Endotracheal suctioning practices of nurses and respiratory therapists: How well do they align with clinical practice guidelines?

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BACKGROUND: A common procedure within intensive care units (ICUs) is the suctioning of respiratory secretions in patients who have been intubated or who have undergone tracheostomy. Previous studies have shown a wide variation in suctioning practices, and although current evidence does not support the routine practice of normal saline instillation (NSI), anecdotally, this is believed to be a common practice.
OBJECTIVE: To examine the suctioning practices of registered nurses (RNs) and registered respiratory therapists (RRTs) in six hospital ICUs in Ontario, with special attention devoted to the use of NSI.
METHODS: A 24-question, self-administered survey was distributed to 180 participants (90 RNs and 90 RRTs) working in the ICU of six hospitals in Ontario. The survey addressed individual suctioning practices within the ICU.
RESULTS: The survey response rate was 96%. There were many similarities between the RRT and RN groups, with both reporting high use of NSI. Both groups observed side effects following NSI with suctioning including decreased oxygen saturation, patient agitation and increased volume of secretions. A significant number of participants from both the RN and RRT groups were unaware of the existence of suctioning and/or NSI protocols in the ICU. Some respondents reported that they routinely suctioned mechanically ventilated patients rather than as required.
CONCLUSION: RNs and RRTs continue to practice NSI despite evidence-based practice guidelines suggesting that this therapy may be detrimental to patients. Increased awareness of best practices with respect to endotracheal tube suction generally, and NSI specifically, should be the focus of professional education in both groups of ICU staff.

Key Words: *Artificial airway; Endotracheal suctioning; Normal saline instillation; Nursing; Practice guideline; Respiratory therapy*

Les pratiques d'aspiration trachéale des infirmières et des inhalothérapeutes respectent-elles les directives cliniques?

HISTORIQUE : À l'unité de soins intensifs (USI), on aspire souvent les sécrétions respiratoires des patients intubés ou trachéostomisés. Des études antérieures ont démontré une importante variation des pratiques d'aspiration, et même si les données actuelles n'appuient pas le rinçage systématique par solution physiologique normale (SPN), les données empiriques révèlent que leur utilisation serait courante.
OBJECTIF : Examiner les pratiques d'aspiration des infirmières et des inhalothérapeutes à l'USI de six hôpitaux de l'Ontario et s'attarder particulièrement à l'utilisation de la SPN.
MÉTHODOLOGIE : Les chercheurs ont distribué un sondage auto-administré de 24 questions à 180 participants (90 infirmières et 90 inalhothérapeutes) qui travaillaient à l'USI de six hôpitaux de l'Ontario. Ce sondage traitait des pratiques d'aspiration individuelles à l'USI.
RÉSULTATS : Le taux de réponse au sondage s'élevait à 96 %. Les groupes d'infirmières et d'inhalothérapeutes présentaient surtout des similarités, tous deux déclarant une forte utilisation du SPN. Les deux groupes observaient des effets secondaires après l'administration du SPN, l'aspiration entraînant une diminution de la saturation en oxygène, une agitation des patients et une augmentation du volume de sécrétions. Bon nombre des participants des deux groupes ne connaissaient pas de protocoles d'aspiration ou d'utilisation de la SPN à l'USI. Certains répondants précisaient qu'ils procédaient à l'aspiration systématique des patients sous ventilation mécanique plutôt que d'attendre les besoins.
CONCLUSION : Les infirmières et les inhalothérapeutes continuent d'administrer un SPN malgré les directives cliniques fondées sur des données probantes indiquant qu'elle peut être néfaste au patient. La formation professionnelle de ces deux groupes d'employés de l'USI devrait s'attarder sur les pratiques exemplaires en matière d'aspiration des sondes trachéales en général et de l'administration de SPN en particulier.

