

# Open system endotracheal suctioning: practices of intensive care nursing professionals

*Aspiração endotraqueal por sistema aberto: práticas de profissionais de enfermagem em terapia intensiva*

*Aspiración endotraqueal por sistema abierto: prácticas de los profesionales de enfermería en cuidado intensivo*

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## ABSTRACT

The purpose of this study was to investigate the practices of nursing professionals working in intensive care units regarding open system endotracheal suctioning (ETS). This quantitative study of 25 subjects was conducted in the State of Mato Grosso do Sul (MS), Brazil. Data was collected from April to September 2011 using a checklist monitoring tool composed of 23 items related to the technique. Data was subjected to descriptive statistical analysis. The mean global adherence rate was 51.33%. Poor adherence to 16 items was observed, these being risk factors for the occurrence of adverse effects, particularly occupational accidents, hypoxemia, infection, and hemodynamic instability. Dissatisfactory performance of ETS was found among the professionals investigated, warranting interventions capable of promoting behavioral changes through continuing education aimed at improving the quality of care.

**Keywords:** Employee Performance Appraisal; Critical Care; Respiration, Artificial; Suction.

## RESUMO

O objetivo deste estudo foi investigar as práticas dos profissionais de enfermagem de terapia intensiva quanto à aspiração endotraqueal (AET) por sistema aberto. **Métodos:** Trata-se de uma pesquisa com enfoque quantitativo desenvolvida em um hospital universitário de Mato Grosso do Sul, Brasil, com 25 sujeitos. Os dados, coletados de abril a setembro de 2011 por meio de instrumento de observação do tipo *checklist* contendo 23 itens da técnica, foram analisados por estatística descritiva. **Resultados:** A média de adesão global foi de 51,33%. Verificou-se baixa adesão a 16 itens, os quais são fatores de risco para a ocorrência de efeitos adversos, sobretudo acidentes ocupacionais, hipoxemias, infecções e instabilidade hemodinâmica. **Conclusão:** Concluiu-se que os profissionais não realizam a AET de forma satisfatória, sendo necessárias intervenções que promovam mudanças comportamentais por meio de educação continuada visando melhoria da qualidade da assistência prestada.

**Palavras-chave:** Avaliação de desempenho; Cuidados críticos; Respiração artificial. Sucção.

## RESUMEN

**Objetivo:** Investigar las prácticas de los profesionales de enfermería de cuidados intensivos cuanto a la aspiración endotraqueal (AET) por sistema abierto. **Métodos:** Se trata de una investigación con enfoque cuantitativo, realizada con 25 sujetos en un Hospital Universitario en el estado de Mato Grosso do Sul, Brasil. Los datos fueron recolectados entre abril y septiembre de 2011 con instrumento de monitoreo tipo *checklist*, con 23 ítems de la técnica, analizados mediante estadística descriptiva. **Resultados:** El promedio de adhesión global fue del 51,33%. Se ha verificado poca adhesión para 16 ítems, los cuales son factores de riesgo para la ocurrencia de efectos adversos, en particular los accidentes laborales, las hipoxemias, las infecciones y la inestabilidad hemodinámica. **Conclusión:** Los profesionales no cumplen satisfactoriamente con la AET, siendo necesario intervenciones para promover cambios de comportamiento a través de educación continua dirigida a la mejora de la calidad de la atención.

**Palabras-clave:** Evaluación del Rendimiento de Empleados; Cuidados Críticos; Respiración Artificial; Succción.

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## INTRODUCTION

Endotracheal intubation and the institution of invasive mechanical ventilation are resources which are widely used in the management of critically-ill patients, so as to provide sufficient gaseous exchange for those with some sort of respiratory insufficiency. However, these devices can cause detrimental effects - inflammation, infections, and traumatic lesions to the airways -, which require preventive care. The appropriate management of the artificial airway has a direct impact on the patients' prognosis, including reduction of morbimortality, length of hospitalization, and hospital costs<sup>1</sup>.

In this regard, one of the most important nursing care actions is endotracheal suctioning (ETS), directed at removing secretions and, through this, promoting the maintenance of the airways' permeability, as well as optimizing ventilation and oxygenation. The procedure is essential for the stability of pulmonary function, as the presence of a ventilatory prosthesis interferes in the physiology of coughing and of the mucociliary system, which can inviabilize the adequate clearance of secretions from the tracheobronchial tree and cause stasis of this content. This can cause atelectasis, infections, respiratory compromise, obstruction of the endotracheal tube, hemodynamic changes and death<sup>2</sup>.

