Effectiveness of an Educational Program on Critical Care Nurses' Practices Regarding Endotracheal Suctioning of Adult Patients Who are Mechanically Ventilated in Hospitals at AL-Najaf, Iraq

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Abstract

Background: Nurses need to participate in many different educational activities that enhance and promote lifelong learning, professional and personal growth. Structured endotracheal educational program is developed to articulate new scientific approach by using researches in the clinical setting and apply research findings in clinical practice.

Objective: The study is aimed to evaluate the effectiveness of an educational program on critical care nurses' practices regarding endotracheal suctioning of adult patients who are mechanically ventilated in hospitals at AL-Najaf, Iraq.

Methodology: This study is carried out by using quasi-experimental of pre-test and post-test one group design. The study conducted over the period of time that started from December 10, 2019 and ended on February 20, 2020, by using observational schedule that concentrated on critical-care nurses' practices related to endotracheal suctioning. The study involved observation of critical-care nurses' practices prior to educational intervention and post-test evaluation of participants' practices after four weeks from implementing ETS educational program.

Results: The preliminary assessment of participants' practices related to endotracheal suctioning indicated that most of the nurses were not be committed to the best evidence-based recommended practice guidelines. Dramatically improvement in participants' practices occurred after implementing educational intervention with statistical highly significant indicators.

Conclusion: In-service educational program is a cornerstone in clinical care settings in terms of promoting healthcare providers' knowledge and practices that can lead to quality care and achieve desired outcomes of critically ill patient.

Recommendations: emphasizing on providing in-service educational program is an imperative aspect to enhance practicum skills for novice nurses. Incorporating most recent scientific approaches plays vitally important role in tracking recommended clinical evidence that reflects on embracing change to daily practice standards.

Keywords: *Critical-care Nurses; Educational program; endotracheal suctioning; Evidence-based practice guidelines.*

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Introduction

Patients who are critically ill generally hospitalized in critical care units. Most of these patients commonly having critical diseases such as respiratory failure and require mechanical ventilation (MV). Therefore, an artificial airway like endotracheal tube is commonly placed through the mouth to connect patients with MV in order to maintain breathing and aspirate airway secretions. Endotracheal suctioning (ETS) is one of the most frequent and important practiced procedures in critical care units. This procedure is often performed by critical care nurses in terms of removing accumulated secretions from the respiratory airway. The ETS includes threatening complications if it is performed incorrectly and may expose patient to risky deterioration.

Therefore, critical-care nurses need to be well trained, educated and competent in providing this procedure. In spite of published scientific practice modalities, many researchers addressed that nurses are having lack of commitment in terms of following evidence-based recommended practice guidelines[1-3]. A study carried out in Australia by Gilder, Parke, and Jull (2018) indicated that nurses were not adhering to follow international recommended guidelines related to ETS.[4] Moreover, a study in Turkey (2017) aimed to assess ICU nurses' knowledge and practices regarding ETS demonstrated that most of the nurses are relying solely on their individual experience rather than incorporating scientific approaches in performing suctioning.[5] Therefore, providing educational program based on clinical evidence is necessary to enhance nurses' practices and to guarantee excellent nursing care to patients who are mechanically ventilated.

Nurses should keep practicum skills, knowledge, and providing effective nursing care update. These aspects can be accomplished by attending continuous education. Schweitzer and Krassa (2010) asserted that "One way to keep current on nursing advances is to attend continuous opportunities." (p. 447).[6] Thus, developing structured educational program concerning ETS based on scientific clinical trials can prompt nurses' practice and achieve desired patient outcomes. Hence, the current study is aimed to evaluate the effectiveness of evidence-based practice educational program on critical-care nurses' clinical skills regarding endotracheal suctioning of adult patients who are mechanically ventilated in Hospitals at AL-Najaf AL-Ashraf City, Iraq. Accordingly, the evidence-based practice PICOT research question posed for this study is "Do critical-care nurses (P) who attend ETS educational program (I) improve their practice level (O) as compared to their pre-intervention practices (C) after four weeks from implementing educational program (T)". Moreover, the researchers hypothesized that there will be a statistical significant enhancement on the level of participants' practices about ETS after applying educational program as compared to their pre-test practices. General System Theory (GST) has been utilized to provide theoretical framework to guide this study.

Materials and Method

Research Design: This study is carried out by using quasi-experimental of pre-test and post-test one group design. The study involved evaluation of critical-care nurses' practices prior to educational intervention and post-test evaluation of participants' practices after four weeks from implementing ETS educational program.

