

Effect of Educational Intervention On Nurses' Knowledge And Practices Regarding Endotracheal Tube Suctioning

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Abstract - Endotracheal suctioning is an essential part of nurses' duties to manage airways for mechanically ill patients in intensive care units. The efficiency and problems with the endotracheal suctioning procedure are associated with the technique of accomplishment. Therefore the nurses should achieve this technique carefully and efficiently.

A. The aim of this study was to determine the effect of an education intervention on nurse's Knowledge and Practices about Endotracheal Tube Suctioning.

B. Research Design: A quasi-experimental research design with a pre-posttest was utilized to fulfill the aim of this study.

C. Subjects: A convenience sample (nurses who were working in intensive care units); 100 nurses at Menoufia University.

D. Tools; two tools were utilized for data collection:

a) Tool I – Structure interview questionnaire schedule: which consists of two parts; **part one** Characteristics of Nursing Staff & **part two** Knowledge questionnaire sheet about endotracheal tube suction and its complication.

b) Tool II- Observation checklist for endotracheal suction practice. Result: Most of the studied sample had bad knowledge regarding endotracheal suctioning pre-intervention (94%). While most of the studied sample had a good knowledge post one & two post-intervention (83% and 94%), respectively. The mean nurse' practice pre-intervention was 29.25, while there was an improvement of mean nurse' practice post-intervention (60.08 & 61.59), respectively.

E. Conclusion: Education intervention about endotracheal tube suctioning has a positive effect on a nurse's knowledge and Practices about endotracheal tube suctioning.

F. Recommendation: Educational intervention about endotracheal suction should be performed periodically.

Keywords: Education intervention, Nurse's knowledge, Practices, Endotracheal Tube, Suctioning

I. INTRODUCTION

One of the vital responsibilities of the nurse in the ICU unit is endotracheal suction to maintain airway clearance from secretion, which improve oxygenation and ventilation for mechanically ventilated Patient who is unable to eliminate secretion from the airway (1)

The indications of suctioning when respiratory rate above the normal range, ineffective airway clearance, decrease level of oxygen saturation, to reduce risk of infection, atelectasis and alveolar collapse due to accumulation of mucous, secretion in critically ill patients, to diminish the hazard of aspiration. (2,3)

Accessible technique to perform endotracheal suction is closed and opens system suctioning. Open suctioning requires disconnecting the patient from mechanical ventilation, while the Closed method performs doesn't need to be disconnected but performs through a special catheter during suctioning (4&5).

In new years, the closed suction system has been approved in advanced states like the United States; it is used close system completely in 58% of Intensive Care Units (ICU). However, 4% of other centers are used the open system. In Egypt, OSS (open suction system) is the greatest technique used as its suction catheter is inexpensive and more accessible. The improper technique of suction lead to complication such as dysrhythmia, collapse or closure of a lung, decrease the level of oxygen in the blood, nosocomial infections, and increases intracranial pressure, which effects on the patient's prognosis, length of hospitalization and costs (6,7&8)

To overcome this complication, staff should be aware of these dangers followed guidelines rendering to the American association of respiratory care (AARC) recommendations which improve patient outcomes (9). These guidelines include; administration of 100% oxygen before, during, after endotracheal suction, avoiding instillation of normal saline before ES, using a close system with high positive end-expiratory pressure, and increase FIO₂. The diameter of the catheter is half about the lumen of an endotracheal tube in adult personals. The maximum period of suction is ranging from 10 to 15 seconds (1&10).



Studied by the researcher(Dougherty and Lister 2015) ⁽¹¹⁾ who Clarified that nurses not aware of guidelines about suctioning which reflected on nursing practice; in addition, there was a difference between ideal performance and actual practice about suction. Because the nurses spend more time beside patients, so it is essential to maintain patient safety and prevent the complication of suctioning; this is done when providing adequate knowledge about recommend guidelines to perform suction efficiently without harming patients. Therefore, the purpose of this research was to determine the effect of an education intervention on nurse's Knowledge and Practices about Endotracheal Tube Suctioning.

