Abstract

**Introduction:** The purpose of this point-of-care study was to test the efficacy of a prevention-based oral care protocol in reducing non-ventilator-associated hospital-acquired pneumonia in a neurosurgical population outside the critical care environment. The researchers hypothesized that an enhanced oral care protocol would decrease the incidence of pneumonia.

**Methods:** This quasi-experimental, comparative study took place on an acute neurosurgical unit at a tertiary care trauma hospital in Western Canada. Subjects were non-intubated, care-dependent adults with a primary diagnosis of neurologic injury/insult, and at high risk for pneumonia. The prospective study group comprised 34 subjects; two subjects were excluded from the study analysis. The retrospective study group comprised 51 subjects.

Data were collected for both groups for a six-month period. Retrospective data were collected through chart review. The prospective group were eligible neurosurgical patients who received the enhanced oral care protocol. Data collection tools were developed and diagnostic criteria for hospital-acquired pneumonia were determined. The pneumonia rates between subjects who received standard oral care (retrospective group) and those who received an enhanced, prevention-based, oral care protocol (prospective group) were compared.

**Results:** A statistically significant decrease in the pneumonia rate occurred in the prospective group (p<0.05).

**Discussion:** An enhanced oral care protocol was beneficial in reducing the incidence of non-ventilator-associated hospital-acquired pneumonia.

**Implications:** Nurses play a vital role in preventing hospital-acquired pneumonia. Foundational nursing practices, such as regular oral hygiene, are important aspects of care in preventing nosocomial infections and related costs, optimizing health, and promoting quality care.

**Key words:** non-ventilator-associated hospital-acquired pneumonia, oral hygiene, neurological injury/insult, care-dependent, multi-disciplinary, clinical nurse specialist

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**L’intensité buccale : réduire la pneumonie nosocomiale non-acquise sous ventilation chez les patients souffrant de déficiences neurologiques et dépendant de soins**

**Introduction :** L’objectif de cette étude menée sur le lieu d’intervention était d’évaluer l’efficacité d’un protocole de soins d’hygiène buccale préventif destiné à une population en neurochirurgie située en dehors d’un environnement de soins intensifs afin de réduire les pneumonies nosocomiales non-acquises sous ventilation. Les chercheurs ont émis l’hypothèse qu’un protocole de soins buccaux amélioré diminuerait l’incidence de pneumonie.

**Méthodes :** Cette étude comparative s’est déroulée dans l’unité de soins neurologiques de courte durée d’un hôpital de traumatologie tertiaire de l’Ouest du Canada. Les sujets étaient des adultes non-intubés, dépendant de soins, qui avaient reçu un diagnostic primaire de lésion/insulte neurologique et présentaient un fort risque de contracter une pneumonie. Cette étude de groupe prospectif comprenait 34 sujets; 2 sujets ont été exclus de l’analyse de l’étude. L’étude de groupe rétrospectif comprenait 51 sujets.

Des données ont été recueillies au moyen d’un examen des dossiers. Le groupe prospectif était composé de patients en neurochirurgie admissibles et qui ont reçu le protocole de soins d’hygiène buccale amélioré. On a créé les outils de collecte des données puis déterminé les critères de diagnostic des pneumonies nosocomiales. On a comparé les taux de pneumonie entre les sujets qui ont reçu des soins buccaux standards (groupe rétrospectif) et ceux qui ont reçu le protocole de soins d’hygiène buccale préventif amélioré (groupe prospectif).

**Résultats :** Il s’est produit une importante baisse statistique des taux de pneumonie dans le groupe prospectif (p<0.05).

**Discussion :** Un protocole de soins d’hygiène buccale amélioré a aidé à réduire l’incidence des pneumonies nosocomiales non-acquises sous ventilation.

**Implications :** Le personnel infirmier joue un rôle essentiel lorsqu’il s’agit d’empêcher les pneumonies nosocomiales. Des pratiques de soins infirmiers fondamentales, telles qu’une hygiène buccale régulière, constituent d’importants aspects des soins dans la prévention d’infections nosocomiales et des coûts qui s’ensuivent, l’optimisation de la santé et la promotion de soins de qualité.