Study Setting and Population: The population for the present study is nurses who are working in hospitals at AL-Najaf AL-Ashraf City, Iraq. The target population is nurses who are working in critical care units in selected hospitals. The accessible population is nurses who are met inclusion and exclusion criteria and who are working in AL-Sadder Medical City, AL-Hakeem General Hospital, and Middle Euphrates Hospital. The sampling technique was a non-probability, convenience sample of 87 out of 172 critical-care nurses who were interested in participating in this study.

The inclusion criteria for sample selection include:

1. Both male and female critical-care nurses at selected hospitals.
2. Critical-care nurses who were interested in participating in this study.
3. Critical-care nurses who were available at the period of data collection.

The exclusion criteria were as follow:

1. Nurses who were holding administrative position.
2. Nurses who were not available during the period of data collection.
3. Nurses who were not working in the critical care units.
4. Nurses who were not attending the ETS educational program.

5. Critical-care nurses who were selected for Pilot Study

Educational Program and Observational Checklist: The educational program has been developed based on extensive review of published studies from 2010 to 2020 and according to recent evidence-based recommended practice guidelines. The structured program is focused on improvement of participants' psychomotor skills by demonstrating and re-demonstrating essential steps in performing ETS. The objectives of the structured educational program are: to provide nurses the most recent scientific clinical evidence related to ETS, to articulate the significance of the suctioning procedure in terms of preventing ETS associated complications and enhancing patient outcomes, and to ameliorate collaboration between nurse educator (researcher) and critical-care nurses by identifying their areas where improvement can be made in order to meet the educational session goals. The researcher used various teaching-learning strategies to meet each individual nurse needs such as facilitate guided group discussion, role playing, concept map, problem solving approaches, and debriefing. However, the program concentrated on practices before suctioning, aseptic technique practices, practices during suctioning event, and post suctioning practices.

The observational checklist developed by Kelleher and Andrews (2008) was utilized and authors' permission was secured as well. The authors developed the clinical performance checklists based on comprehensive systematic reviews and recommended practice guidelines. The researchers took permission to adopt the final version of the tool. The observational schedule is peer reviewed to critical care nursing experts with experience in practice development. The authors did a pilot study to ensure validity and reliability.[7]

The tool contains 20 items that specified the most essential ETS practices: Prior to ETS practices includes nine items, and five items represents infection control practices, the suctioning episode incorporates five items, and post suctioning practices includes six items. These items can be found in the following tables. Moreover, after getting permission to use this observational checklist in the current study, we further requested opinion from ten experts from faculty members in adult nursing and anaesthesiologists with subspecialties in intensive care. The tool was valid and no major modifications were made. In addition, a pilot study was carried out for the reliability of the instrument and was analysed by using test retest method, which measured the coefficient of internal consistency. The obtained value for the instrument score was r = 0.81.

Method of Data Collection/Procedure: After getting the ethical approval from institutional review board, the researchers provided a brief description about the study purpose and informed consent was obtained to ensure confidentiality and privacy. We explained to nurses that observations would be occurred to investigate nursing-care practices related to infection control strategies in order to avoid bias during actual suctioning performances. The study began from December 10, 2019 and ended on February 20, 2020.

The participants were observed in their actual critical care units during morning and evening shifts by using observational checklist to document their actual practices against best evidence-based recommended practice. It took about 20 minutes for each observational checklist. The observation was done through three consecutive periods before implementing the educational program. Moreover, after providing an ETS educational intervention, the researcher used the same observational checklist three times in order to compare pre and post practices. The first observation checklist was done one day after presenting ETS educational program, while the second observation was carried out two weeks later and the third observation was done after one month from educational intervention to evaluate the effectiveness of educational program on nurses' practices.

Results

Eighty seven critical-care nurses are participated in this study. Demographic data for the study sample is shown in table 1. The results indicate that all nurses (100%) did not follow ETS guidelines. The vast majority (97.7) have not been attended previous educational or training program related to ETS. The majority of nurses (70.1%) had nursing diploma. Most of the participants (64.4%) had more than 5 years total experience in nursing, while only (12.6%) of them had more than 5 years experiences in critical care units (Table 1).

Table 1: Demographic Characteristics of the Critical-Care Nurses (N = 87).