A. Significance of the study:

Effective suctioning is a crucial part of airway management in intubated censoriously ill patients. So it is important to reduce complications from it by careful attention through all steps of suction. Patients must be assessed and prepared carefully, maintain sterilization to prevent infection that leads to improving patients' outcomes ^(12, 7). Improved outcomes will shorten patient's ICU length of stay, hospitalization as well as decrease the financial burden on patients and decrease hospital costs.

B. Purpose of the study

To determine the effect of an education intervention on nurse's Knowledge and Practices about Endotracheal Tube Suctioning.

C. Research hypothesis:

- There will be a change in nurse's Knowledge about Endotracheal Tube Suctioning after applying educational intervention.
- There will be a change in nurse's practice regarding Endotracheal Tube Suctioning after applying educational intervention.

II. SUBJECTS AND METHODS

A. Research Design:

A quasi-experimental research design with a pre-post-test was consumed to achieve the object of this study.

B. Location: This research was accompanied in the intensive care unit of Menoufia University hospital, Egypt.

C. Subjects:

A convenience sample of 100 nurses who were employed in intensive care units at Menoufia University. The study was conducted over 4 months started from the first of May 2018 to the end of August 2018. The researchers visited the hospital 3 days weekly until the sample was completed.

D. Tools of data collection:

Two tools were utilized for data collection:

E. The tool 1 - Structure interview questionnaire schedule: This instrument was advanced by the researchers based on the review of the significant literature (Dougherty & Lister 2015 and Nishamol, 2011) ^(11&13). It

was used to determine the level of knowledge about endotracheal suction care and its complication. The instrument contained the overdue two portions:

Part I:-

Characteristics of Nursing Staff; it compromised information about age, gender, level of education, years of experience in ICU.

Part 2:-

A. Knowledge questionnaires sheet: that established by the researchers after studying the associated literature that contains fifteen items to assess nurses' knowledge regarding the assessment of knowledge about endotracheal tube suction such as the purpose of endotracheal suction, frequency of performing endotracheal suctioning, best method of suction, length of insertion, time limit, most appropriate position, rotation of catheter, successful suctioning test, nerve stimulated during suction, a possible complication of carina irritation, the importance of oxygenation before giving suctioning, suction pressure, size of the suction catheter, frequency of changed suction catheter and question about the installation of sodium bicarbonate through the ET tube.

a) Recording system:-

Each question has three response categories, and for data analysis, the respondents answer as following:-

1. The correct and complete answer was given a score of three.
2. Correct and incomplete answer (partially correct answer) was given a score of two.
3. Incorrect answer and do not know was given a score of 1.

The nurse's responses were calculated and recorded, the total score of the nurse's knowledge ranged from 15 as a minimum score of, 45 as a maximum score and was categorized into:

- A score of 15 < 23 (< 50%) denoted poor or unsatisfactory results
- A score of 23 < 34 (50% < 75 %) to indicated fair results
- A score between 34 and 45 (>75%) showed good or satisfactory results.

B. Knowledge questionnaires sheet about complication;

to assess knowledge about the potential complication of endotracheal tube suction that contains nine questions such as lively lung agreement and decrease functional residual capacity, atelectasis, decrease oxygen saturation, tissue trauma to the tracheal, microbial colonization, Variations in brainy blood flow and enlarged intracranial pressure, Bronchoconstriction or bronchospasm, Hypotension, and cardiac dysfunction.

a) Scoring system

Each question was given a score 2 for responses yes and a score of 1 for responses no. All marks were summed, and the range of marks was from 9 to 18.

- A score of 9- 10 (< 50%) denoted a poor knowledge score.
- A score of 11 to 13 (50% < 75 %) indicated moderate results.
- A score more than 14 to 18(>75%) illustrated a good knowledge score.

b) Observation checklist for practice: - that advanced by the investigators after studying the associated literature (11&13) that contains 33 items to assess practice about endotracheal suction performed by nurses. The researchers used this checklist three times (pre educational intervention, after intervention (post two weeks), and after four months from educational intervention to evaluate the effectiveness of practice.

It was comprised of three parts.

