Evidenced-based Research on Preventing Hospital-Acquired Pneumonia with Oral Care Interventions

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**PICO Question and Significance to Nursing Practice**

**Research Question:** Which oral care regimen is most effective in preventing hospital-acquired pneumonia?

This research question focuses on hospitalized individuals as the population or patients (P), and oral care for these patients is the intervention that has been chosen to research (I). It was found that a group of interventions, all used in combination with each other, was the best way to prevent hospital-acquired pneumonia in hospitalized patients, and even those on ventilators. Research found that this bundle consisted of both simple oral hygiene techniques, such as tooth brushing, as well as more in-depth care like rinses, deep suctioning, and patient education. Most of these interventions were found to be positive separately, in their own studies; however, according to Cuccio et al. (2012), a combination of a few different interventions is more effective than simply choosing one, as singling out one treatment does not remove as many pathogens or oral plaque as a variety or oral hygiene care actions do (C). These bundle protocols were developed in hospitals with patients acquiring pneumonia during their stay, and a link to a lack of oral hygiene care was found. These findings and further research conducted to study their validity and the effectiveness of these actions suggested that increased oral hygiene care, particularly a specific set of interventions and education, provided by nurses and other health care providers would lead to the reduction of hospital-acquired pneumonia in all patients, including those on ventilators with that are high-risks (O).
While a “bundle” of interventions has been suggested as the most effective way to prevent hospital-acquired pneumonia (Cuccio et al., 2012), each has its own reasoning behind its use, with tooth brushing as the foundation of care. Everyday an orally-healthy person brushes their teeth at least twice to mechanically remove pathogens and plaque build-up throughout the day. Patients in the hospital eat, talk, and, in terms of oral care, experience everything a healthy individual would in a normal day; however, they are in an environment that is perfect for the development of respiratory infections and tooth brushing by itself is not enough. The second action is to add a mouth rinse to oral care to eliminate those pathogens that mechanical brushing could not. The increased effectiveness of the combination of these two actions is logical, in that two interactions to remove potential disease-developing pathogens would be more powerful than one (Cuccio et al., 2012).

There are, however, high-risk situations, such as patients on ventilators or patient at risk for aspiration leading to aspiration pneumonia, which would require further in-depth oral care in the form of suctioning and deep suctioning. Light suctioning, particularly the suction toothbrush technique, removes mucus and excess saliva that a patient could potentially aspirate, or swallow into the lungs, creating a moist, warm environment for bacteria to grow and cause aspiration pneumonia (Fields, 2008). Deep suctioning, however, is reserved for patients on ventilators to remove mucus that has already formed in the lungs to prevent the common, and dangerous, development of ventilator-associated pneumonia.

The most important intervention, on the other hand, is health care provider and patient education. Now that the effectiveness of oral care has been research and studied, it is essential for those in the health care field to learn about its importance in order to
provider better, healthier care for their patients. The patients’ education, however, may be the most critical intervention. Without the proper education on why it is important to their health, as well as their future health, keep their mouths clean, particularly when in the hospital, patients are often less compliant with the many oral care actions put into effect in the hospital (Cuccio et al., 2012). Applying these interventions not only created a lower rate of patients acquiring pneumonia in studies, but also created a new protocol to prevent one of the major, potentially life-threatening, concerns in hospitalized patients.

**Search Strategies**

When gathering research for this topic, the search began online through Auburn University’s library using the databases CINAHL, Cochrane, and Medline using the key words “pneumonia”, “hospital acquired infection”, “respiratory infection”, “oral care”, “oral hygiene”, “mouth care” and “treatment bundle”. The search topic was then narrowed by limiting the publication date from 2003 to 2013, and only allowing academic journals to be searched. This provided several results that were applicable to the topic.

**Grid**

**Research Question:** Which oral care regimen is most effective in preventing hospital-acquired pneumonia? (See Appendix A).