Characteristics	Rating & Intervals	*n*(%)
Age/Years Mean 7.30 Standard Deviation 31.77	20–24	10(11.5)
	25–29	33(37.9)
	30–34	21(24.1)
	35–39	9(10.3)
	40+	14(16.1)
Gender	Male	64(73.6)
	Female	23(26.4)
Level of Education	Nursing Secondary School	5(5.7)
	Nursing Diploma	61(70.1)
	B.Sc. in Nursing	21(24.1)
Participation in Training/Educational Program	Yes	2(2.3)
	No	85(97.7)
If the answer is (Yes)	One Attendant	2(2.3)
Follow ETS Guideline	No	87(100)
Self-education	Yes	8(9.2)
	No	79(90.8)
If answer is (Yes)	Internet	6(6.9)
	Journal	2(2.3)
Total Experience as a Nurse	1–3 years	20(23.0)
	3–5 years	11(12.6)
	5 years and more	56(64.4)
Total Experience in Critical Care Units	Less than one year	29(33.3)
	1-3 years	24(27.6)
	3–5 years	23(26.4)
	5 years and more	11(12.6)

N = total study sample; *n* = sample number; (%) percentage.

Table 2: Evaluation of Nurses' Practices *Prior to Suctioning* at the Pre-test and Post-test.

Item	Observation	Pre-test	Post-test
		n(%)	*n*(%)
1. Patient Assessment: Did the nurse auscultate the patient's chest before ETS?	Done	29 (33.3)	73 (83.9)
	Not done	58 (66.6)	14 (16.1)
2. Patient preparation: Did the nurse explain to/communicate with the patient about the procedure?	Done	9 (10.3)	33 (37.9)
	Not done	78 (89.7)	54 (62.0)
3. Pre-suctioning hyper-oxygenation/hyperinflation	Done	71 (81.6)	73 (83.9)
	Not done	16 (18.3)	14 (16.1)
4. Sodium Chloride instillation	Done	79 (90.8)	7 (8.0)
	Not done	8 (9.2)	80 (92.0)

n = sample number; (%) = Percentage.

The results in table (2) indicate that the frequency and percentage of the correct performance in aspect "*Practices Prior to Suctioning*" is increased at the post-test as compared with pre-test. This gives an indication that there is an enhancement in the nurses' practices after the application of the ETS educational program.

Table 3: Evaluation of Nurses' Performances Regarding *Infection Control Practices*.

Item	Observation	Pre-test	Post-test
		n (%)	*n* (%)
5. Hands are washed prior to suctioning	Done	47 (54.0)	79 (90.8)
	Not done	40 (46.0)	8 (9.2)
6. Gloves are worn	Done	85 (97.7)	87 (100%)
	Not done	2 (2.3)	0 (0.0)
7. Apron is worn	Done	35 (40.2)	67 (77.0)
	Not done	52 (59.8)	20 (23.0)
8. Goggles/face mask worn	Done	30 (34.5)	70 (80.5)
	Not done	57 (65.5)	17 (19.5)
9. Sterility of suction catheter maintained until inserted into airway	Done	39 (44.8)	63 (72.4)
	Not done	48 (55.2)	24 (27.6)

n = sample number; (%) = Percentage.

Table (3) indicates that there is an improvement in frequency and percentage scores of participants' practices regarding infection control measures after implementing ETS educational program at post-test period.

Table 4: Evaluation of Nurses' Practices during "*Suctioning Event*"

Item	Observation	Pre-test	Post-test
		n (%)	*n* (%)
10. Size of suction catheter & Size of ET Tube: Done = Less than half internal diameter of ETS. Not done = More than half internal diameter of ETS.	Done	57 (65.5)	78 (89.7)
	Not done	30 (34.5)	9 (10.3)
11. Number of suction passes: *Done = two or less, Not done = more than two*	Done	60 (69.0)	82 (94.3)
	Not done	27 (31.0)	5 (5.7)
12. Length of time suction applied to airway: *Done = less than 15 seconds, Not done = more than 15 seconds*	Done	47 (54.0)	71 (81.6)
	Not done	40 (46.0)	16 (18.4)
13. Level of suction pressure: Done = 80 – 120 mmHg, Not done = more than 150 mmHg	Done	11 (12.6)	82 (94.3)
	Not done	76 (87.4)	5 (5.7)
14. Position of catheter when suction applied: *Done = withdrawal, Not done = insertion*	Done	49 (56.3)	82 (94.3)
	Not done	38 (43.7)	5 (5.7)

n = sample number; (%) = Percentage.

The results in the above table demonstrate that there is an enhancement in nurses' practices at post-test in regard to use suctioning catheter less than half internal diameter of ET tube. Similarly, items number 11, 12, and 14 indicate improvement in participants' practices at post-test. Concerning item number 13, the majority of nurses (87.4%) were exceeding the suctioning pressure limit in most of the time to more than 150 mmHg at the pre educational intervention. While after education, the participants adhered to recommended guidelines presented during the implanting ETS educational program.

Table 5: Evaluation of Nurses' Performance Regarding *Post Suctioning Practices*.