**Mots-clés :** pneumonie nosocomiale non-acquise sous ventilation, hygiène buccale, lésion/insulte neurologique, dépendance aux soins, multidisciplinaire, infirmier(-ière) clinique spécialisée
Introduction

Hospital-acquired pneumonia (HAP) is a common nosocomial infection and a significant cause of morbidity and mortality, leading to increased length of stay, increased costs, and decreased quality of life (Rotstein et al., 2008; American Thoracic Society [ATS], 2005; Thompson, Makary, Dorman, & Pronovost, 2006; Davis & Finley, 2012). Research has linked oral contaminants with an increased risk of HAP (ATS, 2005; Chan, Ruest, Meade & Cook, 2007). The acute, care-dependent, neurologically impaired patient is particularly susceptible to acquiring HAP (Cohn & Fulton, 2006; Langmore et al., 1998). Oral care research in the neurosurgical population is largely limited to critical care units, with a focus on ventilator-associated-pneumonia (VAP) prevention (Fields, 2008). Research has led to the development of clinical guidelines and care bundles, including enhanced oral care protocols, to reduce VAP in critical care settings (ATS, 2005; Institute for Healthcare Improvement [IHI], 2005; Sedwick, Lance-Smith, Reeder & Nardi, 2012), yet, when patients transition from these areas to acute wards, oral care practices are less defined.

Therefore, the aim of this study was to explore the impact of an enhanced oral care protocol in reducing non-ventilator-associated HAP (NV-HAP) in an acute, non-intubated, care-dependent, neurosurgical population outside of critical care.

Background/literature review

HAP is defined as an inflammatory condition of the lung tissue caused by infectious agents not present or incubating at the time of hospital admission or within 48 hours of admission (ATS, 2005; Rotstein et al., 2008). Acutely ill, care-dependent patients outside critical care areas are highly susceptible to developing NV-HAP (Cohn & Fulton, 2006; Langmore et al., 1998). The following areas of research support this study’s hypothesis that a relationship between oral contaminants and HAP exists.

The Association of Medical Microbiology and Infectious Disease Canada (AMMI) and the Canadian Thoracic Society’s joint document Clinical Practice Guidelines for Hospital-Acquired Pneumonia and Ventilator-Associated Pneumonia in Adults (Rotstein et al., 2008) clearly identify significant morbidity, mortality, and socio-economic costs associated with HAP. These guidelines recommend that prevention-based oral care protocols be established for in-patients, including those not ventilated. The definition, diagnosis, and prevention strategies in these guidelines inform this study’s hypothesis.

In the critical care literature, evidence-based oral care protocols are associated with prevention of HAP and VAP in the critically ill. Research in intensive care units (ICUs) reports decreased HAP rates with standardized oral care protocols (Chan et al., 2007; Grap, Munro, Ashthiani, & Bryant, 2003). In one study, VAP rates decreased to zero within one week of standardizing teeth brushing to every eight hours (Fields, 2008). Overall, standardized oral care protocols, including aseptic solutions and teeth brushing for acutely ill, care-dependent patients has proven beneficial for prevention of nosocomial pneumonia (American Association of Critical Care Nurses [AACN], 2010; Munro & Grap, 2004).

Studies conducted in the field of cardiac surgery also support perioperative strategies in the prevention of VAP (DeRiso, Ladowski, Dillon, Justice, & Peterson, 1996). Research conducted by Houston, Houglund, Anderson, LaRocco, Kennedy & Gentry (2002) concluded oral decontamination prior to cardiac surgery decreased nosocomial pneumonia in intubated patients by 52%

In response to the literature, perioperative oral decontamination is a key component of pre-surgical physician order sets in a cardiac surgery program at a tertiary care centre in Western Canada (February 15, 2013, oral communication, J. Reimer-Kent, RN, MN).