Part I:-

Observation checklist for practice prior to endotracheal tube suction: it includes Patient assessment, Patient preparation, Pre suctioning hyperoxygenation, Cuff pressure confirmed, Protection of eyes from secretions, Security of central venous catheter from secretions, Analgesic managed and Infection control practices(hand decontamination, gloves worn, Apron worn, a face mask is worn & Sterility of suction catheter
The items were categorized into three levels; correctly done, incorrectly done, and not done.

Part II:-

Observation checklist for practice during endotracheal tube suction: it includes sodium chloride installation, size of the suction catheter, amount of suction passes, period of suction practical to the airway, level of suction pressure, no suction until insertion of the catheter, continuous suction, restarts the oxygen delivery system and flush catheter and suction.
The items were categorized into three levels; correctly done, incorrectly done, and not done.

Part III:-

Observation checklist for practice post endotracheal tube suction: - it includes patient relinked to oxygen, post suctioning hyperoxygenation, chest auscultation post-ETS, Patients reassure, hand disinfection after suctioning, prevents contamination from secretions, cuff pressure checked, the document needs for suctioning and results in nurses 'notes, turn off the suction device, notice any changes in the vital signs and assess the secretion clearance.

a) Scoring system:-

A score of zero was given if the practice was not done, while the score of one was given if the practice was incorrectly done, and the score of two was given if the practice was correctly done. In every part, the total score was applied and converted into a percent score. The practice was reflected poorly if the percent score was less

than 60% and if the percent score was more than 60% considered good practice.

b) Validity and reliability of the instrument:

The two tools were advanced by the investigators after studying the associated literature and tested for their content validity. Validity showed the degree to which the instrument measures what it is expected to measure. The questionnaire validity was resolute by a board of three experts. Alterations were carried out according to the board's judgment on the clarity of the judgments and the appropriateness of the substances. The reliability of the tool was established through the test re-test method at an a15-day interval with a group. Chronbach's alpha was practical for the reliability of the questionnaire and was established to be 0.84 for instrument one and 0.90 for the second tool.

c) Pilot study:

A pilot study passed with 10% of the total number of nurses in ICU to evaluate clarity in addition to the applicability of the instrument and appraisal the time needed to fill each part. The essential alteration was done as exposed from the pilot study. The sample of the pilot study was omitted from the total sample to assure the constancy of the result.

d) Ethical considerations:

An official consent was obtained from the hospital manager and the supervisor of intensive care units. It was obtained after explaining the objective of the study. Nurses' official agreement was obtained to participate in the study after clarification the objective of the study. Each nurse was reassured that confidentiality and privacy would be preserved, and nurses have a right to withdraw at any time.

e) Estimated sample size:

Based on preceding studies about the effectiveness of knowledge and practice toward the endotracheal tube suction among staff nurses, a conformist effect size of 0.40 was assessed. 29, 20 using the statistical software, the statistical power of 0.81 and statistical import 0.05, the assessed sample size essential to implement one-sample t-tests were 100 subjects.

f) Fieldwork: Data gathering for this study was passed out from the first of May 2018 to the end of August 2018. Once permission was granted to conduct the study, the investigators were started gathering.

g) Data collection:-

Prior to data collection, the researchers distributed the questionnaire to the sample that agreed to share in the study and then clarifies the objective of the study to the participants. The usual period taken to finish questionnaires was around 20-30 minutes. Next achievement of the questionnaires, the investigators gather it and make sure that the questionnaires sheet was being

completed. Participants were cross-examined pre interference using tool I and tool II.

h) Implementation Phase:

First session: The researchers divided the sample into small groups (ten nurses), then the researchers gave/provided knowledge about endotracheal suction and its complication through interactive lecture and group discussion by audio-visual aids as PowerPoint, lectures illustrated pictures and videos. This session lasted (45) minutes.

The second session included the practical part: this part explained the steps of the suction procedure (pre, during, and post endotracheal suction). It's done through demonstration and re-demonstrations. It lasted (60) minutes. The researchers were available for three days/week in the hospital.

Third session: the researchers assessed knowledge and practice for studying a sample after two weeks through post-test & observation checklist. Also, the researchers gave feedback.

Evaluation Phase:=

Knowledge and practice were assessed for studying samples at three different intervals before applying educational intervention, after two weeks from educational intervention, and finally, after four months (using a tool I and tool II).