There are currently two methods, or distinct systems, for carrying out the procedure: open and closed. In the first, it is necessary to open the respiratory circuit by disconnecting the mechanical ventilator from the ventilatory prosthesis, followed by suctioning with a single-use catheter; in the second, which dispenses with the disconnection of the ventilator, the suction catheter is multiple use, and may remain connected to the system for up to 24 hours, in line with the maker's recommendations<sup>2</sup>.

There is controversy regarding these systems' efficacy in reducing infections, oxy-hemodynamic changes and length of time on mechanical ventilation, as well as the period of hospitalization. In recent decades, the closed suction system has been gaining popularity in developed countries. In the United States, for example, this system is used exclusively in 58% of Intensive Care Units (ICU), while the open system is used exclusively in only 4% of the centers<sup>3</sup>.

Although ETS is essential, it can entail serious risks and complications for the patient, above all when improperly used, including increases in arterial pressure and intracranial pressure, hypoxemia, cardiac arrhythmias, cardiac and/or respiratory arrest, bronchospasm, atelectasis, nosocomial infections, vagal hyperstimulation, damage to the tracheobronchial tree, anxiety, bleeding, cardiovascular instability, neurological changes and even death<sup>4</sup>.

In undertaking this procedure, therefore, the nursing team must be aware of these possible negative effects, as well as of the prevention and control measures. Studies have shown, however, that in implementing the technique of ETS, among other care taken with the artificial airway and mechanical ventilation, nurses' work is not always based on scientific evidence, and can therefore compromise the patient's clinical evolution<sup>5,6</sup>.

Due to the risks and to the frequency with which nursing professionals carry out the ETS procedure, it is necessary to periodically and critically investigate these subjects' clinical practice, with a view to identifying specific non-compliances, which can support actions of planning and intervention based on the local context, the aim being to improve the quality of the care offered<sup>1</sup>.

Considering the above, the following question is asked: How is the ETS procedure being undertaken by the intensive care nurses, in the light of the evidence? This work's objective was to investigate the practices of the intensive care nursing professionals in relation to ETS with the open system.

## METHOD

For this exploratory-descriptive cross-sectional study with a quantitative approach, data was collected in the period April - September 2011 in two ICUs (general and cardiological) in a university hospital in the state of Mato Grosso do Sul, Brazil. The general ICU, sited on the ground floor, has eight beds, one of which is for isolation. The cardiology ICU, located underground, has nine beds, four of which are allocated for post-operative cardiac recovery, and five for the clinical treatment of cardiac conditions. All the beds are equipped with cardiac monitors and mechanical ventilators, making it possible to offer concomitant ventilatory support for the critically-ill patients frequently admitted to these units. It is highlighted that these ICUs use open system ETS, because they do not have ventilatory circuits which allow suction using the closed system. The choice of this universe is explained by the fact that ETS is a routine procedure in these sectors.

All the nursing professionals allocated in the sectors investigated, who had worked in intensive care for a period equal to or more than one year, were included in the study, apart from those who were on leave of any type during the data collection period. As a result, the population was made up of 34 nursing professionals, 18 of whom were allocated in the general ICU, (two nurses, four nurse technicians and 12 auxiliary nurses) and 16 in the cardiological ICU (two nurses, eight nurse technicians, and six auxiliary nurses). Of these, 25 (73.52%) met the inclusion criteria and represented the sample.

In consonance with the current literature<sup>1,7-9</sup> and with the Standard Operating Procedure Manual of the ICUs studied, a data collection instrument was constructed on the procedure of ETS using the open system. This instrument is made up of three distinct parts. The first covered the participants' socio-demographic data, with seven closed questions. The second was an observational script of the checklist type, and contained 22 obligatory items, that is, necessary in all the ETS, and one optional: necessary only in specific circumstances. For each item there were two possibilities - correct performance or incorrect -, as well as a space for general observations: recording occasions in which the optional item did not apply, as well as unforeseeable situations. The third was an instructional guide containing criteria

for defining correct and incorrect performance, used for standardizing each item's evaluation.