Many areas of health care practice have been viewed through the lens of evidence-based practice (EBP), with the intent of examining current practices to ensure that patients are provided with optimal and consistent care based on high-quality evidence for benefit. EBP has been widely adopted both at the policy and clinical levels, with a key element including the creation of evidence-based clinical guidelines. Clinical practice guidelines are a written guide for health care providers to follow for a specific practice element, and aim to optimize the effectiveness and efficiency of treatments. Well-designed protocols have been shown to improve clinical decision making and effectiveness of treatments (1-4). Despite the development of clinical guidelines, there continues to be discrepancies between best practice based on evidence and actual practice (5,6). Within intensive care units (ICUs), one such common procedure is the suctioning of respiratory secretions in patients who have been intubated or who have undergone tracheostomy (7). The traditional goal of suctioning is to aid in maintaining airway patency and prevent complications related to retention of secretions (8). Sole et al (7) conducted a large study involving 1665 registered nurses (RNs) and registered respiratory therapists (RRTs) at 27 sites throughout the United States and concluded that policies vary widely and do not always reflect current research. In their study investigating nurses, respiratory therapists and physiotherapists in Ontario, Brooks et al (9) similarly found wide variation in suctioning practices. These authors also found that one of the practices used by almost all of the respondents was instillation of normal saline (NSI) before suctioning. Although anecdotal evidence suggests that the practice (NSI before suctioning) remains common, this study was completed more than a decade ago and there has been little research to examine whether this remains the case or whether there is significant benefit from the practice.

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The effectiveness of NSI before suctioning was first investigated almost four decades ago (10), with various benefits attributed to NSI including loosening thick secretions and enhancing cough stimulation, which in turn mobilizes and increases secretion clearance and decreases the viscosity of pulmonary secretions (11,12). Concern has also been raised that NSI before suctioning may result in decreased oxygen saturation (7,13). For example, in a comparison of oxygen saturation following suctioning with or without NSI, Giakoumidakis et al (14) found that although NSI resulted in the removal of more secretions, it also produced a prolonged fall in patient oxygenation. Two reviews of the limited literature regarding this topic have both concluded that there was little evidence to support its continued use, with Paratz and Stockton (15), and Halm and Krisko-Hagel (16) also concluding that there was little evidence of safety risks. Paratz and Stockton (15) did, however, also note there was paucity of high-quality studies investigating this issue. The use of NSI to aid in the mobilization of secretions was supported by the 1993 American Association for Respiratory Care (AARC) clinical practice guidelines (17). However, in 2010, an update of these guidelines recommended that "endotracheal suctioning should be performed only when secretions are present, and not routinely"; and that "It is suggested that routine use of normal saline instillation before endotracheal suction should not be performed" (18). Most practice guidelines no longer recommend NSI into an artificial airway due to lack of evidence that it helps to maintain airway patency, and it is suggested that routine instillation be discontinued altogether due to adverse effects (19). The change in guidelines, and previously documented widespread use of this practice together with anecdotal evidence, suggests it is timely to re-examine this practice.

The objective of the present survey was to examine the suctioning practice of RNs and RRTs in six hospital ICUs in Ontario, with special attention devoted to the use of NSI. The present study aimed to determine whether and why the surveyed RNs and RRTs continue to instill normal saline before suctioning patients with artificial airways.

METHOD

Survey design and development

A survey was used to gather information from RNs and RRTs working in ICUs at six hospitals in Ontario. The survey was entitled "Suctioning an Artificial Airway in the ICU," and requested specific information about the practice and knowledge of participants with respect to the use of NSI before endotracheal suctioning, as well as other suctioning practices.

A 24-question survey was developed by the authors and then reviewed by a small group of health professionals before finalization and being sent to participants. This small review group consisted of two RRTs who worked outside the geographical area being surveyed, one RN who was responsible for research in an ICU and one physician with research experience. The questions in the survey were developed based on a review of the peer-reviewed scientific literature and finalized from input from the small review group. The questionnaire comprised four sections that collected data regarding: demographics; normal (intubated) patient care practices within the ICU; practices relating to NSI before suctioning; and influences on individual practice.

Participants

The survey was mailed to managers in six ICUs at community hospitals within 50 km of the Trillium Health Centre (Mississauga, Ontario). Managers informed their staff about the survey via e-mail or in meetings and the questionnaires were left in staff rooms for any interested parties to complete. The goal was to have a total of 90 RNs and 90 RRTs complete the surveys. Surveys were returned to the principal investigator by a postage-paid envelope provided with the questionnaire. Participation was voluntary and no identifying information was collected, ensuring anonymity; responses were confidential and not disclosed to the unit managers.