In the neurosurgical literature, research on oral hygiene for the prevention of HAP has been limited to ICUs. Acute, neurologically impaired patients are especially vulnerable to developing HAP due to the nature of neurological injury. The care-dependent neurologically impaired patient typically has an increased risk of oral colonization due to decreased cognitive status, impaired swallow and cough, immobility, and dependency for care (Cohn & Fulton, 2006). In one study, the oral care protocol used by the clinicians was so successful in reducing HAP in intubated patients in ICUs with implementation of an enhanced oral care protocol, the control group was dropped after six months (Fields, 2008).

The importance of oral hygiene is also noted in allied health and medical literature. Dysphagia is a common complication of neurological injury, increasing risk for aspiration (Marik, 2001). Marik identifies aspiration of contaminated oral secretions in the presence of bacteria as a key factor in developing aspiration pneumonia. High-quality oral care should be a priority strategy for limiting the occurrence of bacterial pneumonia, particularly in individuals with an increased risk of aspiration secondary to dysphagia (Yoon & Steele, 2007). Dependency for oral care is a significant predictor of aspiration pneumonia (Langmore et al., 1998). Dental research has also identified the importance of vigilant oral care for prevention of pulmonary infections (Terpenning et al., 2001). One pilot comparison study suggested enhanced oral care protocols, including teeth brushing and antimicrobial oral solution, held promise in preventing HAP in patients in critical care and recommended further studies be done (Bopp, Darby, Loftin, & Broschious, 2006).

The multiple studies informing this research study identify the benefits of comprehensive oral care protocols on the prevention of HAP. Oral health is a key element of nursing care and has a significant effect on overall health, yet nursing practice is reported as inconsistent, not evidence-based, and not accurately reflected in documentation (Grap et al., 2003; Munro & Grap, 2004).

In their study on oral care interventions in critical care, Munro et al. (2004) reported nurses value the contribution of oral care to patient’s well-being. However, frequency and documentation of oral care depended upon time and available resources. The notion of oral care being an optional care practice suggests nurses do not fully understand the benefits of evidence-based oral care protocols. In consideration of the lack of quantitative studies exploring the association between oral hygiene and HAP in the care-dependent, neurosurgical patient outside critical care, the researchers propose an enhanced oral care protocol may prove beneficial for this vulnerable population.
Research design and methodology

This quasi-experimental study involved a retrospective chart review and prospective data collection. Retrospective data were collected on eligible patients who had received standard oral care (SOC). An evidence-informed oral care protocol was developed for prospective in-patients: the enhanced oral care (EOC) group.

The research team was led by a clinical nurse specialist (CNS) and a registered speech language pathologist (SLP). Other team members included a clinical nurse educator (CNE), a patient care coordinator (PCC), and a physiotherapist (PT). The team met regularly prior to, during and following the conclusion of the study period. The team developed data collection tools including nursing documentation worksheets to record completion of the protocol, patient information records (to log diagnostic tests, clinical indicators of pneumonia) and instruments to record the subject and study data.

Setting

The study was conducted on a 31-bed acute neurosurgical unit at a tertiary care trauma hospital in Western Canada. The hospital is one of 12 acute care centres in a large metropolitan health region. Unit staff consists of a mix of novice and experienced staff including registered nurses (RNs), licensed practice nurses (LPNs), patient care assistants (PCAs), and a robust rehabilitation team.

Sample

All enrolled patients met specific inclusion criteria including age 19 years or older, non-intubated, care-dependent, and a primary diagnosis of neurologic injury/insult. Exclusion criteria included conditions not consistent with the research question (Table 1).

Sample size considerations

There were no known specific NV-HAP rates for the study unit prior to the start of the study. Therefore, the prevalence of HAP in acute in-patients reported in the literature was considered. The HAP rates reported were 21% in stroke patients (Hilker, Poetter, Findeisen, Sobesky, & Jacobs, 2003), 50% in neurological in-patients reported in the literature was considered. The team developed data collection tools including nursing documentation worksheets to record completion of the protocol, patient information records (to log diagnostic tests, clinical indicators of pneumonia) and instruments to record the subject and study data.

