps as a teaching tool and using mind maps in infection control instruction. Each session began with a recap of the previous session, followed by an explanation of the next session's objectives in Arabic and simple English phrases appropriate to the nurse's level of education. Nurses' performance was improved by using motivation and reinforcement throughout sessions.

Evaluation phase:

During this phase, each nurse in the study sample was questioned individually shortly after educational health sessions were completed to measure their knowledge (posttest) using tools one, two, and three.

After two months, the nurses in the study sample were appraised for follow-up and distributed tools one, two, and three.

Supportive materials:

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

Administrative and ethical considerations:

The manager of the previously selected

setting and the director of the medical-surgical department each received written approval from the dean of South Valley University's faculty of nursing. Each nurse who volunteered to participate in the trial signed an informed consent form orally. All nurses were told of the study's purpose and procedures, as well as their rights to participate or not participate, as well as their right to withdraw without explanation.

Procedures:

Preparatory phase:

This phase began with a review of current and previous local and international related literature about the various aspects of the study's subjects, using textbooks, articles, journals, and websites to gain an understanding of the scope of the study, guide and prepare educational sessions, and data collection tools.

Tool Validity:

The validity was tested for content validity by a jury of three experts in the field medical-surgical nursing specialty to ascertain relevance and completeness; reviewed the questionnaire and the intervention for content and face 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 0.86 and the observational checklist tool had a Cronbach's alpha of 0.96, indicating reliability.

Pilot study:

A pilot study was conducted on 10% of the sample (5 nurses) who were involved in the research. The goal of the pilot study was to ensure that the measurements were clear, 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 collections were done in five months from the beginning of February 2021 to the end of June 2021. The researcher collected

data for 3 days per week from 9:00 am to 11:00 pm. The sample was divided into small subgroups of 9 to 10 nurses during the shifts. Firstly the researcher has clarified the aim and the objectives of the study to nurses gain their oral acceptance of participants in the study.

Assessment phase:

The researcher discusses the study's goal in the first week (1st day). The information was gathered using a simplified Arabic language and a structured interview questionnaire that was distributed to nurses during their lunch hour at work. The researcher then gathered and examined the information to determine their needs and knowledge gaps. By the end of the first week, all nurses were assessed.

Preparation phase:

The second week: The researcher began preparing the lecture room at the medical-surgical department to conduct the theoretical portion of the training sessions. Revise and revamp the prepared educational sessions, including missing things that meet the needs and knowledge gaps of nurses. Inform the nurses ahead of time by creating a schedule that includes the time, location, and several nurses that will participate in the sessions.

Implementation phase:

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

- The second session is about using a mind map to help with infection control in the medical-surgical department (hand wash, waste management, instruments cleaning, and general principles of infection control). This class will last approximately one hour.
- Second week (first day): from 11.45 a.m. to 12.45 p.m. in the lecture room of the medical-surgical department, began by soliciting feedback on what had been presented in previous sessions as well as

the objectives of the new topic (mind mapping), keeping in mind that simple and clear language would be appropriate for all levels of nurses. The researcher uses paper, colored pens, and printed samples to show the mind map method. The nurses then exhibited a mind map using paper and colored pens for half an hour.

- Second week (second day): began by gathering feedback on what had been presented in previous sessions as well as the objectives of the new topic (infection control topics), which the researcher conducted with nurses in the lecture room using paper and colored pens as well as a laptop to project a PowerPoint presentation. The nurses then used paper and colored pens to re-demonstrate how to use a mind map to apply infection control principles. Every session, the researcher conducts a theoretical and practical posttest. To ensure that all sample subjects were covered, the technique was repeated in the third and fourth weeks.
- Apply mind maps to infection control issues in the medical-surgical department during the third week (1st day).
- During the third week (2nd day), the researcher applies mind maps to infection control themes for each sample group until the end of the week.
- In the fourth week (1st to 4th day), the researcher creates a mind map in infection control topics with the paper and colored pens 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.

Evaluation phase:

In this phase, the researcher evaluates the effect of the mind map used to improve nurses' performance regarding infection control at medical-surgical departments by the posttest after one-month educational sessions implementation using the same pretest tools and observational checklist.