Statistical analysis

Descriptive statistics were calculated for each question, both as a total and based on respondent professional group. Comparative statistics between RRT and RN responses was performed using a Pearson χ^2 test; $P<0.05$ was considered to be statistically significant. SPSS version 20 (IBM Corporation, USA) was used to perform data analysis.

Research ethics board approval

The present study, which was considered to be minimal risk, was approved by the School of Biomedical Sciences Ethics in Human Research Committee of Charles Sturt University (Burlington, Ontario) and the Trillium Health Centre's Ethics Committee. A letter of introduction and explanation accompanied each survey. Participant informed consent was implied by the return of a completed survey.

RESULTS

Surveys were distributed to 90 RNs and 90 RRTs employed at six ICUs in Ontario. Of these, 83 completed surveys were received from RNs and 87 from RRTs, corresponding to a response rate of 94% and 97%, respectively.

Overall, approximately one-half (48%) of the respondents had a Baccalaureate degree as their highest level of education, with only 2% of respondents having a Master's or doctoral degree; the remaining respondents possessed a diploma. Most individuals in each group held either a degree or diploma; however, there no significance differences between the groups: diploma – RN 44%, RRT 56% (P=0.219); degree – RN 57%, RRT 43% (P=0.065). No RNs held a Master's or doctoral degree compared with 5% of RRTs (P=0.122). Most respondents had graduated between 2000 and 2010 (40%), followed by graduation in the periods 1990 to 1999 (33%), 1980 to 1989 (18%) and before 1980 (9%). One-half (50%) of the respondents had been working in the ICU ≥10 years. Of the remainder, approximately equal numbers had worked from two to five years and six to 10 years (26% and 21%, respectively); those who had worked in the ICU for <1 year accounted for 3% of respondents. Almost all (97%) respondents worked 12 h shifts with the remainder working 8 h shifts. There was no statistically significant difference between the RNs and RRTs in terms of year of graduation (P=0.263) or years working in the ICU (P=0.773).

The type of humidification used for ventilated patients in the ICUs employing respondents was split between those using heat and moisture exchanger (RN 31%, RRT 41%), and both heat and moisture exchanger and heated chamber (RN 68%, RRT 59%); only one respondent reported use of heated chamber only. There were few statistically significant differences between these two groups with regard to questions relating to artificial airways suctioning practice (Table 1). Differences were observed in awareness of ventilator-assisted pneumonia rates, routine preoxygenation of patients, awareness of protocols for mouth care and checking of endotracheal tube cuff pressures.

During a shift, suctioning frequency was primarily as necessary (PRN); however, the data also showed that RRTs and, to a lesser extent, RNs were also suctioning on 2 h or 4 h schedules (P=0.003). For RNs, PRN frequency was 91.6% versus 71.3% for RRTs with remaining responses for RNs 6.0% 4 h and 2.4% 2 h compared with 17.2% 4 h and 11.5% 2 h for RRTs.

When asked about frequency of use of NSI before suctioning, there was a statistically significant difference between the responses from RNs and RRTs (P=0.014). Of the RRTs, 11.5% indicated that they never used NSI, 49.4% used it rarely, 36.8% frequently and 2.3% always. In contrast, RNs indicated that NSI was used in all patients at least some of the time, with 57.8% rarely using NSI, 41.0% frequently and 1.2% always (no RNs indicted they never used NSI).