Table 1: Inclusion/exclusion criteria

<table>
<thead>
<tr>
<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
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<tbody>
<tr>
<td>• Adult (&gt;19 years)</td>
<td>• &lt;19 years</td>
</tr>
<tr>
<td>• Admitted to the neuroscience unit</td>
<td>• Off service patients</td>
</tr>
<tr>
<td>• Primary diagnosis is neurological (brain injury/insult)</td>
<td>• Intubated, on BiPAP or CPAP (respiratory assistive devices)</td>
</tr>
<tr>
<td>• Non-intubated, non-ventilated</td>
<td>• Palliative</td>
</tr>
<tr>
<td>• Dependent for oral care and unable to direct their own oral care</td>
<td>• Capable of directing their own oral care</td>
</tr>
<tr>
<td></td>
<td>• Unable to receive oral care due to: oral tubes, nasal/ oral airways, wired jaws, or behaviours such as resistiveness, combative ness, non-compliance, etc.</td>
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The oral care protocols

The SOC Protocol

The protocol in place on the study unit during the retrospective period was congruent with regional standards for practice. This standard for oral hygiene for care-dependent patients was an expectation of routine care. However, it did not determine the type of oral care (e.g., oral swabbing, teeth brushing), the frequency of care, the type of oral care supplies, or patient positioning such as elevation of head of the bed. Therefore, wide variation in nursing practice and the quality of oral care provided to patients during the retrospective study period was evident. The standard protocol included universal hand washing precautions, mouth assessments, cleaning and moisturizing of the mouth at the discretion of the nurse, and mouth and/or tracheostomy suctioning on an as-needed basis. Oral suction equipment was changed weekly and as necessary. Oral hygiene products were available for use including swabs, suction swabs/toothbrushes, standard oral rinse solution and mouth and lip moisturer supplied by an approved vendor. These supplies were available and regularly stocked on the unit and used at the discretion of the bedside nurse.

The EOC Protocol

This study involves acutely ill hospitalized patients, most of whom transferred to the study unit from a higher level of care where critical care oral hygiene protocols were in place. The EOC protocol developed for the prospective study was informed by the literature (Bopp, 2006; DeRiso et al., 1996; Fields, 2008; Grap et al., 2003; Safdar, Crnich, & Maki, 2005; Shorr & Kollef, 2005) and is outlined in Table 2.

The toothbrushes, swabs and solution used for both study groups were the same. The toothbrushes and oral swabs were impregnated with sodium bicarbonate. The oral rinse solution was standard solution for the institution, Perox-a-mint® (1.5% hydrogen peroxide solution). Some oral care protocols have explored use of non-pharmacologic agents and antimicrobial solutions, such as chlorhexidine gluconate. Routine use of chlorhexidine gluconate for oral hygiene is not recommended in areas outside critical care areas by the AACN (2010) and, therefore, was not included as a component of the EOC protocol.

The oral care provided to subjects was delivered by RNs and LPNs; no PCAs were involved in providing oral care to study subjects at any time. Oral care kits were provided at each subject’s bedside for the duration of their participation in the study. Prior to implementation, a series of education sessions were held for nursing staff to become familiar with the purpose of the study, the EOC protocol, and the study’s nursing documentation tools.
Data collection
The six-month period of study for both groups was selected to include the months February through August of the relevant year. HAP was defined according to the AMMI Canada Guidelines (Rotstein et al., 2008) and was confirmed by the researchers by a positive chest x-ray and two of the following three criteria: elevated WBC count, pyrexia, and positive sputum culture. Upon identification for full chart review (retrospective study) or upon recruitment to the prospective study, each subject was assigned a unique identification number to anonymize collected data.

The variables collected were evidence-informed, and were captured in two data collection tools. One tool was used to collect data constants such as demographic information and relevant patient characteristics such as age, gender, admitting diagnosis, length of stay (admission and discharge dates), date of consent and dental status (teeth or dentures or neither). The second tool collected weekly data such as clinical signs of HAP, the level of care dependency, presence or absence of tracheostomy, presence or absence of dysphagia, and mode of nutrition. These variables enabled the study researcher to trend and track the clinical condition of the study subjects to ensure they still met the study inclusion criteria and to capture the date of HAP diagnosis.

