Original Article

Effect of clinical audit process on level of endotracheal suctioning skill in nurses and anesthesia technicians working in intensive care units

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ABSTRACT

Background & Aim: With the implementation of incorrectly airway suctioning, many complications and risks can be followed. Therefore, health care providers can expedite recovery of patients by increasing in quality of suction. This study was conducted to evaluate the effect of clinical audit process on the level of endotracheal tube suctioning skill in nurses and anesthesia technicians working in intensive care units (ICUs) of AJA hospitals in Tehran, Iran.

Methods & Materials: In this semi-experimental study, 135 nurses and anesthesia technicians working in ICUs in AJA hospitals in Tehran, Iran recruited by census method and were randomly allocated into two groups of intervention and control, in 2013-2014. The intervention was conducted via implementation of the five-stage clinical audit in the intervention group. For detection of endotracheal tube suctioning skill in subjects, pre- and post-intervention, the checklist was used. Then, data were analyzed using the SPSS version 21.

Results: In pre-intervention phase, independent t-test not showed significant differences in the mean scores of the subjects' clinical endotracheal suction skill in two groups (P = 0.7300) but in post-intervention phase, two groups were different (P = 0.0001). Paired t-test showed that the total score of nursing skill in endotracheal suction of the subjects in intervention group after the intervention significantly increased (102.38 ± 7.24 to 121.25 ± 2.10, P = 0.0001).

Conclusion: The results of this study suggested a positive impact of clinical audit process on nurses and anesthesia technicians' endotracheal suction skill. Therefore, it seems that the implementation of this process can promote level of nursing care.

Introduction

Because of critically ill patient's hospitalization, intensive care unit (ICU) of the hospitals require to accurate, effectiveness and high quality care and lack of optimal care offering to the patients lead to very high costs (1). So that evidences show more than 47% of patients in ICUs undergoes to respiratory infections and time of their hospitalization increases (2). Usually, patients in ICUs are in critical conditions and to provide oxygenation and prevent aspiration, need for mechanical ventilation and artificial airway (3). Complications of this artificial airway include defect in coughing reflex, the loss of normal function of ciliary cells, accumulation of respiratory secretions and the incidence of cardiovascular events. Since these patients are not able to excretion this secretions, periodically, they requires to suctioning of airways (4). Endotracheal suction considers as an important

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intervention in the care of these patients and normally performed by nurses and anesthesia technicians. If endotracheal suction has not performed according to correct principles, it can cause a lot of complications, including reduced and irregular heartbeat, reduction of arterial oxygen, atelectasis, and increases of brain pressure, mild to severe bleeding, rupture of tracheobronchial, emphysema, pneumothorax, cardiac arrest, and even death (5). Therefore, considering the risks of this basic care, it is essential to nurses and anesthesia technicians be familiar with the various stages of this process and with promote in work quality, accelerates recovery of patients (6).

Studies showed that health care centers do not use an evidence-based standard method for suctioning and different methods for suction of endotracheal tube uses by therapeutic and health care staff (1, 7). For example, in a study has been showed that nurses in suctioning procedure, seldom used from the recommended standard methods. Also, despite having acceptable knowledge, they had moderate or low levels of performance (4). Also, other studies showed that nurses had low level of knowledge and clinical skill of suction (8, 9).

Today, accessibility to health services with the best quality is the concern of many people in the world; therefore having an awareness of the quality of work to evaluate intervention and its effectiveness, is an essential component of care, especially for patient's care in ICUs. Therefore, the clinical governance model to overcome the problems of care is formed (10). Services clinical governance is a framework in which service provider organizations are responsible for the improvement of quality and by creating a favorable environment pay to preservation the standards of service (11). On the other hand, today, quality is not comply of the minimum standards, but is accessibility to client's expectations in the providing of effective, adequate and divestible services by health centers. Based on clinical services authority model, clinical audit is one of the most effective tools for quality improvement. In fact, clinical audit is part of clinical governance and one of the education topics that lead to improvement of therapeutic standards (12). Clinical audit is a systematic review and a five-step

process that in order to enhance the quality of clinical services, compares manner of patient's care with standards and identify and apply necessary changes to improvement of structure, process and outcomes of patient's care. Also, to ensure the correct application of the changes and improvement of service quality, health system pays to monitoring and reassess of processes and in certain cases, changes in the individual, group and organizational levels has been implemented and to confirm the improvement of health care delivery, required monitoring regularly takes places (10). Clinical audit can also be considered as an educational tool for the introduction of new ideas in care and learn from experiences. Hence it was suggested that in conducting clinical audit cycle, in addition of managers, after training everyone in the organization are involved in the control of quality of care (6).