Sessions included three theoretical sessions as following:

- What exactly is a mind map? What materials are required to use a mind map, and how may it be used in infection control training? , as well as the advantages of using it (It will just take one session)
- Precautions for infection control in the medical-surgical section (hand wash, waste management, instruments cleaning, and general principles of infection control). (It will just take one session)

It included the following two practical sessions:

- Explaining infection control principles via a mind map. (Two sessions are required.)

Statistical Design:

The collected data were coded and entered into a social science statistical package (SPSS Version.23.00). At the coding and data entry stages, quality control was performed. For categorical variables, descriptive statistics were used in the form of frequencies and percentages, whereas for continuous quantitative variables, means and standard deviations were used. The Chi-square (X²) test was used to compare qualitative category data, with the hypothesis that the row and column variables are independent, but without revealing the degree or direction of the link. The chi-square test, T-test, and F test were used to compare qualitative variables. When the P-value was less than 0.05 and the difference was p0.001, statistical significance was evaluated.

Results:

Table (1) shows that (62%) of the studied nurses were aged ≤ 25 years with a mean of (23.5 ± 4.6) years), and 70% of them were females. Concerning qualifications of the studied nurses (66%) of them were technical nurses and (34%) were high qualified nurses. Regarding years of experience, (48%) of them had experience from 6 to 14 years, and (32%) had experience ≤ 5 years.

Table (2) portrays that (34%) of nurses' opinions about mind maps used in training, regarding infection control precautions before an explanation was reported as acceptable.

Also, (84%) of them did not use mind map in their previous training, and 80% of them prefer mind map using after explanation.

Table (3) illustrated that the majority of the studied nurses as more than three-quarters of them demonstrated the wrong answer or were didn't know infection control precautions pre-intervention. It was noticed that the majority of nurses' knowledge had improved post-intervention than pre-intervention and there was a highly statistically significant difference between nurses' knowledge regarding infection control precautions pre and post ($P < 0.001$). Also, the same table illustrated a highly significant improvement in the post-test ($F = 32.9$, $p < 0.000$) in the mean total score of knowledge.

Figure (1) showed that 96% of the studied nurses had an unsatisfactory level of knowledge about infection control precautions in the pretest but post-intervention, (94.0%) of them had a satisfactory level of knowledge.

Figure (2) showed the total practice scores of the nurses before and after mind map using. Before the mind map using, it was revealed that (81%) of the nurses had inadequate practice regarding infection control at surgical departments, which decreased to 2% after the intervention. However, only 19% of the nurses in the study had adequate practice before the mind map using, but after one month, 98 percent of nurses increased their practices score with a statistically significant difference.

Table (4): Portrayed that there were highly statistically significances between practices level and all principles applied in various activities in medical-surgical departments regarding infection control precautions ($p \leq 0.001$).

Table (5): showed that there is no statistically significant correlation between demographic characteristics and total knowledge among the studied nurses at pre and post-intervention. There is a significant correlation between nurses' knowledge, gender, qualification, and years of Experience ($p = 0.001, 0.03, 0.04$) respectively at the pre-program.

Table (6) portrayed that age and gender, years of Experience there is a mild correlation at pre and post-intervention. Meanwhile, there is

a significant correlation regarding gender ($p > 0.05$) at pre-intervention, as well as regarding the qualification of nurses there is a mild significant correlation at post-intervention.

Table (7) showed the correlation between the total score of nurses' knowledge and

performance pre and post the mind map using; there was a significant positive correlation between the score of knowledge and the score of performance with statically significant differences ($p < 0.05$).