Those who responded that they use NSI were asked further questions about instillation practices (how the normal saline was prepared, why instillation was used, what effects they noted following instillation and what influenced suctioning practices). The majority (97.5% of RRTs, 96.4% of RNs) of respondents used sterile nebulae

TABLE 1
Responses to questions regarding suctioning practices in the intensive care unit (ICU)

	RN (n=83)	RRT (n=87)	P
Does your ICU have a suctioning protocol for intubated patients?			
Yes	49	60	
No	30	19	0.241
Don't know	21	21	
Do you routinely suction mechanically ventilated patients with an artificial airway?			
Yes	86	87	
Sometimes	1	0	0.590
No	13	13	
Do you routinely pre-oxygenate patients prior to suctioning?			
Yes	60	77	0.021
Most commonly used suction type			
Open	1	1	0.973
Closed (in-line suction catheters)	99	99	
Does your ICU have a protocol for routine mouth care?			
Yes	84	99	
No	1	0	0.003
Don't know	15	1	
Does your ICU have a protocol for daily checking of ETT cuff pressures?			
Yes	93	77	
No	5	7	0.007
Don't know	3	16	
Are you aware of your unit's VAP rate?			
Yes	29	60	<0.0001
Does your ICU have a protocol relating to NSI prior to suctioning?			
Yes	15	7	
No	39	53	0.098
Don't know	47	40	

Data presented as % unless otherwise indicated. Values may sum to >100% due to rounding. ETT Endotracheal tube; NSI Instillation of normal saline; RN Registered nurse; RRT Registered respiratory therapist; VAP Ventilator-associated pneumonia

to prepare the normal saline. The remaining (3.6%) RNs used a pre-drawn syringe although the RRTs drew the syringe themselves (2.5%). The volume of saline used was similar between groups, with most using 1 mL to 2 mL (RRT 50.0%; RN 41%), or 3 mL to 5 mL (RRT 46.2%; RN 51.8%); the remaining respondents used >5 mL. Most respondents suctioned the airways immediately following the NSI (RRT 79.2%; RN 67.1%). The remainder waited up to 1 min (RRT 16.9%; RN 30.5%) or 1 min to 2 min (RRT 3.9%; RN 2.4%). Respondents were also asked why they used NSI before suctioning (Figure 1) and whether they had observed any effects following NSI (Figure 2). Most respondents had multiple reasons for using NSI and all had observed ≥1 adverse effect(s) on patient(s) following NSI. The only statistically significant differences between the two groups were in relation to the use of NSI to thin secretions (RRT 10.3% versus RN 1.2%; P=0.018) and that NSI increased the volume of secretions (RRT 29.6% versus RN 8.9%; P=0.001).

The greatest influence on both RNs' and RRTs' practice was reported to be EBP guidelines followed by initial training and continuing education (Figure 3). There was no statistically significant difference between the two groups in this area (P=0.220). When asked whether they had attended any training or workshops that discussed suctioning of mechanically ventilated patients, most reported 'no' (45.3% overall; RRT 34.5% versus RN 56.6%; P=0.005) followed by 'yes, but it was more than a year ago' (RRT 32.25 versus RN 16.9%; P=0.022). Approximately 16% overall (RRT 19.5% versus RN 13.3%; P=0.306) reported they had attended training in the past 12 months,

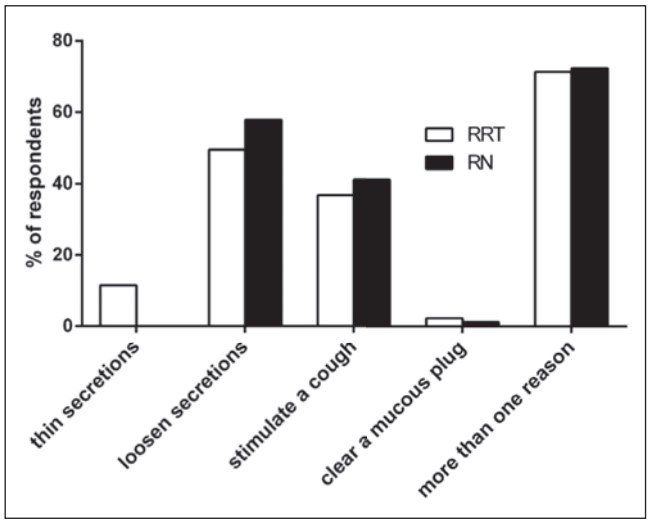

Figure 1) *The frequency of registered respiratory therapists (RRTs [n=87]) and registered nurses (RNs [n=83]) response to the question "Why do you instill N/S prior to suctioning?" N/S Normal saline*