Statistical analysis

The data together were tabulated & investigated by SPSS (statistical package for the communal science software) statistical package version 20 on IBM well-matched computer. Two categories of data were done:

Descriptive statistics: were stated as mean and standard deviation (X+SD) for quantitative data or number and percentage (No & %) for qualitative data.

1) Analytic statistics:

- a) Student t-test: is a test of significance used for comparison between two independent clusters of normally distributed quantitative variables.
- b) Repeated-Measures ANOVA: is a test of significance used when we had a long line of data for each contestant, with the repeated measures entered as separate variables on that same line (used for comparison between more than two related clusters of normally disseminated quantitative variables).
- c) ANOVA test (parametric test): is a test of import used for judgment between three independent clusters of not normally distributed quantitative variables.
- d) Spearman correlation: is a test of import used for quantitative variables that were not usually

distributed or when one of the variables is qualitative.

A. P-value of 0.05 was used to decide import concerning:

P-value > 0.05 to be statistically insignificant.

P-value ≤ 0.05 to be statistically significant.

P-value ≤ 0.001 to be highly statistically significant.

Results

Table 1. Exposed that more than half of the study sample were female (59.0%), the mean age was (26.29±4.11). In relation to educational level, more than two-thirds of the study sample were Institute degree of nursing (77.0%). Almost half (42%) had experience of sex for ten years in the intensive care unit.

Figure 1 Revealed that the greatest of the studied sample had bad knowledge regarding endotracheal suctioning pre-intervention (94%). While most of the studied sample had a good knowledge post one & two post-intervention (83% and 94%), respectively.

Figure II showed that more than the study sample had a bad level of knowledge (60%) about hazards /complications of endotracheal suction. However, there was an improvement of knowledge level post-intervention one and two (60% & 90%), respectively.

Figure III Showed that the mean nurse' practice pre-intervention was 29.25, while there was an improvement of mean nurse' practice post-intervention (60.08 & 61.59), respectively. Information about endotracheal suctioning among nurses in ICU & their total score of Practice. Moreover, there was a statistically important relationship between information and practice (**P= 0.03**).

Table III Discovered that there was a positive correlation between total scores of Knowledge assessment related to complications of suction among nurses in ICU (baseline) & their total score of Practice (baseline). Furthermore, there was a highly statistically significant relationship between knowledge related to complications and practice (**P<0.001**)

Table IV –illustrates that there was a highly statistically significant relationship between the level of education among nurses in ICU & their knowledge about endotracheal suctioning **P (0.001)**. Also, there was a statistically important relative between years of experience among nurses in ICU & their knowledge about endotracheal suctioning **P (0.004) at baseline**.

Table V: Illustrated that there was a statistically important relationship between the level of education among nurses in ICU & their baseline practice prior to, during, and post endotracheal suction (ETS) events, **P (0.002)**. Moreover, there was a statistically significant relationship between years of experience among nurses in ICU & their practice before, throughout, and post Endotracheal Suction (ETS) actions, **P (0.01)**.

Table 1: Distribution of the nurses regarding their demographic data (n=100)

Variable	Frequency NO	Percentage %
Age (years): Mean ± SD Range		26.29±4.11 21.0 -- 40.0
Sex: Male Female	41 59	41.0 % 59.0 %
Education: Secondary Institute University	12 77 11	12.0 % 77.0 % 11.0 %
Years of experience in ICU: <1 year 1≤5 year 6 ≤10 year 11≤15 year		
	1 36 42 21	1.0 % 36.0 % 42.0 % 21.0 %