The instrument was submitted for content validation by five judges with technical-scientific knowledge regarding the issue (one researcher, two nurse lecturers with the title of Doctor, and two nurses directly involved in care). These evaluated the objectivity, relevance and clarity of the items, and all the suggestions were accepted. A pilot-test was undertaken with 10 ETS events observed during the practice of nursing professionals from the institution's Emergency Room, the aim being to identify problems in its application which could interfere in the research process. After this stage, no changes were made.

Prior to the instrument's application, each professional received advice about the research and on how he or she would participate. They were then asked to sign the Terms of Free and Informed Consent and provide their socio-demographic data. Data collection took place through structured observation (checklist) in the subjects' work environment, in which a single observer (a member of the nursing service of the ICUs investigated) analyzed and recorded, on the different days of the week and shifts, the participants' performance in relation to the ETS technique. Each professional was observed three times, on different days, only one of these events being considered for the purposes of compilation (mode), that is, the correct or incorrect behavior that was observed most for each item.

Due to differences of complexity and psychomotor demands, only those ETSs undertaken with orotracheal tubes were evaluated; those undertaken via a tracheostomy cannula were not considered. In addition to this, the aim being to select complete behaviors and cover all the items of the instrument in the evaluations, only the ETSs with two or more successive suctionings interspersed by connection of the patient to the mechanical ventilator were considered.

The ethical aspects prescribed by Resolution 196/96 of the National Health Council, referent to research involving human beings, were respected. The project which gave rise to this study was approved by the Research Ethics Committee of the Federal University of Mato Grosso do Sul under protocol nº 1949/201.

The data was organized in a database using the Microsoft Office Excel software, version 2007, and was analyzed with descriptive statistics, using the modalities of absolute and percentage distribution, as well as means and standard-deviation for the socio-demographic data.

## RESULTS

Of the 25 professionals investigated (100%), 11 (44%) worked in the general ICU (two nurses, two nurse technicians and seven auxiliary nurses) and 14 (56%) in the cardiological ICU (eight nurse technicians, and six auxiliary nurses). Of this population, 14 subjects (56%) were male. The mean age was 40.56 years old,  $\pm$  7.19. The mean length of experience in the profession was 17.16 years  $\pm$  7.74 and the mean length of service in adult ICU was 10.12 years  $\pm$  6.03. Neither of the two nurses had

a specialized qualification in intensive care, although one of them was a postgraduate (*lato sensu*) and, among the professionals with technical qualifications, 16 (70%) had finished senior high school, six (26%) had attended higher education (three in nursing) and one (4%) had a postgraduate qualification in Intensive Care Nursing. In relation to continuous education, 10 (40%) of the professionals stated that they had never received any type of training at work on ETS.

Table 1 presents data on the nursing professionals' performance regarding the items related to the ETS procedure, with the respective values for adherence, that is, undertaking the procedure in line with the bibliography used in constructing the investigation instrument.

Item 23 - suctioning of the upper airways - was considered optional, as it was not obligatory in all the ETSs, as its undertaking depends on the accumulation of secretions above the level of the cuff of the ventilatory prosthesis. The component of this sample was therefore smaller, as, to be compiled in this item, the professional had to be observed at least twice with the same behavior in situations which called for its use.

## DISCUSSION

Corroborating the literature, the present study's data evidenced low adherence to various items of the standard procedure for ETS by open system by nursing professionals<sup>5,8,10,11</sup>. It is therefore observed that both patients and health professionals are exposed to risks, above all for occupational accidents, hypoxemias, infections and hemodynamic instability, with ethical and legal implications.

Although the analysis of the results reveals that, in 12 items, at least 70% of those investigated adhered to the measures recommended for ETS, these professionals' general performance was shown to be inadequate, as the global mean of correct actions, the sum of the percentage values of all the items divided by 23 - the total number of items - was low (51.33%). This finding has a close relationship with the low rates of adherence to items 2, 3, 5, 8, 13, 14, 16, 19 and 22 (respectively, hand washing before the procedure, explanation of the procedure to the patient, increase of the basal FiO<sub>2</sub> in the mechanical ventilator, use of eye protection, the slow removal of the OTT catheter in a rotating motion, monitoring of the HR and O<sub>2</sub> saturation during the procedure, the duration of each suctioning not exceeding 15 seconds, the return to initial FiO<sub>2</sub> on the mechanical ventilator and the instillation of isotonic normal saline solution in the OTT only in the management of thick secretions or mucus plugs), given that fewer than 30% of those investigated undertook these indications.