**Synthesis of Findings**

Preventable hospital acquired infections, specifically pneumonia, have created an area of serious concern in recent years. The hospital provides the ideal environment for respiratory infections, due to compromised oral airways, decreased levels of consciousness, and decreased body defense systems (Fields, 2008). Mortality ranges for ventilator-associated pneumonia alone are between 24 and 50 percent, with potentially higher figures looming in the distance (Berry,
Davidson, Maters, Rolls, & Ollerton, 2010). Studies have revealed a relationship between compromised oral hygiene and the development of pneumonia or other respiratory tract infections. Researchers now believe that creating a specific oral regimen is critical in preventing the spread of dangerous microorganisms, and consequently, the development of preventable respiratory infections (Sjogren, Nilsson, Forsell, Johansson, & Hoogstraate, 2008).

Researchers continue to use the techniques of tooth brushing as a foundation for oral hygiene studies. These beliefs come from the previous hypotheses that prevention of aspiration pneumonia relies heavily on the reduction of pathogens, including dental plaque, from the oral cavity (Tada, & Miura, 2011). Researcher Lorraine B. Fields began a randomized controlled trial in a 24-bed intensive care unit to determine the effectiveness of standard mouth care versus the development of a specific plan of care with the inclusion of a suction toothbrush (Fields, 2008). The design had to be altered to include the control group due to the development of VAP in four of the participants of the control group over a six-month period (Fields, 2008). As a result of the high levels of success in this study, this specific suction toothbrush technique is now included as protocol in this hospital. Dental plaque can only be removed by tooth brushing; therefore, it is a critical practice (Fields, 2008). A multidisciplinary approach to effective oral hygiene must begin with the basics, specifically tooth brushing, in order to create positive results (Cuccio et al., 2012). In supporting evidence, the use of mechanical cleaning alone eliminates concerns of resistance and susceptibility that come with antibacterial agents (Tada, & Miura, 2011). Tooth brushing provides a basis for oral hygiene that can be built upon in order to achieve an optimal level of patient oral care.

Although tooth brushing is effective in decreasing pathogens in the oral cavity, evidence-based practice suggests that a “bundle” of 3 to 5 oral hygiene interventions used in combination
can most successfully improve patient outcomes (Cuccio et al., 2012). Cuccio et al. (2012) conducted a quasi-experimental study aimed to examine the influence of oral decontaminants, such as chlorhexidine rinses, along with a revised oral care bundle. The researchers collected six months of preintervention data as well as 12 months of post-intervention data on mechanically ventilated patients in the intensive care unit (Cuccio et al., 2012). Chlorhexidine gluconate mouthwash removes plaque while also working as an antimicrobial agent as well (Berry et al., 2010). As a result of the study conducted by Cuccio et al. (2012), ventilator-associated pneumonia (VAP) rates were reduced from 4.3 to 1.86 per 1000 ventilator days. This research provides sufficient evidence in favor of a 6-hour oral care protocol with chlorhexidine for the reduction of VAP rates (Cuccio et al., 2012). Similar findings were obtained in a systematic review of preventative oral hygiene methods on pneumonia; an overall positive effect was seen when combining the use of tooth brushing and 0.12% chlorhexidine gluconate oral rinses (Sjogren et al., 2008). Each of the studies of the systematic review points to a need for a combination of tooth brushing and oral decontaminants in order to improve patient outcomes.

Further research reveals oral suctioning as part of a multidisciplinary approach in the prevention of hospital-acquired pneumonia. Ventilator-associated pneumonia develops when subglottic secretions colonized by oropharyngeal pathogens travel down to the lower respiratory tract (Chow, Kwok, Luk, Law, & Leung, 2012). This happens more frequently if leakage occurs around an endotracheal tube, or if the oral functioning of the patient is compromised (Chow et al., 2012). As a part of a revised oral care protocol, Cuccio et al. (2012) included deep oral suctioning in the interventions being tested. Suctioning would assist in removing dangerous microorganisms and improving oral functioning. Although researchers found suctioning to be effective in a context with chlorhexidine rinses and tooth brushing, they recognized a need for
additional studies (Cuccio et al., 2012). Similarly, two randomized controlled trials tested the effectiveness of continuous removal of subglottic secretions by specially designed endotracheal tubes (Chow et al., 2012). Of the 14 patients receiving subglottic suctioning and 13 patients in the control group, there were 13 incidences of VAP; only three participants from the experimental group, as compared to ten in the control group (Chow et al., 2012). Building on the current body of evidence, this study determines that incidences of VAP can be significantly decreased with the use of continuous oral suctioning in ventilated patients (Chow et al., 2012). Patients who are mechanically ventilated have an increase in microorganisms found in the mouth, due to lack of consciousness and dysphagia. Consequently, health care facilities must put into practice a multitude of oral hygiene interventions.