The EOC protocol was listed on the nursing worksheets and required nurses to document and initial the provision of oral care over a 24-hour time period. The worksheets also served as an easy reference of the protocol to encourage and monitor compliance with the EOC. Study variables and diagnostic tests for the purpose of confirming pneumonia, such as sputum specimens, blood tests, positive chest x-rays and presence of fever were recorded on the patient's patient information record to monitor and track indicators consistent with a diagnosis of HAP.

Ethical considerations
The study proposal was submitted and approved by the Fraser Health (FH) Department of Evaluation and Research Services (DERS). The proposal went through a full board review, in accordance with FH policies for clinical research. A study consent form and the consent process were developed according to DERS policies for research and approved by the FH Ethics Review Board.

Recruitment
The retrospective study group was determined through a chart review process. The co-principal investigators reviewed all patients who were admitted to the neurosurgical unit with a primary diagnosis of neurological injury/insult consistent with likelihood of care dependency, during a six-month period. In total, 300 charts were reviewed. From this list, care dependency was confirmed through electronic records. Once care dependency was confirmed, patients who met the inclusion criteria were included in the study (n=52) for the period of time in which they met the study criteria.

Prospective study subjects were screened for potential participation upon admission to the unit. Once identified as a potential subject, a study team member approached the designated temporary substitute decision maker (TSDM) to inform them of the study and offer them the opportunity to participate. The TSDM was given information about the study and copy of the consent form to review. They were provided 24 hours to decide whether or not they would participate. The TSDM was aware the EOC protocol would be provided for the duration of stay on the unit, until the subject was no longer dependent for oral care, or upon withdrawal of consent.

Once consented, the TSDM of all recruited subjects received a copy of their signed consent form, a copy was placed on the patient’s chart, and a copy was secured by the study’s principal investigator. Language services were made available when indicated and/or upon request of the TSDM. Upon consent, and while subjects continued to fit the study criteria (e.g., age 19 or over, primary diagnosis was neurologic, non-intubated, dependent for care), the subjects received the EOC protocol.

Results
Descriptive statistics were collated (see Table 3) to summarize the subjects’ demographic and medical status for both the SOC and EOC groups. A greater proportion of subjects had a tracheostomy at some point during the study period in the EOC group (40%) than in the SOC group (24%). There was a greater proportion of male subjects in the EOC group (ratio of 23:9) than in the SOC group (27:24). The average age of subjects in the two groups was similar (see Table 3) and not significantly different on a t-test (p=0.382). The percentage of subjects with

Table 2: Oral Care Protocol Worksheet

<table>
<thead>
<tr>
<th>Date:</th>
<th>Minimum HOB 300 for all Mouth Care</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Write in Time of Care and Initial</td>
</tr>
<tr>
<td><strong>Intervention</strong></td>
<td></td>
</tr>
<tr>
<td>Change mouth suction equipment every 24 hours</td>
<td></td>
</tr>
<tr>
<td>Mouth assessment every 2-4 hours</td>
<td></td>
</tr>
<tr>
<td>Cleanse mouth with toothbrush every 12 hours</td>
<td></td>
</tr>
<tr>
<td>Cleanse oral mucosa with oral rinse solution every 2-4 hours</td>
<td></td>
</tr>
<tr>
<td>Moisturize mouth/lips with swab and standard mouth moisturizer every 4 hours</td>
<td></td>
</tr>
<tr>
<td>Suction mouth and throat as needed</td>
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</tbody>
</table>
Dysphagia was the same for both groups. The mix of neurological diagnoses of the two groups is summarized in Figures 1 and 2 and is broadly similar. The similarities and variances in subject characteristics (such as age, gender and neurological diagnosis) between the two groups reflect the typical population cared for on the neurosurgical unit and, while measured, they were not specifically controlled for in this study. One TSDM withdrew participation in the study to allow the subject uninterrupted sleep at night. For four subjects, participation in the study ended when the subject showed signs of improved cognitive status and the ability to direct or carry out their own oral care. All other subjects’ participation ended with transfer/discharge from the unit.