Based on the results of the studies, clinical audit is an important tool for measuring the quality of care and useful for substantially increase in quality and effectiveness (13). For example, researchers showed that the audit of prenatal care will lead to increased quality of care (14). Also, others showed that clinical audit program can be an effective step to reduction of nursing error in bladder catheterization process (15). According to what was said, it seems that the use of clinical audit can be a suitable solution for improving the quality of nursing care such as airway suctioning. This study was conducted to evaluate the effect of clinical audit process on the level of endotracheal tube suctioning skill in nurses and anesthesia technicians working in ICUs of AJA hospitals.

Methods

This study is a semi-experimental which was conducted in 2013-2014.

All nurses and anesthesia technicians working in the ICUs of AJA hospitals in Tehran, Iran were recruited by census method. Inclusion criteria included anesthesia technicians and nursing staff in the ICUs with an associate degree or higher and at least 2 months work experience in the ICUs. Exclusion criteria were unwillingness to maintain in the study and having very good

score in the pre-intervention phase. Hence, of 140 staffs who worked in these units, three nurses due to lack of sufficient work experience in the ICUs, have not been studied. Also, one subject of intervention group and one of control group after completing the checklist, due to the very good score was excluded in the initial stage of the audit. To reduce the transmission of knowledge between subjects, hospitals randomly were assigned into two groups of intervention (3 hospitals) and control (3 hospitals) by use of throwing coin. Finally, 135 nurses and anesthesia technicians (70 in the intervention group and 65 in the control group) participated in the study.

The data collection tool was an instrument consisting of two parts. The first part of the instrument was related to personal characteristics of subjects (12 questions) and the second part was a researcher-made checklist to assess the clinical skill of nurses and anesthesia technicians in endotracheal suction (45 questions). Scoring mentioned items was in four-point Likert from 0 to 3. In this way that if the subject did work completely, earns score 3, if did work incompletely, earns score 2, if not performed the work, earns score 1 and if it is not required to doing work, earns score zero. It should be noted that where were zero not included in the calculation of the mean. The maximum score achieved was 135 which represent the highest level of expertise in the field of endotracheal suction. The scores 108-135 indicated a very good performance. Also, the scores of 81-107.9 demonstrated desired, whereas the scores of 54-80. Nine represented undesired and the score of < 54 indicated a very poor performance.

The whole procedure of suctioning was investigated on the basis of clinical audit steps. Questions 1-23 were related to stage before the start of the suctioning and paid to assess patient, preparation of required equipment and infection control. Questions 24-36 were related to the stage during suctioning which insisted on suctioning procedure and out of secretions in appropriate method. Questions 37-45 were related to the stage after suctioning which investigate the patient's response. To prepare a checklist of endotracheal suction, the latest standards in library resource were used (16). Then, ten faculty

members of nursing in AJA, Tehran and Shahid Beheshti University of Medical Sciences, who have experience and expertise in ICUs evaluated checklist and after making necessary changes, instrument content validity was confirmed. To confirm face validity, comments of 10 nurses working in ICUs, outside the research environment were used and their ideas were applied. In order to confirm the reliability of tools, an agreement between the two raters was used. Raters, include one of researchers (MSc student of nursing with 5 years of experience working in the ICU) and a nurse with 10 years' experience working in the ICU. These nurses completed the checklists and performed five stages of clinical audits. Raters in a 2 hours meeting, studied instrument and coordinated with together to complete the checklist. The evaluation was conducted precisely on the content of the checklist and two raters independently evaluated a number of 20 nurses in an ICU during endotracheal suction procedure by observing their practice. Kappa formula was used to examine contingency coefficient of questions that varied between 0.5 and 1. Questions 17 and 35 had values 0.4-0.6 that indicates moderate agreement between two raters. Other questions had value above 0.8 that indicates excellent agreement between two raters (17). To assess the internal consistency of checklist, Cronbach's alpha coefficient ($\alpha = 0.75$) was used and instrument reliability was approved.

In the pre-intervention phase, assessment of endotracheal suction procedure was performed in both intervention and control groups by completing the checklist. This step is based on the clinical audit process and was including the evaluation of current situation that performing endotracheal suction in three stages before, during and after suctioning by nurses and anesthesia technicians was assessed. In the second and third stages, current situation was compared with standards and weaknesses were identified based on the checklist and the scores of both groups were calculated. If the score of each of the nurses and anesthesia technicians was in the highly desirable, they were excluded from the process.