Whereas most included studies focus on specific interventions to improve oral care, two specific studies highlight the need for both patient and healthcare provider education related to oral hygiene practices. Cuccio et al. (2012) conducted a randomized assessment of competency of oral care practices in 30 registered nurses and respiratory therapists over a two-month period. This evaluated a wide spectrum of practices, from mechanical cleaning to oral suctioning (Cuccio et al., 2012). Results indicated that 78 percent of the assessed staff members were completely compliant to protocol (Cuccio et al., 2012). This experiment demonstrates significant decreases in VAP incidences, suggesting that healthcare providers’ compliance with protocol is critical in promoting positive patient outcomes related to hospital-acquired pneumonia.

Additionally, the study conducted by Berry et al. (2010) sought to ensure that the oral care protocol was implemented appropriately; therefore, the study included a training program for the ICU registered nurses (Berry et al., 2010). This program delivered a detailed description of the procedures, involving proper techniques for oral care and appropriate use of the oral assessment
tool. Once again, the success of this study relies in part on the effective compliance of these registered nurses with correct protocol.

Although hospital-acquired pneumonia is preventable, it remains a highly prevalent and serious condition. Accordingly, a combination of oral care interventions and education must be implemented in order to provide remarkable improvements. A specific oral care bundle must be put in place to provide the best possible patient outcomes.

**Appraisal of Evidence**

What are the levels of evidence of your supporting studies?


Cuccio et al., (2012) – narrative review – Level VI


Is there a sufficient quantity of studies with consistent results to support recommendations?

Within the context of these six articles, there are a substantial number of studies with consistent results to support recommendations. The articles in sum implemented thorough tooth brushing, variations of oral rinsing, the use of suctioning devices, heightening the adherence to strict oral regimens, and increasing oral hygiene measures in addition to the prototypical use of ventilator bundles on
patients in hospitals to evaluate the effectiveness of reducing and preventing hospital-acquired pneumonia. In all of these trials, the rates of hospital-acquired pneumonia consistently and significantly decreased. One article in particular that had substantial results was the cohort study that implemented the use of 0.12% chlorhexidine (CHX) rinses and an oral care protocol on ventilator-associated pneumonia patients. The rates of ventilator-associated pneumonia significantly decreased from the first collection of data, six months prior to the intervention, to the final collection of data, one year after applying the intervention: “Fourteen fewer VAPs occurred during the 12-month period after the CHX protocol was implemented, as compared with the prior 12 months, with an estimated cost avoidance of $700 000 to $798 000” (Cuccio et al., 2012).

Are recommendations consistent among systematic reviews, evidence-based practice guidelines, and individual studies?

Findings supporting recommendations are consistent among the systematic reviews, evidence-based practice guidelines, and individual studies. In the six articles used, every recommendation to decrease and prevent hospital-acquired pneumonia was proven effective. In one study, findings showed that rates of acquirement were cut down by more than half when recommendations of applying oral hygiene measures every eight hours in addition to the prototypical VAP bundle were followed correctly:

“As of June 2007, the VAP rate was 0.62%, but by December 2007 it had risen slight to 1.17%. These rates are in contrast to those of 2005, when at one
point the neuro intensive care unit had a VAP rate of 6.49% per 1,000 ventilator days” (Fields, 2008).

In the articles used, the implementation of recommended interventions resulted in many positive results, all of which are thoroughly supported throughout the studies. Are there identified benefits to the patient for applying evidence-based practice recommendations? Are there identified risks?