In relation to the use of personal protective equipment (PPE), similarly to what is found in the literature<sup>5,8,10-12</sup>, high adherence to the use of gloves was ascertained (92%) as was regular use of the mask and apron (72% and 60%), although there was no adherence to the use of eye protection (0%). Studies have shown that the nurses themselves, in spite of recognising the importance of the use of PPE, do not use it appropriately when undertaking the ETS procedure<sup>13,14</sup>.

**Table 1.** Distribution of absolute and percentage values of the performance of the nursing professionals, according to items of the ETS procedure. Campo Grande/MS, 2011

Items	f	%
Obligatory (n = 25)		
1 - Assess the need for suction	19	76
2 - Wash hands before procedure	7	28
3 - Explain the procedure to the patient	4	16
4 - Keep or place the patient in the semi-Fowler position	23	92
5 - Increase the basal FiO <sub>2</sub> * on the mechanical ventilator	0	0
6 - Use sterile gloves	23	92
7 - Use mask	18	72
8 - Use eye protection	0	0
9 - Use apron	15	60
10 - Use sterile suction catheter and keep it sterile until introduction into the OTT <sup>†</sup>	20	80
11 - Introduce the suction catheter into the OTT <sup>†</sup> with the vacuum suction system switched off	22	88
12 - Undertake the procedure respecting aseptic technique	18	72
13 - Remove the OTT <sup>†</sup> catheter slowly in a rotating motion	5	20
14 - Monitor HR parameters <sup>‡</sup> and O <sub>2</sub> saturation during the procedure	7	28
15 - Connect the mechanical ventilator to the patient in the intervals between suctioning	21	84
16 - The duration of each suctioning is less than 15 seconds	6	24
17 - Wash the suction system with distilled water or NaCl <sup>§</sup> when finishing suctioning	19	76
18 - Protect the suction system after suctioning with clean and dry packaging	23	92
19 - Return to the initial FiO <sub>2</sub> * on the mechanical ventilator	0	0
20 - Wash the hands after the procedure	18	72
21 - Note the procedure in the patient's hospital records, including the characteristics of the secretions and/or the patient's reactions	10	40
22 - Instillation of isotonic NaCl <sup>§</sup> in the OTT <sup>†</sup> only in the management of thick secretions or mucus plugs	5	20
Optional (n = 19)		
23 - If suctioning the upper airways, follow the sequence: trachea, nose, mouth	19	100
Global mean (%)		53.56

\* Fraction of inspired oxygen; <sup>†</sup> Orotracheal tube; <sup>‡</sup> Heart rate; <sup>§</sup> Sodium chloride solution.

The decision not to use eye protection may be associated with the personnel's high sense of security, as - in addition to those investigated being experienced professionals with many years of experience in the role and in intensive care - ETS is one of the nursing procedures undertaken most in ICU. Although security in the work affords a series of benefits for the process of health production, when exaggerated it can become dangerous, as it leads to the banalization of the risks which exist. This can contribute to the increase in the professionals' exposure to the risks, as the accidents are unpredictable and everything does not always occur in the same way<sup>2</sup>.

One study with an epidemiological character found enough data to calculate the risks of occupational accidents to which the health professionals are exposed when they handle secretions

from the respiratory tract or the prosthesis inserted there. Among the results observed, the ETS was the procedure which was second-most related to the incidence of accidents. Also emphasized in second place were the containers with excreta/secretions among the objects which cause accidents; the splashing of excreta on the face, mouth or eyes; and, more worryingly, negligence in relation to the use of PPE<sup>15</sup>.

In addition to the use of PPE, it was observed that more than 70% of the professionals complied with each one of the stages related to the prevention and control of infections (items 1, 6, 10, 12, 17, 18, 20 and 23; respectively, evaluation of the need for suction, use of sterile gloves, use of a sterile suction catheter, undertaking the procedure respecting aseptic technique, washing the suction system with distilled water or NaCl at

the end of the suctioning, protection of the suction system after suctioning with a clean and dry packaging, hand washing after the procedure, and suctioning of the upper airways), apart from hand washing before the procedure (item 2), which had only 28% adherence. A similar study<sup>8</sup> which evaluated health professionals in a general way (nurses, nurse technicians and auxiliary nurses, doctors and physiotherapists) obtained similar results: 19.46% of the professionals washed their hands before the ETS and 50.29% did so after the procedure.