In the fourth stage of the clinical audit process (intervention phase), education was per-

formed only in the intervention group. All educational sessions were conducted individually and face to face for at least 45 minutes by raters in a separate room. Education was presented due to the scores gained by the subjects in the before stage and based on the content of endotracheal suction procedure. The purpose of the training was the correct procedure of suctioning and avoids from unnecessary works during suctioning and enhances the skill of subjects suctioning. Educational content validity was confirmed by faculty members of nursing faculties of AJA and Shahid Beheshti University of Medical Sciences. It should be noted that a training manual were given to subjects of intervention group. The content of training manual was included guidance to the correct suctioning and equipment needed for suctioning.

Post-intervention phase that including the final stage of the audit conducted 2 weeks after the intervention. So, subjects' clinical skill using the checklist was assessed in both groups. In the control group, no intervention was performed and only in the pre- and post-intervention phases, subjects were evaluated using the checklist (Diagram 1).
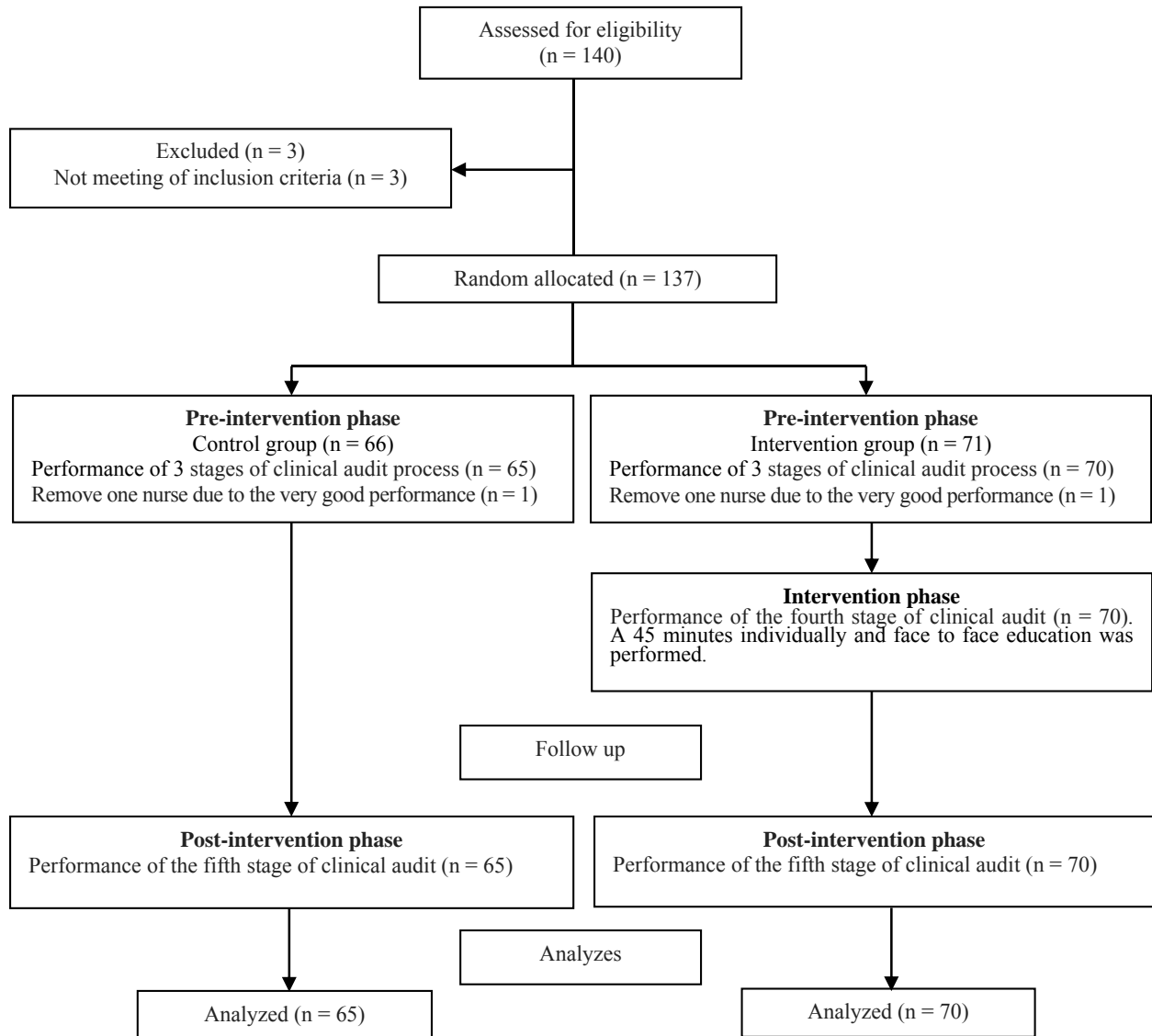