Because of the consistent and positive nature of the results, there are identified benefits to the patient and to the provider for applying these recommendations. The strictly positive results of significantly reducing hospital-acquired pneumonia rates is assuring for both patients and providers to know the effectiveness of such measures; “The authors reported that CHX was associated with a 30% relative reduction in VAP” (Cuccio et al., 2012). From the large reduction in both hospital-acquired pneumonia and ventilator-associated pneumonia rates, benefits arise for the patients and providers.

Have cost studies been done on the recommended action, intervention, or treatment?

Cost studies have been done on the recommended interventions to further prove their worth. One study initially states that each patient diagnosed with ventilator-associated pneumonia “can cost an additional $29,000-$40,000... and the (VAP) kits cost the floor an additional $12,000 a year” (Fields, 2008). The quasi-experimental design that used implemented the use of 0.12% chlorhexidine rinses and an oral care protocol to test the effects it had on the rate of VAP, determined that “ventilator-associated pneumonia rates were reduced from 4.3 to 1.86 per 1000 ventilator-days during the study period, with an estimated cost avoidance of $700 000 to $798 000”
(Cuccio et al., 2012). As evidenced, significant costs are bypassed when the VAP rates are decreased, which demonstrates that the implementation of proven interventions is of utmost importance.

**Recommendations for Evidence-Based Practice**

1. Implement tooth brushing and rinsing oral care for all patients with over-night stays in the hospitals (A). Supporting studies
2. Implement deep suctioning for patients on ventilators (B). Supporting studies
3. Implement suctioning tooth brushing protocol for patient’s at risk for aspiration (B). Supporting studies
4. Create and implement a “bundle” system to have as current hospital protocol for all care units (ICU, MedSurg, etc). This bundle would have different degrees of risk for aspiration or hospital-acquired pneumonia and different amounts of oral care, from everyday tooth brushing to deep suctioning for more at-risk patients (A). Supporting studies
5. Implement a training program regarding oral hygiene and the importance of patient education for health care professionals (A). Supporting studies
References


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**Appendix A**

**Evidence Analysis Grid**

<table>
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<tr>
<th>Evidence Grid:</th>
<th>Purpose of study/research questions</th>
<th>Research elements:</th>
<th>Major findings relevant to project</th>
<th>Critique of validity, bias and significance for your project</th>
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<tr>
<td>Article citation in APA format</td>
<td>The purpose of this PI project was to (a) define oral care policies at Summa Health System and (b) compare rates of VAP in patients on ventilators whose teeth were brushed three times a day (i.e., every 8 hours) with those of patients who received daily tooth brushing and oral care with Toothettes as needed.</td>
<td>Design: Randomized Control Trial (RCT) Experimental originally, but became Quasi-experimental to include the control group. Population: Any mechanically ventilated patient on the stroke/medical ICU who had been intubated in the hospital for less than 24 hours and did not have a previous diagnosis of pneumonia? Sampling method: Simple Random Sampling. Sample Size: 345 patients (1,850 ventilator days) Description of methods or interventions: An oral-care project was implemented on an intervention group, which included: thorough oral care every 8 hours, pharynx and mouth suctioning as needed, and a full oral assessment every 12 hours. Outcomes measured: The study showed that brushed patient’s teeth three times a day and using the IHI VAP bundle can be</td>
<td>After instituting the oral-care project, a VAP rate of 0.62% was found in a total of 1,850 ventilator days (345 patients). Because of the success of the intervention group, and the development of VAP in four of the control group patients, the control group was dropped and all intubated patients were placed in the intervention group. Due to the success of the study, the protocol was implemented.</td>
<td>In the end, the control group was eliminated. But the study began with a control group and simple random sampling. This study was limited because of the lack of documentation by nurses. The number of ventilator days recorded by nurses was significantly lower than the number of ventilator days recorded by respiratory therapists. To validate this study, more research with a larger sample size over a longer period of time with better documentation needs to be done. It was strong.</td>
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LOE: II/III
The purpose of this article was to review the effect of oral hygiene and training for oral function (such as swallowing, mastication, and saliva secretion) on the prevention of AP.