Table (1): Distribution of the studied nurses according to their demographic characteristics (N = 50)

Demographic characteristics	N0.	%
Age (Years)		
≤ 25 years	31	62
26 -36 years	19	38
Mean ± SD	23.5 ± 4.6	
Gender:		
Male	15	30
Female	35	70
Qualifications:		
Technical	33	66
High qualified nurse	17	34
Years of experience:		
≤ 5 years	16	32
6 – 14 years	24	48
15 - 25 years	10	20

Table 2: Distribution of the studied nurses' satisfaction after using mind map in previous training (N=50)

Nurses' satisfaction about Mind mapping	N0.	%
Nurses' satisfaction about mind maps using in training, regarding infection control precautions before explanation		
• Excellent	3	6
▪ Very Good	14	28
▪ Good	17	32
▪ Acceptable	15	34
Previous using of Mind Mapping in their studies:		
• Yes	8	16
▪ No	42	84
Preferring using this training after explanation?		
• Yes	40	80
▪ No	10	20

Table (3): Distribution of the studied nurses according to their knowledge about the infection control precautions pre and post-intervention (N = 50)

Nurses' knowledge about the infection control precautions	Study Group (n= 50)				X2	P-value
	Pre-intervention		Post-intervention			
	No	%	No	%		
Definition of infection control process						
• Incorrect.	37	74	2	4	148.73	0.0001
• Incomplete.	10	20	7	14		
• Correct.	3	6	41	82		
Chain of the process of infection					172.54	0.0001
• Incorrect.	43	86	3	6		
• Incomplete.	3	6	12	24		
• Correct.	4	8	35	70		
Appropriate isolation precautions					148.67	0.0001
• Incorrect.	37	74	6	12		
• Incomplete.	10	20	7	14		
• Correct	3	6	37	74		

Nurses' knowledge about the infection control precautions	Study Group (n= 50)				X2	P-value
	Pre-intervention		Post-intervention			
	No	%	No	%		
Methods of prevention of infection control					112.23	0.0001
• Incorrect.	28	62	4	8		
• Incomplete.	10	20	5	10		
• Correct.	9	18	41	82		
Methods of transmission					143.38	0.0001
• Incorrect.	32	64	3	6		
• Incomplete.	11	22	4	8		
• Correct.	7	14	43	86		
Knowing standard universal precautions					84.13	0.0001
• Incorrect.	29	58	3	6		
• Incomplete.	16	32	10	20		
• Correct.	5	10	37	74		
Knowing transmission-based universal precautions					58.47	0.0001
• Incorrect.	28	56	7	14		
• Incomplete.	12	24	15	30		
• Correct.	10	20	28	56		
Using antiseptic for skin					143.67	0.0001
• Incorrect.	32	64	4	8		
• Incomplete.	11	22	3	6		
• Correct	7	14	43	86		
Using infection control precaution during intravenous infusion					89.78	0.0001
• Incorrect.	29	58	5	10		
• Incomplete.	16	32	5	10		
• Correct	5	10	40	80		
Using infection control precaution during a safety box					59.35	0.0001
• Incorrect.	28	56	7	14		
• Incomplete.	12	24	15	30		
• Correct	10	20	28	56		
Using infection control precaution during cleaning of surgical instruments					133.89	0.0001
• Incorrect.	38	76	6	12		
• Incomplete.	10	20	7	14		
• Correct	2	4	37	74		
Using infection control precaution during disposal of medical waste					172.63	0.0001
• Incorrect.	42	84	2	4		
• Incomplete.	4	8	4	8		
• Correct	4	8	44	88		
Using infection control precaution during gloves					149.823	0.0001
• Incorrect.	39	78	5	10		
• Incomplete.	5	10	7	14		
• Correct	6	12	38	76		
Using infection control precaution during acupuncture through needles or other sharp objects					142.37	0.0001
• Incorrect.	35	70	3	6		
• Incomplete.	11	22	4	8		
• Correct	4	8	42	84		
Mean Knowledge total score	8.3±2.2		11.5±1.9		F=32.9 P=0.000HS	