The low adherence to hand washing is not always directly related to the level of theoretical knowledge or to the situation in which it is indicated, but rather to the incorporation of this knowledge into the professionals' routine practice. The lack of motivation, the failure to understand the risk of spreading pathogens, the excess of activities and lack of materials, and/or inadequacy of the physical structure of the institution stand out among the principal factors responsible for the non-incorporation of this practice<sup>16</sup>.

Regarding the measures recommended to be taken immediately prior to the suctioning, high adherence was observed to items 4 and 11 (respectively, maintaining or placing the patient in the semi-Fowler position and introducing the suction catheter in the OTT with the vacuum suction system switched off), although it was low for items 3 and 5 (explaining the procedure to the patient and increase of the basal  $\text{FiO}_2$  on the mechanical ventilator, respectively). This last finding is supported by Brazilian studies which evaluated the three professional categories of nurse regulated in Brazil - nurses, nurse technicians, and auxiliary nurses<sup>8-10</sup> - differently from what was observed in studies in other countries, where the care for patients in ICU is undertaken by nurses alone<sup>5,11,13</sup>.

In relation to item 5, it is known that during ETS hypoxemia can occur, with consequent hemodynamic changes, cardiac arrhythmias, cardiac and/or respiratory arrest and even death<sup>4</sup>. As a preventive measure against these adverse events, it is widely recommended by the literature, and emphasized in recent guidelines<sup>9</sup>, that adult and pediatric patients should be offered oxygen at 100% for 30 to 60 seconds prior to the suctioning event.

Regarding the actions indicated during the suctioning itself, the mean adherence to items 13, 14 and 16 (respectively, the slow removal of the OTT catheter in a rotating motion, the monitoring of the HR parameters and oxygen saturation during the procedure, and the duration of each episode of suctioning lasting not more than 15 seconds) was poor, as in other studies<sup>5,8,10,11</sup>. These items are necessary, respectively, for the prevention of tracheobronchial lesions, the early detection of hemodynamic instability, and the prevention of hypoxemia. For this reason they deserve to be analyzed and reviewed in the ambit of the nursing teaching and nursing care in the place where the research was undertaken, the more so because 40% of those investigated stated that they had never received any type of training at work regarding open system ETS.

The analysis of the data relating to the care given after the suctioning reveals that there was no adherence (0%) to item 19 (return to the initial  $\text{FiO}_2$  on the mechanical ventilator) and

that there was poor adherence (40%) to item 21 (recording the procedure in the patient's hospital records, indicating characteristics of the secretions and/or the patient's reactions). The first is a consequence of non-adherence to item 5 (increasing the basal  $\text{FiO}_2$  on the mechanical ventilator). Although indicated by some authors<sup>5,8</sup>, the systematic practice pre-oxygenation as a preventive measure against hypoxemia can be questioned, given that current studies<sup>1,9</sup> recommend it in hypoxemic patients and in those whose oxygen saturation level reduces during ETS but do not recommend, however, that this care measure should be implemented on all occasions when ETS is used.

Regarding the nursing notes (item 21) it stands out that - apart from the poor adherence (40%) - various recording problems were found: illegibility, spelling mistakes, use of improper terminology, absence of stamps, or the professional's name being written illegibly. Records, if not made or if made inadequately, promote communication failures between the nursing and multiprofessional teams, thus compromising the continuity of care and the patient's progression. Furthermore, this failure can result in facing disciplinary procedures for failing to comply with the profession's code of ethics, since, if there is no record, there is no way to guarantee that the procedure was undertaken. In this regard, the nursing notes must be recorded objectively, clearly, concisely, accurately, punctually and chronologically, in addition to providing all the information necessary for the adequate transmission of the message<sup>17</sup>.

Item 22 (instillation of isotonic normal saline solution in the endotracheal tube prior to the suctioning) is one of the topics of the ETS procedure which is discussed most in the literature. This conduct is supported by the hypothesis that facilitating the removal of pulmonary secretions by fluidifying them and stimulating coughing, which can facilitate their mobilization to the more central airways, increases the volume of secretions removed and, as a consequence, improves oxygenation and reduces the incidence of ventilator-associated pneumonia (VAP)<sup>4,6,14</sup>.