**Design:** Narrative Review

**Population:** Elderly people in hospitals and nursing homes

**Sampling Method:** The different research studies described had varying sampling methods. There were 3 major studies described.

**Description of Methods/Interventions:** Interventions included oral decontamination with a chlorhexidine (CHX) rinse, application of topical plurals, antibiotics, and use of mechanical cleaning patient’s mouths.

**Outcomes Measured:** Rates of VAP and infection were significantly lower in patients receiving chlorhexidine oral rinse, topical antibiotics, and patients receiving chlorhexidine (CHX) showed a significantly lower rate of gram-negative bacteria, and a reduction in mortality compared with the untreated group. Patients treated with topical prophylaxis antibiotics had a fewer incidences of VAP. The rate of fatal AP in

This is weak evidence because there could be research subjectivity. It is also weak because none of the research studies were described in great detail.

**Significance:** One study discussed highlighted the importance of mechanical cleaning, and the lack of resistance that comes with antibiotic agents.
| Tada, A., & Miura, H. (2012). Prevention of Aspiration Pneumonia (AP) with Oral Care. *Archives of Gerontology and Geriatrics*, 55, 16-21. doi:10.1016/j.archger.2011.06.029 | The purpose of this study was to examine the impact of 0.12% chlorhexidine rinses and an oral care protocol on VAP rates in critical care patients. | Design: Quasi-experimental
Population: All patients admitted to the 3 critical care units and on mechanical ventilation at any time during the study period at Miriam Hospital in Providence, Rhode Island.
Sampling Method: Non-probability
Sample Size: 1,000 ventilator days

Description of Methods/Interventions: The oral care protocol included chlorhexidine gluconate rinse, daily oral assessment, and tooth brushing. Changes in protocol and importance of oral care were explained to staff, and they were given an online test to
After data was collected for one year, there were 14 fewer VAPs while the oral care protocol was in place, and an estimated cost avoidance of $700,000 to $798,000. This study was weak because there was no control group and no randomization. This study was limited because the database used to record and track VAP incidence does not include any demographic criteria. Also, the oral care protocol is comprehensive, so this limits the ability to determine the impact of individual
| Berry, A. M., Davidson, P. M., Masters, J., Rolls, K., & Ollerton, R. (2011). Effects of three approaches to standardized oral hygiene to reduce bacterial colonization and ventilator associated pneumonia in mechanically ventilated patients: A randomized control trial. *International Journal of Nursing* | The purpose of this study is to test two methods of oral hygiene on their effectiveness against preventing the colonization of dental plaque with respiratory pathogens and the occurrence of ventilator associated pneumonia as a secondary outcome. | Design: Randomized control trial
Population: Patients with an expected duration of mechanical ventilation for more than 48 hours.
Sampling Method: Single blind randomized comparative study of patients selected by cluster sampling.
Sample Size: 109
Methods and Interventions: Patients were randomized to one of the three study regimens (Group A second hourly, oral rinse with sterile water, Group B sodium biocarbonate mouth wash second hourly, and Group C twice daily irrigations with chlorhexidine 0.2% aqueous oral rinse and second hourly) | Data showed that there was not a significant relationship between the different treatments as to the better agent for reducing growth, just that the use of an antimicrobial agent helped in the reduction of plaque. The data gathered from this study supports that effective oral care is \components. Significance: Due to the fact that individual interventions aren’t analyzed, it shows a “bundle” of oral hygiene interventions are beneficial. This study also focused on the importance of health care providers being educated on the oral care protocol and its significance in preventing VAP. |

| verify understanding of rational and procedure. Instrumentation: Data collection tools Outcomes Measured: There was a decrease in the average VAP rate after implementation of the oral care protocol. | Data showed that there was not a significant relationship between the different treatments as to the better agent for reducing growth, just that the use of an antimicrobial agent helped in the reduction of plaque. The data gathered from this study supports that effective oral care is components. Significance: Due to the fact that individual interventions aren’t analyzed, it shows a “bundle” of oral hygiene interventions are beneficial. This study also focused on the importance of health care providers being educated on the oral care protocol and its significance in preventing VAP. | It is stated that the study was prematurely terminated due to market withdrawal of one of the study’s products, leaving sufficient data for only 109 of the participants, leaving a small sample to give sufficient information. The study was also done in only a single ICU unit, not giving much variation in the sample. |
**HOSPITAL-AQUIRED PNEUMONIA ORAL CARE**