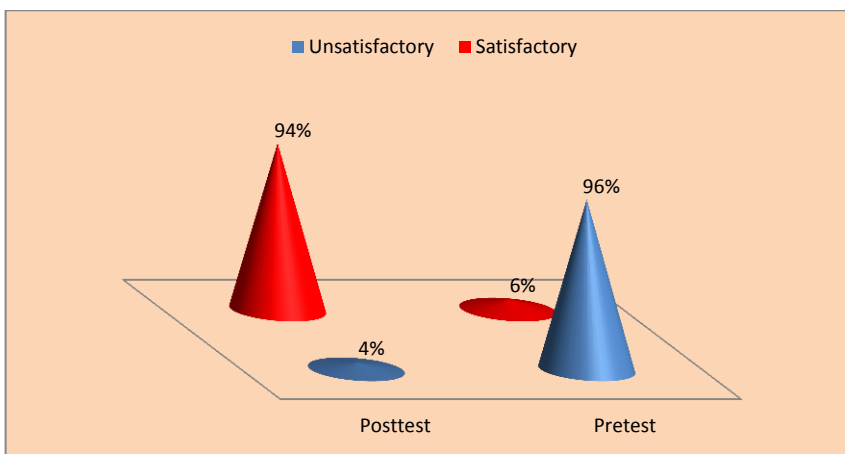


Figure (1): Percentage distribution of the studied nurses according to their knowledge level about the infection control precautions pre and post-intervention (N = 50)

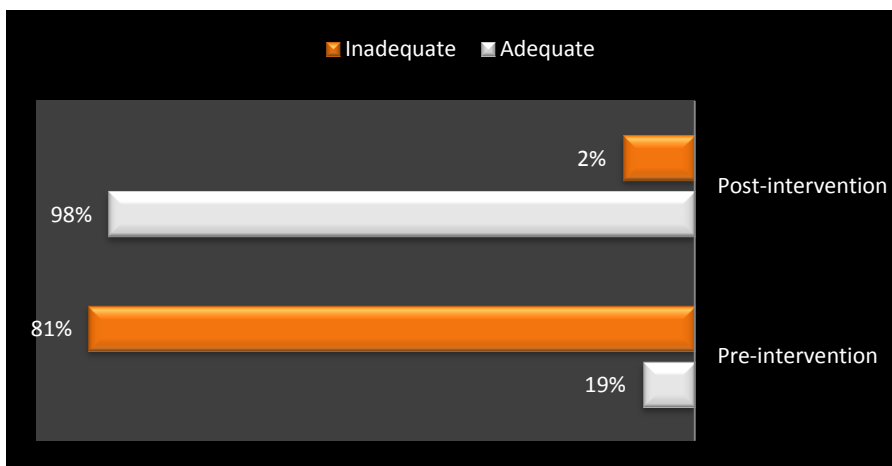


Figure (2): Percentage distribution of the studied nurses according to their total practices score level about the infection control precautions pre and post-intervention (N = 50)

Table (4): Distribution of the studied Nurses' practice regarding infection control precautions throughout observational checklist (n=50)

Nurses' practice regarding infection control precautions	Pre				Post				X ²	P-value
	Done		Not done		Done		Not done			
	No	%	No	%	No	%	No	%		
Hand hygiene	12	24	38	76	32	74	18	26	17.68	<0.001
Personal protective equipment	18	36	32	64	40	80	10	20	89.45	<0.001
Applying infection control principles while performing various nursing tasks	16	32	34	68	39	78	11	22	96.53	<0.001
Disposal of patient wastes	14	28	36	72	44	88	6	12	19.45	<0.001
Operating and dressing room	20	40	30	60	45	90	5	10	38.49	<0.001
Surgical and medical unit, Medication room and handling of medical files)	17	34	33	66	39	78	11	22	18.28	<0.001

Table (5): Correlation between demographic Characteristic and total knowledge among the studied nurses (n=50)

Demographic characteristics	Total knowledge			
	Pre		Post	
	R	P	R	P
Age (years)	-0.004	0.9	-0.01	0.9
Gender	-0.47	0.001*	-0.21	0.2
Qualification	0.35	0.03*	0.36	0.02*
Years of Experience	0.33	0.04*	0.37	0.02*

Table (6): Correlation between demographic Characteristic and total infection control practice among the studied nurses (n=50)

Demographic characteristics	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	-0.20	0.2	0.03	0.8
Years of Experience	0.33	0.04*	0.04	0.8

Table (7): Correlation Co-efficient between the knowledge scores and performance scores pre and post mind map using

Correlation	Performance scores	
	R	P
Knowledge score		
Pre mind map using	0.173	0.367
Post mind map using	0.372	0.046*

Correlation is significant at the 0.05 level **.