Analytical data for all subjects (both comparing between the SOC and EOC groups and also combining all subjects’ data from both groups) were calculated. As hypothesized, a significant decrease in the rate of HAP occurred in the EOC group when compared with the SOC group (p=0.039, 2-sided Fisher’s Exact test). The percentage rate of HAP dropped by more than three-quarters, from 25.5% to 6.3% (Figure 3). Although the sample size did not allow for the two study groups to be precisely matched for gender, age or specific neurologic diagnosis, none of these factors are known to affect HAP incidence. Pre-morbid conditions of the subjects were not compared. There was no analysis of the variable of dysphagia, as the number of subjects without dysphagia was too small to reveal any statistical significance. A larger scale study may be better able to control for these factors and analyze these variables. It is notable that data were collected weekly, in order to capture potential for multiple HAP occurrences in one subject, but no instances of this occurred in either group in this study.

The sample size was too small to reveal any significance of the presence of tracheostomy in the incidence of HAP. Irrespective of SOC/EOC group membership, 28% of those with tracheostomy developed HAP compared with 13.8% of those without a tracheostomy (p=0.134, 2-sided Fisher’s Exact test). Notably, data were collected weekly, in order to capture potential for multiple HAP occurrences in one subject, but no instances of this occurred in either group in this study.

The sample size was too small to reveal any significance of the presence of tracheostomy in the incidence of HAP. Irrespective of SOC/EOC group membership, 28% of those with tracheostomy developed HAP compared with 13.8% of those without a tracheostomy (p=0.134, 2-sided Fisher’s Exact test). Notably,
when comparing the two groups, all occurrences of HAP in the EOC group (n=2) were in subjects with a tracheostomy, whereas only 38% of HAP cases in the SOC group (n=5) were in subjects with a tracheostomy. Again, this effect did not reach significance in this small-scale study.

Subjects who developed HAP were slightly, but not significantly younger (mean age 51.07) than those who did not (mean age 60.6 years). In a sample of this size, dental status was not a significant factor affecting HAP outcome (p=0.720, 1-sided Fishers exact test). Many subjects’ data regarding this variable were missing (N=22) particularly from the SOC group, as it was not charted at the time of the subject’s hospitalization. Length of stay (LOS) was significantly longer (p=0.044, Mann-Whitney test) in subjects who had HAP (median 41) than in those who did not (median 14). However, it must be noted that the LOS data include a confounding factor; the SOC group’s data records a total LOS on the unit, whereas the EOC group data reflected only the number of days that the subject was on the study, and did not account for any days on the unit prior to their consent and participation in the study. Also, LOS between groups was not significantly different in this relatively small study (p=0.266, Mann-Whitney test).

Discussion
This study’s results add to mounting evidence that improving oral hygiene in care-dependent patients can reduce the risk of NV-HAP. This work expands the finding to settings outside of critical care and residential care areas and implies likely benefits in other hospitalized, acutely ill, care-dependent patients. The researchers suggest EOC protocols would benefit acute, care-dependent populations outside neurological units, such as those on acute medical and geriatric wards.

The actual HAP rate in the SOC group (25.5%) was lower than the researchers’ estimated rate of 47%. During data collection, the researchers found that some subjects in the retrospective group had strong signs of HAP (e.g., positive sputum sample, high WBC count, nursing reports of chest congestion), but could not be counted as confirmed cases, as there was inadequate documentation to confirm that all the diagnostic criteria had been met (e.g., no chest x-ray reported). Hence, the researchers suggest the reported HAP rate in the SOC group is likely a conservative value.

As stated in the results, both cases of HAP in the EOC group occurred in subjects with a tracheostomy, where an open stoma provides an additional route to the lungs. Unit staff report the number of patients with tracheostomy on the unit typically fluctuates at any given time. The proportion of subjects with a tracheostomy in the EOC group was almost double that of the SOC group. This suggests the rate of HAP could have been even higher in the SOC group had there been a similar proportion of patents with tracheostomy in that group. However, due to the limited sample size in this study, there are inadequate data to support a dependent relationship between the presence of tracheostomy, dysphagia, or dental status and any effects on the efficacy of oral care in preventing HAP. It is an interesting finding that merits further inquiry in future studies.