Diagram 1. The process of study

The Research Council and the Research Ethics committee in the AJA University of Medical Sciences and Iranian Registry of Clinical Trials approved this study with NO. 9214 and NO. IRCT2015080123446N1, respectively. The researchers bounded themselves to observe the ethical issues based on the Helsinki Declaration (18). Data collection was performed after explaining the purpose of this study and obtaining informed consent from the subjects. All subjects were assured of obscurity and confidentiality of their personal information, and the right to refuse participation or withdraw from the study at any time.

Finally, the data were analyzed using SPSS software (version 19, SPSS Inc., Chicago, IL, USA). The statistical significance set as P < 0.0500. It should be noted that statistical analyzer and subjects were unaware from allocation of subjects in the intervention and control groups. Meanwhile, Since the Kolmogorov–Smirnov test represented the normality of the data (P > 0.0500); parametric statistics were used to analyze the data.

Data were analyzed using descriptive and analytical statistics. We used t-test and paired *t*-test for analysis of ratio data and χ^2 test or Fisher exact test for nominal and ordinal data.

Results

The mean age of subjects was 32.05 ± 4.75 (range = 25-51 years); 55.6% of the subjects were female; and 57.8% were married. About 50% of the subjects had BA degree in nursing. No statistically significant differences were observed between the two groups regarding individual characteristics (P > 0.0500) (Table 1).

Independent sample *t*-test not showed significant difference between the two groups in the total score and the scores of before, during and after endotracheal suctioning in the pre-intervention phase (P > 0.0500). However, this test indicated the significant differences in two groups in the total score and the scores of before, during and after endotracheal suctioning in the post-intervention phase (P < 0.0500) (Table 2).

Table 1. Individual characteristics of subjects

Variables	Intervention f (%)	Control f (%)	P value
Sex			
Male	34 (56.7)	26 (43.3)	0.2040
Female	36 (48.0)	39 (52.0)	
Marital status			
Single	25 (51.0)	24 (49.0)	
Married	41 (52.6)	37 (47.4)	0.9020
Divorced	3 (60.0)	2 (40.0)	
Widow	1 (33.3)	2 (66.7)	
Educational level			
Associate	6 (75)	2 (25)	
BA	58 (49.2)	60 (50.8)	0.9020
MS	6 (66.7)	3 (33.3)	
Staff			
Nurse	63 (121.0)	58 (47.93)	0.4010
Anesthesia technician	7 (50)	7 (50)	
Employment status			
Official	63 (50)	63 (50)	
Contractual – treaty	7 (77.78)	2 (22.22)	
Working shift			
Morning	31 (52.5)	28 (47.5)	
Evening	7 (43.8)	9 (56.3)	0.3220
Night	8 (38.1)	13 (61.9)	
Passing the course of special care			
Yes	18 (58.1)	13 (41.9)	0.2800
No	52 (50)	52 (50)	
Work overtime			
Yes	44 (53.7)	38 (46.3)	0.3650
No	26 (49.1)	27 (50.9)	
Age (years), mean ± SD	32.34 ± 5.29	31.37 ± 4.18	0.0684
Nursing work experience (years), mean ± SD	9.74 ± 6.24	8.42 ± 4.90	0.2520
Experience of working in an intensive care unit (years), mean ± SD	6.24 ± 4.79	5.51 ± 3.32	0.0680

Group comparison was tested by t-test in ratio data and by χ^2 test or Fisher exact test in nominal and ordinal data. SD: Standard deviation

Table 2. The means and standard deviation of endotracheal suctioning skills in two phases in the intervention and control groups

Stages of suction	Time	Group		P value†
		Intervention (Mean ± SD)	Control (Mean ± SD)	
Before suctioning	Pre-test	55.67 ± 3.77	55.26 ± 2.07	0.4410
	Post-test	64.47 ± 0.94	56.50 ± 2.26	0.0001
	Mean difference	8.8	1.24	
	P value‡	0.0001	0.0001	
During suctioning	Pre-test	23.20 ± 2.85	23.41 ± 2.53	0.6440
	Post-test	30.55 ± 1.47	23.50 ± 2.47	0.0001
	Mean difference	7.25	0.09	
	P value‡	0.0001	0.0110	
After suctioning	Pre-test	23.51 ± 1.90	23.56 ± 1.34	0.8480
	Post-test	26.22 ± 0.99	24.69 ± 1.63	0.0001
	Mean difference	2.71	1.13	
	P value‡	0.4790	0.0001	
Total score	Pre-test	102.38 ± 7.24	102.24 ± 3.66	0.8890
	Post-test	121.25 ± 2.10	104.70 ± 3.73	0.0001
	Mean difference	18.87	2.46	
	P value‡	0.0001	0.0001	