Discussion:

Education is a vital element in lives and one must get the maximum level of knowledge in the shortest period possible. Furthermore, they must read a large amount of material in their specialty, which causes retention issues. However, several new technologies have emerged in the modern era to help overcome this. As a result, employing mind mapping as a study tool to establish clear links and relationships between topics might assist trainees in providing more effective instruction (Eshwar et al., 2019). Hence, the present study aims to evaluate the effect of mind map using on improving nurses' performance regarding infection control at surgical departments.

Regarding characteristics of the studied nurses, the present study revealed that the majority of the studied nurses were 25 years old, and roughly one-third of them had less than five years of experience, according to the findings. According to Khalifa (2016), more than half of nurses are under the age of twenty-five, and fewer than half have less than five years of experience.

This finding was in line with Mohammed et al., (2019), who looked at the "Effect of Teaching Program on Nurses' Performance Regarding Drugs that Affect Blood Coagulation in Coronary Care Unit" and found 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. This is not in the same line with Ponikowski et al., (2016) who mentioned that; the administrators selected older age nurses to be able to perform mainly tasks in the intensive care unit effectively. As well, Shorofi, & Arbon, (2017) revealed that the majority of nurses working in ICU their ages ranged from 20-40 years, married, female, and have diploma of nursing, more than half of them their experience was more than 5 years.

Results of the current study revealed that the majority of the studied nurses did not use mind map in their previous training, and the majority of them prefer mind map using after explanation. From the researchers' point of view, this is reflected the important need to apply the study.

As regarding the nurse's knowledge about infection control precautions and the results

showed that the majority of the studied nurses didn't know infection control precautions pre-intervention and noticed that, the majority of nurses their knowledge had improved post mind map intervention than pre mind map intervention. The results of the exciting study detected that the total score of nurses' knowledge about infection control application was poor before implementation of the teaching sessions, in researcher point of view this may be due to nurses didn't receive previous training program about infection control as no pre-employment orientation program, insufficient number of nurses and lack of instructions. Also maybe due to lack of updating information, and this might be because basic education was not incorporated into either diploma or degree curricula. On the other hand, Egyptian nurses, particularly those who work in bedside care are overworked because of the nursing shortage in the nursing staff. Therefore, they have limited time to enhance their knowledge about critical care.

This finding reported that, give the incorrect answer about hand washing, this agreement 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.

According to **Goodman & Spry, (2014)** who studied " prevention of infection Aseptic practices, chapter 4, preparation of instruments and items used in surgery, cleaning, packaging and storage" stated that hand hygiene is often considered the single most important step in preventing infection. Operating room personnel like all health care personnel should perform hand hygiene before and after patient contact before donning gloves and after removing gloves. Similarly, **A Abdel Hamid, (2017)** conducted a study about " Mind maps as a new teaching strategy for medical students" and reported that, in medical education, mind maps enable the student to better integrate information so that it is better organized. This results in a better recall of information.

Supporting the previous results by **Bawaneh, A. (2019)** who studied " The Effects of

Herrmann Whole Brain Teaching Method on Students' Motivation towards Science Learning" and recommended using mind mapping as the majority recommend integrating mind map during their training and using it in workshops, also to be part in the clinical work, while a little number of the sample recommend the using of exciting teaching methods to have information.

These results are consistent with the results of some other studies. **Akinoglu, and Yasar (2017) who studied** " The effects of note-taking in science education through the mind mapping technique on students' attitudes, academic achievement and concept learning "and **Balim (2016) who done a study about** " Use of technology-assisted techniques of mind mapping and concept mapping in science education: a constructivist study" and emphasized the importance of mind maps in improving studied sample' achievement and understanding concepts.

The findings of the present study supported the implementation of infection control applications using mind map to improve nurses' knowledge and practices about infection control. Moreover, all studied nurses were a satisfactory level of knowledge after implementation, in the researcher's opinion it reflected a significant improvement in nursing staff knowledge after implementation of mind map about infection control application. According to **King, & Shell, (2019)** reported that each organization and profession must set standards and objectives to guide individuals and practitioners in performing safe and effective care. Also not only must standards exist, but leaders and managers also must see that subordinates know and understand the standards and employees must be aware that their performance will be measured in terms of their ability to meet the established standards.