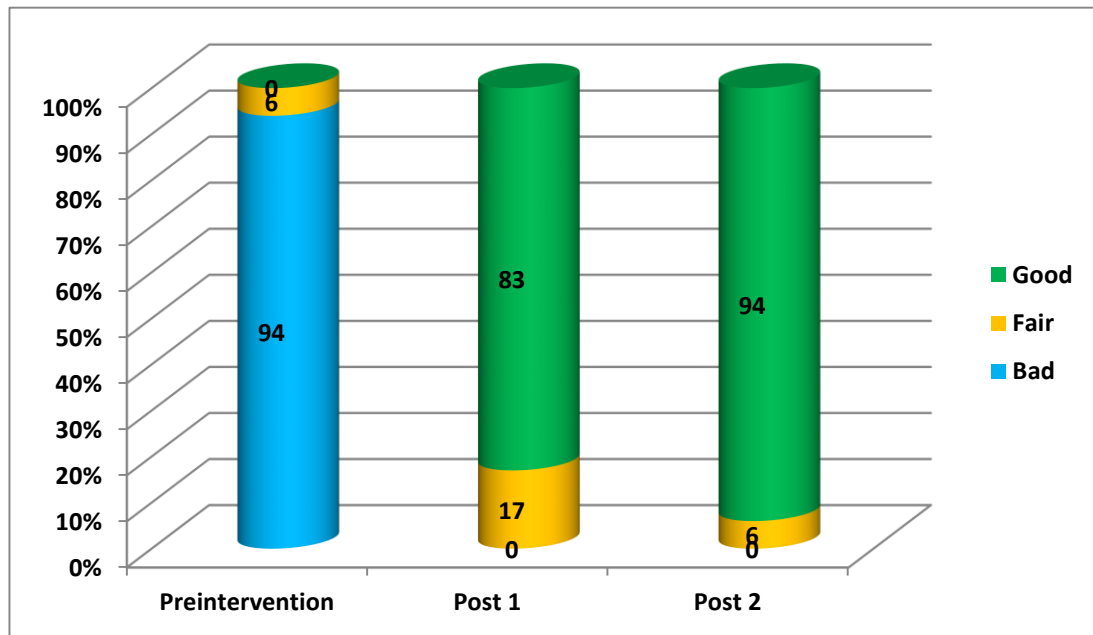


Figure 1: Levels of Knowledge among nurses in ICU about endotracheal suctioning at three intervals (pre-intervention, post 1, post II)

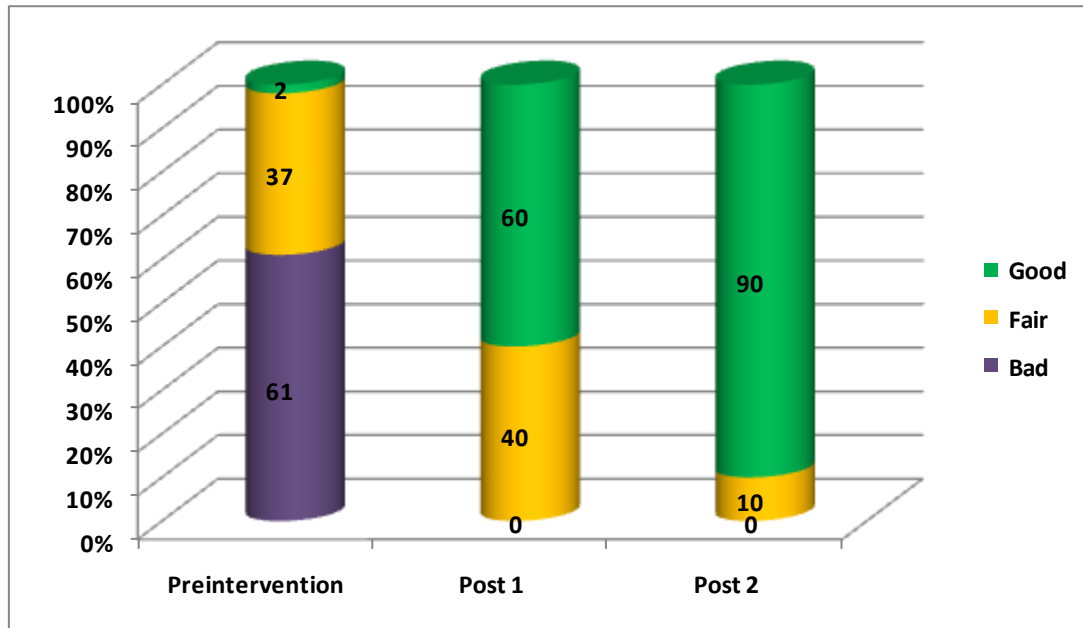


Figure II- Levels of Knowledge among nurses in ICU about complications of endotracheal suctioning at three intervals (pre-intervention, post 1, post II)