However, there is insufficient evidence to prove this hypothesis, as various studies have recorded that this solution facilitates the removal of secretions insufficiently. In addition to this, other studies have observed harmful effects related to the use of this solution, such as reduction in the oxygen saturation ( $\text{SaO}_2$ ) values and in the partial pressure arterial oxygen ( $\text{PaO}_2$ ), rise in the partial pressure of carbon dioxide ( $\text{PCO}_2$ ), a rise in heart rate in the fifth minute after the end of ETS<sup>18</sup> and, even, increase in the incidence of VAP<sup>1</sup>.

Considering the various controversies and the lack of documented evidence regarding the concrete benefits of the use of isotonic normal saline solution in ETS, the guidelines of the American Association for Respiratory Care<sup>9</sup> do not recommend its routine use (category 2C), given that this procedure is associated with risks and complications, its use remaining optional for the management of secretions which are difficult to remove, as in the case of thick secretions and mucus plugs.

Currently, VAP is one of the great challenges for the team caring for patients hospitalized in ICU, and can result from medical

harm related to the ETS procedure. With this in mind, the Centers for Disease Control and Prevention<sup>7</sup> consider health education to be an important tool to improve competence and motivate the health professionals to implement interventions aiming for the prevention and control of this infection.

One randomized study demonstrated the importance of educational interventions for improving ICU nurses' preparation for undertaking the ETS procedure. In that study, the professionals from a single unit were divided in two groups. In the control group ( $n = 8$ ), regarding the recommendations for carrying out the technique, 66.66% of knowledge was observed, and 31.94% of adherence in practice, while in the experimental group ( $n = 8$ ), made up of professionals who had received training, 88.88% and 94.44%, respectively, of knowledge and adherence in actual care situations were ascertained<sup>14</sup>.

The evidence used for developing the present study's observation instrument was based on what could be considered as the best evidence available when the research was undertaken. There is still, however, a certain disparity in relation to what exactly constitutes best practice at specific stages of the ETS procedure, due to the scarcity of clinical studies on the various aspects of this technique<sup>11</sup>.

As may be expected from an observational study, one of the main problems is the effect of the observer upon the subject being observed - referred to as the "Hawthorne effect". This constitutes an important threat to the study's internal validity, due to the fact that because the research subjects know that they are participating in a study and are being observed they may change their behavior. Similarly to in another study<sup>11</sup>, the Hawthorne effect may have occurred through the individual training of the participants in how to undertake ETS, in relation to the best evidence-based recommendations, prior to their being observed. This having occurred, one can infer that the participants' practice is normally of a worse quality than the results suggest. On the other hand, it is emphasized that the subjects were observed undertaking ETS on three occasions and only one event (mode) was considered; each professional was observed on different days and the observer was part of the service and did not interfere in the procedure, but remained close to the procedure so as to be able to observe all the stages, and sought to act naturally so that the subjects would not perceive the reason for the observation.

One limitation of this study is the fact that the results are not representative of the general population of nursing professionals who work in intensive care, which leads to the weakness of the results' external validity. This could, however, be minimized in future studies covering a greater number of observations of the ETS procedure in different ICUs in distinct geographical regions.

However, this study demonstrated progress in establishing the current state of the nursing team's practice of ETS, and can provide support for the development of clinical guidelines for future practice. The principle recommendation is to introduce guidelines based on evidence-based research. Furthermore, it is

suggested that each professional, irrespective of their length of experience in ICU or their qualifications, must receive appropriate supported teaching in these guidelines.

## CONCLUSIONS

Bearing in mind what has been presented, it is possible to conclude that there are divergences between the evidence available and the practices found in the ICUs researched. The mean of the total rate of adherence was 51.33%, denoting dissatisfactory adherence in relation to the best practices available for undertaking open-system ETS.

This study made it possible to establish the situational diagnosis regarding nursing practices in relation to ETS in the institution studied, identifying flawed aspects, as well as those which are correctly undertaken by the professionals. Based on this, in conjunction with the institution's continuing education service and the team of the multiprofessional residency in healthcare, a cycle of educational activities on the prevention and control of pneumonia was implemented for health professionals. ETS was one of the issues addressed, and the various items evaluated in this study were discussed in the light of the technical-scientific knowledge available.