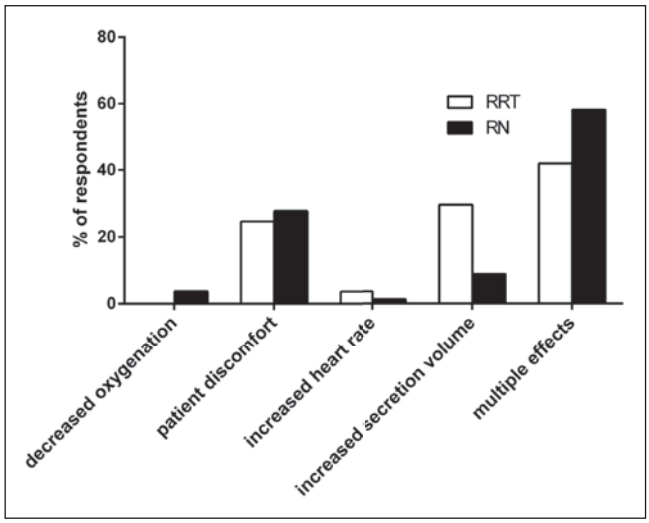

Figure 2) *The frequency of registered respiratory therapists (RRTs [n=87]) and registered nurses (RNs [n=83]) response to the question "Have you observed any of the following effects following NSI?". NSI Normal saline instillation*

where suction was discussed and the remainder could not recall whether it was discussed (RN 13% versus RRT 14%).

DISCUSSION

In the present study investigating suctioning practices of ICU RNs and RRTs, there were few demographic or practice differences between the two professional groups. Most RNs and RRTs reported that they routinely suctioned mechanically ventilated patients and almost all respondents were aware of ICU protocols regarding checking of endotracheal tube cuff pressures and oral hygiene. This was not the case for suctioning protocols in general and specifically related to NSI before suction.

It was beyond the scope of the present study to investigate the documentation held in each ICU and, hence, it is unknown whether lack of knowledge of particular protocols reflects a lack of protocols or a lack of individual awareness of protocols. That the 'don't know' responses for the question relating to knowledge of NSI protocols was double that for other protocols (47% for RNs and 40% for RRTs) may suggest that this is an area that is not discussed within the ICU. Despite the lack of evidence for benefits of NSI before suctioning (and concerns about possible

adverse effects), that this practice is not a recommendation in current clinical practice guidelines and a lack of knowledge about ICU protocols regarding NSI, all RNs and 89.5% of RRTs in the present study used NSI before suction at least some of the time. The most frequent reasons given for using NSI were to clear a mucous plug and/or to loosen secretions. Respondents also witnessed a range of adverse effects including decreased oxygenation, patient discomfort, increased heart rate and/or increased volume of secretions. The high level of NSI use reported in the present study is consistent with that reported previously (9,20,21); however, in contrast to the study by Schwenker et al (20), we report a lower level of combined 'always' and 'frequent' use of NSI. Schwenker et al (20) report 'always + frequent' use by 83% of RNs and 75% of RRTs, compared with 42.2% of RNs and 39.1% of RRTs in the present study. This may suggest a shift away from more routine use of NSI and toward the recommendations of the AARC that "routine use of normal saline instillation before endotracheal suction should not be performed" (18).

An interesting finding from our study was that 8.4% of RNs and 28.7% of RRTs appeared to suction patients on a regular basis (other than PRN). It is unclear whether this reflects a misunderstanding of the question (perhaps the option responses other than PRN were seen as an estimate of actual practice) or whether suctioning was performed at these times regardless of need. A lack of knowledge in ICU RNs regarding endotracheal tube suctioning has been reported by both Day et al (21) and Negro et al (22). Although the study by Day et al (21) was small (n=16), the study reported by Negro et al (22) was larger (n=247). ICU nurses from 11 Italian hospitals were surveyed on their knowledge of the 2010 AARC clinical practice guidelines and found only 58% of questions were answered correctly. These authors also reported higher knowledge by more experienced nurses; however, only 2.5% answered nine of the 10 questions correctly.