It must be considered that a subject’s LOS is impacted by many medical factors and not solely by HAP incidence, but significant reduced LOS was found in subjects with no HAP compared with subjects who experienced HAP. It could be hypothesized that, in a larger study with neurological injury type, severity and other medical factors being controlled, LOS could be shorter in an EOC group, as a consequence of the reduction in HAP rate.

In addition to preventing HAP, one of the most common nosocomial infections, EOC implies widespread benefits. For example, a cleaner mouth is believed to improve patient comfort and patient/family satisfaction in maintaining this aspect of basic daily hygiene (Grap et al., 2003). Preventing HAP also provides benefits to the team; for the SLP in dysphagia care it expedites swallowing assessments and enhances outcomes, it reduces the need for chest physiotherapy, and reduces respiratory therapist (RT) and nurse workload for HAP-related interventions. The indication that LOS may be reduced when patients do not develop HAP has significant implications for cost reduction, particularly as oral care is a relatively inexpensive intervention compared with the healthcare costs associated with HAP (Davis et al., 2012).

Although nurse compliance with the EOC protocol is not a focus of this study, documentation on the nursing worksheets suggested an excellent degree of compliance with performing oral care for the EOC group subjects (95%). Informal reports from nursing staff suggested they saw the benefit of the EOC in ease of maintaining oral hygiene and perceived patient comfort. The convenience of patient-specific bedside oral care supplies, rather than bulk ‘ward stock’ supplies, created time efficiency that ameliorated any effect of the enhanced protocol on their workload. Families reported higher satisfaction with subjects’ cleaner mouths. Other team members also reported significant benefit of the enhanced oral care protocol. For example, SLPs reported an improved level of oral hygiene in patients with dysphagia on the unit, which facilitated assessments and enabled earlier or more liberal initiation of oral diets.

Implications
The researchers suggest improvements in oral hygiene for hospitalized patients have far-reaching effects. The implications are not exclusive to the patient, or the nurse, or the system. Rather, the study results imply there are implications to all three of these spheres. Therefore, the implications of this study will be discussed in the context of these three spheres.

Implications for patients
The health outcomes of HAP are well documented in the literature and prevention of incidences of HAP was the main focus of this study. Just one incident of HAP alone can have severe detrimental effects on vulnerable, acutely-ill patients, including death. Preventing an incident of HAP implies prevention of sequelae of illness, less need for invasive tests and treatments, fewer medications and their side effects, and an overall optimization of a state of being, allowing optimal opportunity for patients to recover from their illness.

Implications for nursing practice
Maintaining good oral hygiene for care-dependent patients is a foundational activity of nursing practice. In today’s busy health care environments, nurses are challenged to fit the basic
elements of personal care such as oral care into their over-stretched workloads. The amount of time required to perform the enhanced protocol was originally expected by unit nurses to increase their workload. However, at the study’s conclusion, nurses anecdotally reported the enhanced protocol did not negatively impact their overall workload. Rather, nurses stated they spent less time on performing routine oral care in this population, compared with time normally spent on interventions when caring for a patient with HAP. The lower HAP rate during the study period appeared to reduce nursing workload, as nurses had far fewer patients with HAP for whom to care. Nurses reported patients on the EOC protocol required less incidental oral and tracheostomy suctioning, that caring for a cleaner mouth was easier, improved surveillance for oral infections and gum conditions, fewer diagnostic tests and invasive procedures were required, and patient comfort and family satisfaction improved.

This multidisciplinary study, which was spearheaded by the unit CNS, was the first clinically based, population-focused study of its kind on this unit at this tertiary institution, involving a high-risk NV-HAP population. Conducting research on a unit for the first time requires careful planning, time, and staff engagement and the CNS is in a prime position to engage direct care staff and lead multidisciplinary teams in conducting clinical research to improve quality care, nursing practice and patient care outcomes. As a nursing leader, the CNS educates direct care staff on evidence-based practices and assists in the implementation of evidence-based protocols in clinical environments. The CNS on this neurosurgical unit identified a concern about unit NV-HAP rates and, with critical inquiry, advanced a research question into clinical research to improve nursing practice. The critical inquiry, research and leadership skills, and the connection a CNS has to clinical environment are instrumental in conducting clinical research in acute care settings.