## REFERENCES

1. Pedersen CM, Rosendahl-Nielsen M, Hjermdind J, Egerod I. Endotracheal suctioning of the adult intubated patient - what is the evidence? *Intensive Crit Care Nurs.* 2009 feb;25(1):21-30.
2. Frota OP, Ferreira AM, Loureiro MDR, Cheade MFM, Reis MG. O uso de equipamento de proteção individual por profissionais de enfermagem na aspiração endotraqueal. *Rev. enferm. UERJ.* 2012;20(esp.1):625-30.
3. Pagotto IM, Oliveira LRC, Araújo FCLC, Carvalho NAA, Chiavone P. Validation of sedation scores in mechanically ventilated children admitted to a tertiary pediatric intensive care unit. *Rev. bras. ter. intensiva.* 2008 out/dez;20(4):325-30.
4. Celik SA, Kanan N. A current conflict use of isotonic sodium chloride solution on endotracheal suctioning in critically ill patients. *Dimens Crit Care Nurs.* 2006 jan/feb;25(1):11-4.
5. Day T, Farnell S, Haynes S, Wainwright S, Wilson-Barnett J. Tracheal suctioning: an exploration of nurses' knowledge and competence in acute and high dependency ward areas. *J Adv Nurs.* 2002 jul;39(1):35-45.
6. Sole ML, Byers JF, Ludy JE, Zhang Y, Banta CM, Brummel K. A multisite survey of suctioning techniques and airway management practices. *Am J Crit Care.* 2003 may;12(3):220-30.
7. Centers for Diseases Control and Prevention. Guidelines for preventing health-care associated pneumonia, 2003: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. *MMWR Recomm Rep.* 2004;53(RR-3):1-36.
8. Farias GM, Freire ILS, Ramos CS. Aspiração endotraqueal: estudo em pacientes de uma unidade de urgência e terapia intensiva de um hospital da região metropolitana de Natal - RN. *Revista Eletrônica Enfermagem.* 2006 set/dez;8(1):63-9.
9. American Association of Respiratory Care. AARC clinical practice guidelines: endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. *Respir Care.* 2010 jun;55(6):758-64.
10. Farias GM, Freitas MCS, Rocha KMM, Costa IKF. Pacientes sob ventilação mecânica: cuidados prestados durante a aspiração endotraqueal. *InterScience Place [periódico na internet].* 2009 set/out;[citado 2012 jan 22];2(9):[18 telas]. Disponível: em: <http://www.interscienceplace.org/interscienceplace/article/view/109/111>

11. Kelleher S, Andrews T. An observational study on the open-system endotracheal suctioning practices of critical care nurses. *J Clin Nurs*. 2008 feb;17(3):360-9.
12. Freire ILS, Farias GM, Ramos CS. Prevenindo pneumonia nosocomial: cuidados da equipe de saúde ao paciente em ventilação mecânica invasiva. *Revista Eletrônica Enfermagem*. 2006 set/dez;8(3):377-97.
13. Ania González N, Martínez Mingo A, Eseberri Sagardoy M, Margall Coscojuela MA, Asiain Erro MC. Evaluación de la competencia práctica y de los conocimientos científicos de enfermeras de UCI en la aspiración endotraqueal de secreciones. *Enferm Intensiva*. 2004 jul/sep;15(3):101-11.
14. Day T, Wainwright SP, Wilson-Barnett J. An evaluation of a teaching intervention to improve the practice of endotracheal suctioning in intensive care units. *J Clin Nurs*. 2001 sep;10(5):682-96.
15. Nishide VM, Benatti MCC, Alexandre NMC. Ocorrência de acidente do trabalho em uma unidade de terapia intensiva. *Rev. latino-am. enfermagem*. 2004 mar/apr;12(2):204-11.
16. Oliveira AC, Cardoso CS, Mascarenhas D. Contact precautions in Intensive Care Units: facilitating and inhibiting factors for professionals' adherence. *Rev. Esc. Enferm. USP*. 2010 mar;44(1):154-63.
17. Silva JA, Grossi ACM, Haddad MCL, Marcon SS. Avaliação da qualidade das anotações de enfermagem em unidade semi-intensiva. *Esc Anna Nery*. 2012 jul/set;16(3):577-82.
18. Akgül S, Akyolcu N. Effects of normal saline on endotracheal suctioning. *J Clin Nurs*. 2002 nov;11(6):826-30.