According to some authors, there continues to be a large discrepancy between EBP and actual practice (23), and Beechey (24) suggested that many nursing and respiratory therapy practices are still based on experience and routine, rather than on evidence, and that a gap between knowledge (scientific evidence) and practice still exists. A large study involving 1665 RNs and RRTs at 27 sites in the United States found that 83% of respondents did not base their suctioning practice on evidence-based protocols, instead relying on their basic educational programs or the routine practice of their colleagues (7). The results of the current study are consistent with these findings and suggest that in the ICUs participating in the present study, best practice was followed in some suctioning practice areas (eg, oral care); however, there are gaps between best practice and actual practice in other areas.

Implementing changes to practices within health care can be complex and much has been written about implementing EBPs into a range of health areas. Although there is consensus that EBP can improve the effectiveness and efficiency of health care, and improve patient outcomes, there can be significant challenges in adopting practices. Competing workload pressures, institutional and individual resistance to change, lack of EBP champions, poor change management processes and lack of access to quality information can act as barriers to implementation, even among those most willing to adopt new practices (25-27). Critical to many implementation strategies is building knowledge in the topic of interest (28). Although there is limited literature specifically relating to improving adoption of EBPs in endotracheal suctioning practice, both McKillop (29) and Day et al (21) have demonstrated knowledge and practice improvements following interventions. Although the methods used by the two studies were different (McKillop [29]: best practice information checklists; Day et al [21]: structured teaching program) both programs aimed to increase participant awareness of current best practice.

It is a concern in the current study that while approximately one-half of the respondents in both groups stated that they were influenced by EBP protocols or guidelines, there is a gap between best practice and self-reported practice. In addition, less than one-half recalled attending training or workshops covering endotracheal suction practice in the recent past. This is a training gap and an opportunity for the profession or employers to improve the quality of care and, hence, patient outcomes within the ICU.

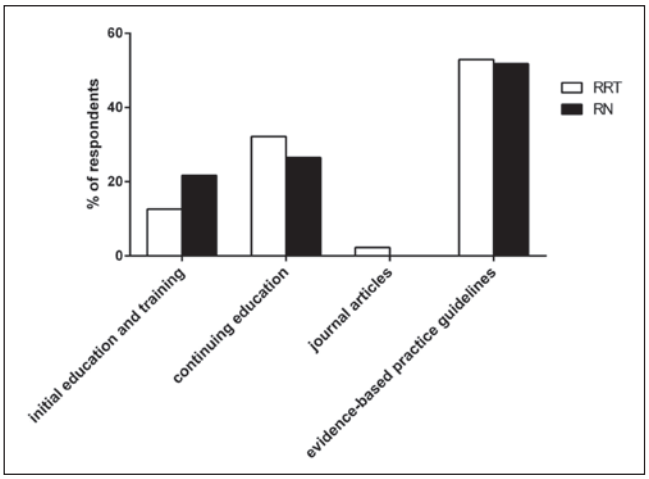

Figure 3) *The percentage of registered respiratory therapists (RRTs [n=87]) and registered nurses (RNs [n=83]) response to the question "What do you feel influences your practice the most?"*

There were several limitations to the present study; specifically, the geographical proximity of participants working within 50 km of the Mississauga Hospital. The participants may have received their formal education at the same institutions and clinical sites, which may have influenced their practice. The number of participants (n=180) does not constitute a large study and may be viewed as a limitation.

CONCLUSION

The present study identified a gap between what is considered best practice and what is used within groups of community hospital ICUs. This highlights the need for greater education for both RNs and RRTs with respect to endotracheal tube suctioning generally and, specifically, with regard to the use of NSI. The routine practice of NSI before suctioning an artificial airway is not recommended and may be detrimental to patients; however, current practice guidelines do not describe the conditions under which NSI may be used. The risk may outweigh the benefit and, as such, should be carefully considered before engaging in this practice. Lack of clarity regarding best practice will contribute to inappropriate and, possibly, unsafe procedures, which in turn reduces the quality of care and increases the potential of poor patient outcomes. Suctioning of an artificial airway is not a benign procedure and, as such, health care providers must be aware of the potential complications and side effects.

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