Implications for the system

HAP is a costly and largely preventable nosocomial infection (Davis et al., 2012). Therefore, preventing NV-HAP in non-critical care environments through fundamental care practices is a sensible and practical way of reducing health care costs. In addition to the benefits previously outlined in this report, reducing NV-HAP prevents extended days in hospital associated with the disease, further optimizing the patient’s transitions through the care continuum. As patient movement through the health care system improves, access to in-patient specialty beds and access to care improves, as well. At an estimated cost of tens of thousands of health care dollars per HAP event, prevention of NV-HAP in the acute care environment makes financial and clinical sense and EOC protocols are a cost-efficient way to avert pneumonia-related expenditures.

Future studies

The results of this study provoke more questions on the relationship between nursing activities and preventing HAP. To what extent does enhanced oral care prevent NV-HAP in patients with tracheostomy? What other nursing activities play a role? It would also be of interest to explore nurses’ attitudes to performing and prioritizing routine oral care in care-dependent populations, to further understand the attitudes and barriers to performing preventative care practices over reactive care practices.

Nursing workload remains a concern in health care and more needs to be understood about how to assist nurses in deciding and prioritizing which care activities to perform, and with what rigour, when time is limited. This study demonstrated that when nurses fully understand the relationship between oral contaminants and NV-HAP, and their work environments are set up with adequate resources and supplies, their compliance to evidence-informed protocols increases and workload related to reactive-based care activities and searching for supplies is reduced. Finally, exploring opportunities for oral care to be learned and performed by non-employed personnel such as family members may provide health care teams with new ways to facilitate care transitions, as patients emerge from their state of care dependency.

Limitations

This study was limited to a small sub-specialty population on a single unit at a single acute care institution. More research in this area could support the assumption that the findings of this study are generalizable to other surgical, neurologic, or care-dependent non-ventilated populations. The small sample size of both groups limited analysis of some of the study variables. A larger sample size in both groups is needed in order to validate whether the presence of tracheostomy, dysphagia, or dental status contributed to NV-HAP events. The two study groups were similar in categorical neurologic diagnosis, however, a direct comparison cannot be made and, therefore, there is limitation in comparison of the two groups. Additional morbidities were not addressed.

In the prospective study period, the nurses had gained the advantage of education and knowledge of the relationship between oral hygiene and NV-HAP and, as a result, unavoidably influenced the quality of the care they provided. It is unknown what the nurses’ knowledge level of oral care and its link to NV-HAP was during the retrospective study period. A randomized control trial could not be conducted for this study, as, ethically, nurses were not in a position to deny oral care to a control group and blinding could not be achieved.

Accuracy of nursing documentation of oral care completion was not a measured variable in this study and, therefore, despite a documented 95% rate of compliance for the prospective group (32 patients, combined total of 676 days), it cannot be confirmed with total accuracy, that the protocol was completed as documented. However, compliance is further implied by the significant HAP rate reduction.

Conclusion

The results of this study demonstrate an EOC protocol was beneficial to reducing incidences of NV-HAP, averting pneumonia related health care costs, and improving oral hygiene and the overall health of care-dependent neurosurgical, non-ventilated patients. Improving patient outcomes begins with critical inquiry and maximizing opportunities to conduct point-of-care research. CNSs are positioned well to lead multidisciplinary teams in conducting clinical research to improve quality care, nursing practice and patient care outcomes. Nurses play a vital role in identifying vulnerable patients and implementing comprehensive oral care regimens in the prevention of HAP.
Nurses need to be aware of the connection between oral bacteria in precipitating HAP, and the importance of diligent oral care. Foundational practices such as regular oral hygiene are increasingly recognized as important aspects of nursing care in preventing nosocomial infections, optimizing health, and promoting quality patient care.

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