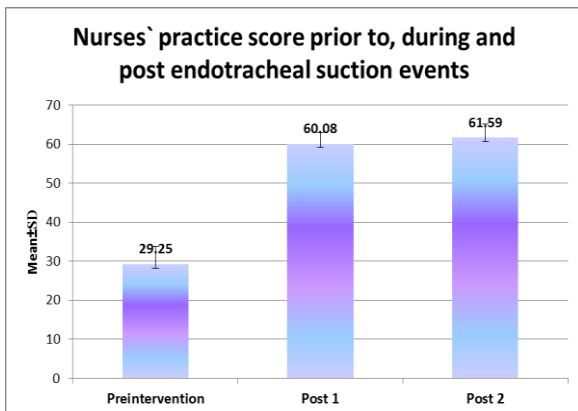


Figure III: Nurses' practice related to endotracheal suctioning at three intervals (pre-intervention, post 1, post II)

Table II: Correlation between total score of Knowledge about endotracheal suctioning among nurses in ICU & their total score of Practice (baseline)

Variable	The total score of nurses` knowledge	
	R	P-value
Total score nurses` practice	0.21	0.03 S

P-value > 0.05 to be statistically insignificant.
 P-value ≤ 0.05 to be statistically significant.
 P-value ≤ 0.001 to be highly statistically significant.

Table III: Correlation between total scores of Knowledge related to complications of suction among nurses in ICU & their total score of Practice (At baseline)

Variable	The total score of nurses` knowledge	
	R	P value
Total score nurses` practice	0.51	<0.001 HS

Table IV: Relation between nurses' knowledge at baseline and their characteristic regarding endotracheal suctioning

Demographic characters	Mean ± SD	Test of sig.	P-value
Age (years):	r=0.09	Spearman` s rho	0.36 NS
Sex:		t=1.44	0.15 NS
Male	30.02±4.26		
Female	28.71±4.60		
Education:		F=6.56	0.002 S
Secondary	28.50±5.21		
Institute	28.74±3.90		
University	33.63±5.50		
Years of experience in ICU:		F=3.75	.01 S
<1 year	20.0±0.0		
1≤5 year	28.72±4.10		
6≤10 year	29.28±3.78		
11≤ 15 year	32.52±5.87		

P-value > 0.05 to be statistically insignificant.
 P-value ≤ 0.05 to be statistically significant.
 P-value ≤ 0.001 to be highly statistically significant

Table V: Relation between demographic characters of nurses in ICU & their baseline Practice.

Demographic characters	Mean \pm SD	Test of sig.	P-value
Age (years):	$r=0.12$	Spearman's rho	0.22 NS
Sex: Male Female	32.19 \pm 2.56 31.94 \pm 2.78	$t=0.44$	0.65 NS
Education: Secondary Institute University	30.0 \pm 1.90 32.06 \pm 2.58 34.18 \pm 2.56	$F=7.93$	0.001 HS
Years of experience in ICU: <1 year 1 \leq 5 year 6 \leq 10 year 11 \leq 15 year	27.0 \pm 0.0 31.50 \pm 2.75 31.83 \pm 2.25 33.66 \pm 2.72	$F=4.80$	0.004 S

P-value > 0.05 to be statistically insignificant.

P-value ≤ 0.05 to be statistically significant.

P-value ≤ 0.001 to be highly statistically significant

III. DISCUSSION

Endotracheal suctioning is perhaps one of the most communal insidious actions achieved in patients with an artificial airway. So the nurses must have acquired enough information and practices to prevent complications.

Regarding Socio-demographic structures, the current study exposed that the mean age of the deliberate subjects was reached from twenty-one to forty years. Moreover, most of them have nursing institute education. These events may affect knowledge and practice among nurses. Regarding years of experience among nurses, the present study showed that most nurses have thirty-eight years. Furthermore, years of experience in ICU among nurses are forty-two years within six to ten years. These outcomes were in contract with (Miia et al., 2015) ⁽¹⁴⁾, who evaluate endotracheal suctioning practices of critical-care nurses. These results clarified that the mainstream of contributors had experienced less than ten years in ICU. These experiences reflect on knowledge & practice.