†Independent t-test, ‡Paired t-test. SD: Standard deviation

Table 3. Comparison of level of endotracheal suctioning skills in pre- and post-intervention

Time	Level of endotracheal suctioning skills	Group		P value†
		Intervention f (%)	Control f (%)	
Pre-test	Very good	14 (18.8)	6 (9.2)	0.0800
	Desired	56 (81.2)	59 (90.8)	
Post-test	Very good	70 (100)	16 (24.6)	0.0001
	Desired	0 (0)	49 (75.4)	

†χ^2

The results of paired t-test showed that the total score of nursing skill in endotracheal suction of the subjects in intervention group in the pre-intervention phase (102.38 ± 7.24) and 2 weeks after the intervention (121.25 ± 2.10) were significantly different (P < 0.0500). Also, this test showed that in the control group, the total score of nursing skill in endotracheal suction of the subjects, before the intervention was 102.24 ± 3.66 and after the intervention increased to 104.70 ± 3.73, which also this difference was statistically significant (P = 0.0001). It should be noted that scores of the intervention group was higher than the control group (Table 2). Level of endotracheal suctioning skill of nurses and anesthesia technicians in pre- and post-intervention has presented in table 3.

Discussion

This study was conducted to evaluate the effect of clinical audit process on the endotracheal tube suctioning skill in nurses and anesthesia technicians working in ICUs of AJA hospitals. In this study, clinical audit process was used to promote the skill of nurses and anesthesia technicians. Researchers believe that the theories of quality management should be present and applied to improve the quality of practice. Evidence suggests that the use of models can facilitate the observance of standards and evaluation of nurse's practice (19). As shown, the two groups were comparable in terms of all individual characteristics measured. In the pre-intervention phase, the two groups were also comparable in terms of the total score of nursing skill in the field of endotracheal suction that these findings suggest which the two groups were homogeneous. The results showed that the scores of the two groups after the intervention in three section of checklist (before, during, and after of suction) significantly increased, but scores of the intervention group was higher than the control group. As, all of subjects' scores in intervention group increased to very good level. Whereas, about 25% subjects in control group

were in very good level. It seems that a small increase in the skill of control group related to presence of auditor in the re-audit step and her evaluate and supervision on performance of procedure in the environment. In general, the results show the effectiveness of the implementation of clinical audit process on nurses and anesthesia technicians' endotracheal suction skill in AJA hospitals. This finding is consistent with the results of other studies (15, 17, 19, 20). For instance, a study performed with the aim of "examine the effect of instructing the principles of endotracheal tube suctioning on knowledge and performance of nursing staff working in neonatal ICUs," researchers reported that after the intervention, knowledge and performance in both intervention and control groups increased (17). In other research, which aims to assessment of basic criteria for improves the quality of prenatal care in clinical audit method on 65 patients with complications of pregnancy, the results showed considerable improvement in prenatal care after using this method and clinical audit was introduced as an acceptable method for evaluation and improving the quality cares provided in therapeutic environment (21). Also, in a study showed that performance of the nurses in intensive unit during endotracheal suctioning was low to moderate, but after education, their knowledge and performance significantly increased (20) which is compatible with the results of this study.

One of the limitations of this study was presence of researcher in the environment of study which may have affected on nurses and anesthesia technicians' practice. However, considering that the operation and effectiveness of training programs and promotion of services provided by nurses is a fundamental need in the nursing community (21) and with regard to effectiveness of clinical audit process on quality of nursing care and enhance clinical skill, this process can be described as an efficient, effective, simple, and low cost model to improve the nursing care. However, for better and more effective use and clarify its strengths and weaknesses, it is suggested that this process will also be studied in other procedures to can be considered as implementation model for operating care and education programs for nurses.

The results of the present study highlighted a positive impact of clinical audit process on nurses and anesthesia technicians' endotracheal suction skill. Therefore, it seems that the implementation of this process can promote level of nursing care.

Acknowledgments

Conflict of interest

None declared.

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