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

Regarding the nurses' performance, most of the nurses had an unsatisfactory level of practices of the principles of infection control, highly statistically significances between practices level regarding and all principles

applied in various activities in medical-surgical departments regarding infection control precautions. This finding disagrees with **Kabir, (2018)**. They studied "Nurses knowledge and practice regarding prevention of surgical site infection in Bangladesh" and reported that the nurses had a low level of knowledge and high level of practice. This confirmed that mind map is a method that can be used to quickly organize patient and staff education while evaluating the learner's comprehension of critical information (**Kalyanasundaram et al., 2020**).

Also, the study is in the same line with **Phillips et al., (2019)** who performed a study entitled "Effectiveness of the spaced education pedagogy for clinicians' continuing professional development" and reported that; there is no need to improve nurses' knowledge and practices related to infection control.

The previous finding was supported by **Spoorthi, et al., (2019)** who conducted a study about "Mind Mapping- an effective learning adjunct to acquire a tsunami of information" in which the majority of the trainees thought "mind mapping helped them understand concepts and ideas in science". It enables students and staff members to link stories through patterns, keywords, or symbols. Moreover, mind mapping can be used in self-learning; it facilitates the performance of a conceptual understanding of a huge amount of information, integrates concepts, as well as promoting inquiry and reflection, and helps bridge the gap between theory and clinical competence. It can be integrated into problem-based learning. It was even recently used in the conduction of systematic reviews and biomedical research as well as related software programs. (**Wilson et al., 2016**)

Similarly, **Farrand, et al., (2020)** who studied "The efficacy of the 'mind map' study technique" found that spider diagrams (similar to mind maps) had a significant, impact on memory recall in undergraduate students as compared to preferred study methods. This improvement was only robust after a week for those in the diagram group and there was a significant decrease in motivation compared to the subjects' preferred methods of note-taking. A meta-study about mind mapping concluded

that mind mapping is more effective than "reading text passages, attending lectures, and participating in class discussions".

The same study conducted by **Tee et al., (2020)** also about " Buzan mind mapping: An efficient technique for note-taking "concluded that mind mapping is slightly more effective "than other constructive activities such as writing summaries and outlines". However, results were inconsistent, with the authors noting "significant heterogeneity was found in most subsets". In addition, they concluded that low-ability students may benefit more from mind mapping than high-ability students.

Abdel Hamid, (2017) also revealed that, in medical education, mind maps enable the student to better integrate information so that it is better organized. This results in a better recall of information. Supporting the previous results by **Bawaneh, A. (2019)** who studied the reliability of the mind-map assessment rubric in a cohort of medical students and recommended using mind mapping as the majority recommend integrating mind map during their training and using it in workshops, also to be part in the clinical work, while a little number of the sample recommend the using of exciting teaching methods to have information.

Buzan and Buzan (2010) identified that mind mapping promotes the use of radiant or central thinking to enhance the multiplicity of the brain. Mind mapping helped to explore the concept and its key associations in an organized, colorful, vibrant, and logical manner. While developing the mind maps, it found that it's exploring the concept of critical thinking by reflecting how it makes patient care decisions in the clinical setting.

Mind maps also organize the relationships, and links between ideas and information. This makes it easier for the studied sample to remember information and ideas for both immediate achievement and retention **Al-Otaibi & Wadha, (2016); Hariyadi et al., (2018)**. In the same context, mind maps allow students to see the whole picture of the subject and increase the chance to remember ideas and information (**Awajan, 2016**). In addition, these maps are very rich in images, drawings, and shapes with different and attractive colors.

Thus a mind map produces the best ways to transfer and remember knowledge and information. 90% of the inputs of the brain originate from the sense of visual sources, where the brain has an automatic response to the symbols and images that have a significant influence on recalling ideas and information (Awajan, 2016).

Similar results are consistent with the results of the current study conducted by Akinoglu, and Yasar (2017) a study titled “**The Random-Map Technique: Enhancing Mind-Mapping with a Conceptual Combination Technique to Foster Creative Potential**” and emphasized the importance of mind maps in improving studied sample' achievement and understanding concepts.