Item	Observation	Pre-test	Post-test
		***n* (%)**	***n* (%)**
15. Patient reconnected to Oxygen: *Done = less than 10 seconds, Not done = more than 10 seconds*	Done	56 (64.4)	65 (74.7)
	Not done	31 (35.6)	22 (25.3)
16. Post suctioning hyper-oxygenation/hyperinflation	Done	80 (92.0)	87 (100.0)
	Not done	7 (8.0)	0 (0.0)
17. Post ETS assessment: Did the nurse auscultate the patient's chest?	Done	32 (37.0)	65 (75.0)
	Not done	55 (63.0)	22 (25.0)
18. Patient reassured	Done	16 (18.4)	50 (57.5)
	Not done	71 (81.6)	37 (42.5)
19. Used catheter and gloves are disposed of in a manner that prevents contamination from secretions	Done	81 (93.1)	87 (100.0)
	Not done	6 (6.9)	0 (0.0)
20. Hands washed post suctioning	Done	41 (47.1)	72 (82.8)
	Not done	46 (52.9)	15 (17.2)

n = sample number; (%) = Percentage.

The finding in table (5) shows that prior to implementing ETS educational intervention, most of the critical-care nurses did not auscultate patient chest after suctioning procedure, whereas after education, most of nurses did auscultation examination. This table illustrates enhancement in the level of nurses' practices after providing the educational program.

Table 6: Mean Difference among Overall Nurses' Practices in Two Periods of Measurements (Pre-Test and Post-Test).

Phases of ETS	Pre-test	Post-test	Enhancement	Paired t-test	p- value S
	Mean (SD)	Mean (SD)	Mean (SD)		
Practices Prior to Suctioning	0.72 (0.43)	1.38 (0.42)	0.66 (0.11)	9.57	0.0001 HS
Infection Control Practices	0.88 (0.27)	1.19 (0.40)	0.31 (0.16)	6.01	0.0001 HS
The Suctioning Event	1.06 (0.33)	1.61 (0.28)	0.55 (0.9)	11.61	0.0001 HS
Post Suctioning Practices	1.11 (0.26)	1.43 (0.26)	0.32 (0.12)	8.14	0.0001 HS
Overall Practices	0.94 (21)	1.40 (0.22)	0.46 (0.7)	12.79	0.0001 HS

SD = Standard Deviation; S = Significance; HS = Highly Significance;

Paired t-test analysis is conducted to determine the difference in the mean of the nurses' practices at two points of measurements (pre-test and post-test). The study results presented in table (6) show that there are statistically highly significant differences in the nurses' practices at p-value less than 0.01. Based on the statistical mean, the results indicate that there is a highly significant improvement in the statistical mean in the post-test as compared with pre-test (i.e. there is an enhancement in the nurses practices after application the education program).

Discussion of the Study Finding

Regarding critical-care nurses' practices, the researchers observed participants during three times in each period of measurement (pre-test and post-test) in order to ensure the accuracy of recorded performances. The three recorded observations were statistically

analysed and calculated to compare overall mean scores for pre and post intervention. However, during pre-educational intervention period, the result of item no 1 regarding patient assessment shows that most of the participants did not perform auscultation technique before suctioning procedure (Table 2). This is consistent with what has been found in previous study in Finland that conducted by Jansson et al., (2013a) who stated that "the majority of suctions were carried out without clinical indicators (related to chest auscultation) being identified". (p.103).[3] A similar pattern of results was obtained from study in Iran that conducted by Haghighat and Yazdannik (2015) who reported that (90%) of nurses did not perform auscultation technique in terms of finding indications to ETS.[2]

On the other hand, after applying ETS educational program, the vast majority of participants performed auscultation in order to examine suctioning indications. This is evident that our educational intervention was an effective approach in terms of enhancing participants' practices. Our finding was directly in line with Azizian, Azadi, Veisani and Bastami (2020) who concluded that different educational method regarding ETS can be effective and significantly improving nurses' practices.[8] Özden and Görgülü, (2012) mentioned that nurses' practices about ETS improved after training program and reflected on enhancement of patient safety and excellent quality of nursing care.[9] The nurse must be aware that chest auscultation is a mandatory technique to determine clinical indicators for ETS. Performing chest auscultation is one of the most important assessment techniques that nurses should master to detect respiratory indicators to ETS.