Concerning nurse's information beforehand and after interference, the current study indicated that the majority of the study sample had poor knowledge before the intervention; however, there was a noteworthy improvement of knowledge score among the studied sample immediately after interference. These results were in the same line with studies carried by (Elbokhary et al., 2015) ⁽¹⁵⁾ that provide information and practice of ICU nurses concerning endotracheal suctioning for mechanically ventilated patients, who indicated that the greatest number of nurses had poor knowledge during the assessment of knowledge. At the same line, Ozden D, et al., 2012 ⁽¹⁰⁾, who study the advance of typical practice strategies for open and closed system suctioning who revealed that nurses had low levels of information and

clinical skill of suction pre-intervention but enhancing of knowledge and practice after training (Seema et al., 2017) ⁽¹⁶⁾.

Regarding knowledge score categories among nurses related to complications of endotracheal suctioning. The current study found that two-thirds of subjects had bad knowledge in pre-intervention than post-intervention; on the other hand, the majority of subjects had good knowledge and significant difference than pre-intervention. These grades were reinforced by Elsaman, 2017 ⁽¹⁷⁾, who found that enhancement of nurses 'knowledge after application of Endotracheal Suction Guidelines, which reflected on patients' respiratory status. This means that inadequate educational programs provided to nurse to refresh nurse's knowledge lead to these results pre-intervention. While after applying educational intervention, the knowledge improves that due to interaction, a discussion between researchers and nurses.

Regarding nurses' practice scores before, during, and after endotracheal suction. The present study explained that two-thirds of nurses had improvement in practice post two interventions than pre-intervention. In the same line, Farsi et al., 2015 ⁽¹⁸⁾ who study the result of the scientific review process at the level of endotracheal suctioning skill in nurses and anesthesia technicians working in intensive care units. This result clarified that the total score of nursing skill in endotracheal suction of the subjects in the intervention group in the post-intervention phase enhanced after weeks than pre-intervention and had significantly different. Moreover, the total score of nursing skills about endotracheal suction in the study group was higher than the control group after the intervention.

Furthermore, Savita et al., 2014 ⁽¹⁹⁾, who study the efficiency of "endotracheal suctioning protocol" in terms of information and practices of nursing personnel, this findings clarified that the nurses who follow the ordinary practice strategies for open and closed suctioning were significantly increased in the mean knowledge and practice scores in all areas of knowledge questionnaire and observation checklist post-application of guidelines than the mean knowledge and practice scores before application.

Also, the current study exposed a significant association between the total score of knowledge about endotracheal suctioning among nurses and their total score of practice. These results are supported by Majeed, 2017 ⁽²⁰⁾, who found there was an association between nurses' practice and training course, a work training course for ICU nurses to improve knowledge and practice toward efficient suctioning performance, and reinforcement of nurses in promoting knowledge and practices in this field. However, Zainab, 2017 ⁽²¹⁾ mentioned that there was a weak correlation between nurse's knowledge and practice scores in addition to there was no statistical significance. It means that nurses have knowledge about standard guidelines, but they do not put it into practice. The researcher explained these results that due to ongoing

learning, open discussion and comments between researcher and participant allow them to understand the practice from their mistakes; thus, skills improved and reflected on patient outcomes.

Regarding years of experience. The current research showed that there was a statistically significant relationship between years of experience among nurses in ICU & their knowledge about endotracheal suctioning, this result in contrast with the results (Miia et al., 2015)⁽¹⁴⁾ who stated that there was there is no major association between years of experience, knowledge, and practice. In my view, as a researcher, the experience increases the level of information and practice increase from repeated procedures and training programs. So recurrent education and guidelines among nurses help them to improve knowledge and reflect on practice among patient care.

Conclusion: Education intervention about Endotracheal Tube Suctioning has a positive effect on a nurse's knowledge and Practices about Endotracheal Tube Suctioning.

RECOMMENDATION

Educational intervention about endotracheal suction should be performed periodically. A colored booklet about the technique of suction should be distributed in the intensive care unit.

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