The study of Harkirat (2015) emphasized the importance of using mind mapping in teaching and enhancing studied samples' perceptions as well as their ability to translate information and ideas in an organized, coherent, and comprehensive manner. This was confirmed by Ackerman and his colleagues (2016) who demonstrated the role of mind mapping in studied sample' assimilation, information, application of dispensed concepts, and long-life learning retention. Nevertheless, Wickramasinghe (2017) a study titled “**Effectiveness of Mind Maps As A Learning Tool for Medical students** ” did not find significant statistical differences between the use of mind mapping and the conventional method for medical students at the University of Colombo in Sri Lanka even though who studied mind mapping suggested that it was a useful way to summarize and remember information as the sample was different. This result was somewhat consistent with the results of Farrand et al., (2016) Their findings were that the studied sample who studied under mind mapping, did not prefer it at all, against the present study as the results have the high significance of satisfaction, were more reluctant to adopt it. This was evidenced by their diminished motivation for learning compared with those who studied traditionally.

In the same context, the result was not consistent with that of Trevino (2015) aimed at investigating the effect of the use of mind maps. The results indicated that there were no

statistically significant differences between the mind maps strategy and the traditional method while mind mapping was its flexibility. The researchers' observations indicated that it can be used to help an individual trainee, group of nurses, and nursing supervisors to improve work activity such as topics of the current study (infection control which is a very broad topic). It can be used in any type of activity or any stage of work; thus, maps can be narrow or broad in scope, depending on the time of work or the topic of the activity. When needed staff nurses can construct the maps in a very short period (an average of 15 to 20 min.), with little instruction and they can receive feedback, either from the head nurse or other staff members, on the spot very quickly.

According to findings of the current study showed that there is a statistical significance between the use of mind mapping and nurses' performance, the results agree with Davies, (2020) who concerning the relation between knowledge regarding mind mapping and staff nurses' performance, that the performance of the study sample that has theoretical knowledge about the mind mapping was highly statistical significance. It could be explained by that well understanding of mind mapping strategy provides an opportunity for active involvement of nurses in their training process.

This result was in agreement with the study done by Eshwar et al., (2019) conducted a study entitled " Comparison of mind mapping and lecture-based teaching-learning method among dental undergraduates using solo taxonomy in Bangalore " the study mentioned that active learning methods and models are frequently used in educational sciences. Although the use of these methods in nursing education has increased recently, the number of studies is insufficient. Study results in this review indicate that using active learning methods in nursing education provides positive cognitive, affective, and psychomotor outcomes for nursing students. Therefore academicians and nursing students should be supported for the use of these methods. Also, more studies are needed in theoretical and clinical practices. Finally, the findings of the present study supported the implementation of educational sessions about infection control application using mind map and reflected

success in improving nurses' knowledge and performance about infection control.

The current study showed that that age and gender, years of Experience there is mild correlation at pre and post-intervention as well as regarding the qualification of nurses there is mild significant correlation at post-intervention, as the nurse' performance of previous bachelor degree of nursing who work as high qualified nurse or nursing supervisor using mind mapping method exceeded those of previous nursing technical institute of nursing education and work as bedside nurse who exposed to the same training strategy. This result was in the same line with **Considine et al., (2016)** which means when the nurses' experience and qualification increase or if the nurses had a training course on their favorable knowledge also improves. The study of **Ahmad et al., (2015)** is not matched with the current results and reported no relationship between knowledge or practice regarding infection control and age, years of experience, and training course of the studied group. In this regard, **Abdel Hamid et al (2017)**, indicated that factors such as age and years of experience did not contribute to the acquisition of knowledge about blood-borne illnesses or the practice of infection control.

The total score of nurses' knowledge and performance before and after the mind map using was shown to have a statistically significant link in the current study. This association explains the fact that increasing information leads to increased performance. In addition, the nurses in the study were able to practice effectively when they got enough knowledge.

Conclusion:

Based on the findings of the present study, the present study concluded that the mind map strategy used had a positive effect on improving nurses' knowledge & practice in medical-surgical departments.

Recommendations:

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

- The study recommended that the mind map 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.

- Working nurses require a variety of easy teaching strategies that respect and take into account their varying ages, jobs, and obligations.
- Further studies, replication of the current study with a larger sample of nurses in different settings is required for generalizing the results.

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