In the same domain "*Practices Prior to Suctioning*" item number 4 "Sodium Chloride Instillation" the result indicates that most of participants had been doing normal saline instillation (NSI) before suctioning episode (Table 2). This was revealed in the study by Haghighat and Yazdannik (2015), where most of the nurses implemented NSI before suctioning event.[10] Similar study results that carried out in Baghdad Teaching hospital and Surgical Specialties Hospital/ Medical City Directorate by Majeed (2017) has also demonstrated that the majority of ICU nurses performed NSI.[11] AARC (2010) does not recommend using NSI because there is no enough evidence that articulated its benefits.[12] In spite of evidences that do not support using normal saline (NS), nurses still practicing this procedure. The reason for that could be lack of nurses' knowledge about recent evidence-based recommended practice guidelines. Oppositely, after implementing ETS educational program, the vast majority of participants did not use NSI prior suctioning (Table 2). Moreover, the statistical finding regarding participants' practices "*prior to suctioning"* revealed highly significant improvement in nurses' practices (p = 0.0001) after educational intervention as indicated in table (6). This is proved that our structured educational program has a positive impact on nurses' practices in terms of adhering to the best recommended practices.

In relation to the second aspect "*Infection Control Practices*" the result of pre-test shows that nurses were not fully adhere to infectious preventive measurements. For example, apron was not be worn in most of the participants (59.8%), many participants (65.5%) did not wear face mask and (55.2%) of nurses were not maintain sterility of suction catheter when inserted into airway (Table 3). Our finding is in line with Haghighat & Yazdannik (2015) who found that most of nurses in their study did not adhere to infection control practice guidelines such as (82.5%) of nurses did not wash their hands and goggles were not be worn in (90%).[2] Infection control practices are an essential aspect in terms of preventing hospital acquired infection specifically in ICU. The most common nosocomial infection in critical care units is ventilator-associated pneumonia (VAP) with the occurrence rates ranging up to 70%.[12] Jansson et al., (2013b) stated that despite current available guidelines regarding VAP prevention, nurses still have discrepancies between evidence-based best practices and their performances.[13] Another research study in Jordan conducted by Aloush (2017) indicated that nurses' commitment to infection control strategies regarding VAP were low. The researcher emphasized that poor adherence toward infection control principles could be due to the lack of in-service education for ICU nurses.[14]

Consequently, after providing in-service educational program, the result in table (3) indicates that most of the participants adhered to the best recommended practice guidelines related to infection control practices. Our results demonstrated that there is an improvement in nurses' practices occurred after applying ETS educational program. According to overall statistical analysis for the aspect "*Infection Control Practices*" the result appeared to be very highly significant (p = 0.0001) as indicated in table (6).

Concerning the next domain (table 4) "*The Suctioning Event*", our finding shows that there is a statistically highly significant improvement in participants' practices after implementing ETS educational intervention as illustrated in table (6). In addition, the last section (Table 5) namely "*Post Suctioning Practices"*, our finding revealed that the participants' performances enhanced significantly after educational intervention as delineated in table (6). These findings are in accordance with findings reported by Fernandes, Dasila, and Banerjee, (2018) who mentioned that "Regular in-service education programme at every hospital is required to keep the nurses updated with evidence-based guidelines to achieve positive patient outcomes" (p. 147).[15]

After application the ETS educational program, our finding shows that the overall evaluation of participants' practices in all domains was statistically very highly significant. This could be due to our structured educational program was focusing on the main aspects related to ETS. The second reason can be the study was guided by GST which provided a conceptual framework as a roadmap to delineate crucial steps in demonstrating and re-demonstrating practicum skills through input, output, and feedback process. Thus, our hypothesis is accepted at high level of significance (p = 0.0001) and null hypothesis is rejected as shown in table (6).

Conclusion and Recommendation

Directed by general system theory, evidence-based practice recommended guidelines, most recent studies, and standards of nursing care were used to develop an effective ETS educational program to improve practices of critical-care nurses in performing suctioning to patients who are mechanically ventilated. The structured educational intervention is provided in one session. For future researchers, different didactic approaches should be considered, for example using simulation training modalities and implementing several sessions over period of times to include more sample size are highly recommended. Studies recommended conducting continuous educational intervention to maximize the benefit in gaining knowledge and refining practical skills. Bridging the gap between knowledge and practices is the key to enhance the quality of nursing care and improve outcomes for patients who are under mechanical ventilation. In-service educational program based on evidence-based recommended practice guidelines is strongly advised to embrace change with updated scientific approach. Finally, ETS must be performed by well trained, educated and competent nurse to avoid potential adverse event of suctioning procedure.

Ethical Clearance: Taken from University of Babylon/College of Nursing Research Ethics Committee, Iraq.

Source of Funding: The authors have no sources of funding to declare.

Conflict of Interest: The authors have no conflict of interest to declare.

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