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**irrigations sterile water, which were three different methods of oral hygiene thought to optimize oral hygiene to help prevent VAP. A comprehensive cleaning of the mouth using a soft, pediatric toothbrush three times a day followed each of the regimens.**

Outcomes: The study did not give sufficient power to discriminate between differences in VAP occurrence among the three methods of rinses used. The study did conclude, however, that the use of mechanical toothbrush resulted in improved oral hygiene of patients, and staff compliance with protocol improved the patient’s outcome.


<table>
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<tr>
<th>The aim of this pilot randomized control trial was to test the effect of a low-cost device (saliva-ejector) for continuous oral suctioning on the incidence of VAP in patients receiving mechanical ventilation.</th>
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<tr>
<td>Design: Parallel-group Randomized Control Trial</td>
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<tr>
<td>Population: The patients were chosen based on an inclusion or exclusion criteria; patients that met the inclusion criteria of age 18 or older, hospitalized in the medical-surgical ICU being studied, and receiving mechanical ventilation for 48 hours or more and gave informed consent were included in the study. The exclusion criteria included being HIV positive or being contraindicated to receiving oral suctioning, receiving immunosuppressive therapy, having blood leukocyte level less</td>
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<tr>
<td>This study contributes to the body of evidence that oral suctioning for the removal of infection causing bacteria can decrease VAP.</td>
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<td>The results of the study were limited by the small sample sizes and perhaps too restricted criteria for participation. The study was also only conducted in one hospital in one ICU. Only having 25 participants is a small number, however, the study is only a pilot study, and the article states the need for a larger study to</td>
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**Strengths:**
- Validity
- Attrition
- Homogenity
- Construct validity
- Cofounding
- Interrater reliability
- Funding/Conflicts
- Cost
- Theory / Framework
- Informed consent / IRB
- Statistic analysis reviewed

**Weaknesses:**
- Power
- Blinding
- Data Collection
- Randomization not identified

LOE: II

than 1000 cells/mm^3, or having being diagnosed with solid or hematological tumors.

Sampling Method: Stratified random sampling

Sampling Size: 197 were assessed for eligibility, 163 of those did not meet the criteria and 7 declined participation. The remaining 27 was reduced by 2 because of lost follow-up, and then the remainder was divided into experimental and control groups, containing 13 and 12, respectively.

Methods and Interventions: The design of this study was a parallel-group randomized control trial. The experimental and control groups both used a conventional endotracheal tube for suctioning, and the experimental group used a saliva ejector. The saliva ejector is a device used in dental suctioning, and in this trial it was used as a device for long-term secretion removal, changed every 24 hours. VAP occurrence, VAP-free time, duration of mechanical ventilation, tracheostomy, the length of ICU stay, and mortality in the ICU were assessed daily in congruence with the treatment methods.

Outcomes: The study was completed without adverse complications to the patients and was received well by the participating staff and patients.

obtain better results.
Of the experimental group, only 3 patients developed pneumonia compared to 10 in the control group. The results of the saliva ejector and continuous oral suctioning as interventions for the prevention of VAP is still considered investigational after this study since the study size was reduced to an almost insignificant level. As a pilot study, it did reveal that with further testing these interventions could be beneficial.


### Design:
A systematic review that aimed to elucidate and systematically summarize the effect estimates and the methodological quality of available randomized control trials.

### Population:
Elderly people in hospitals and nursing homes.

### Sampling Method:
The information came from high quality randomized control trials linked to oral hygiene, health care associated pneumonia or respiratory tract infection in elderly people. Studies were included from Dutch, English, German, and any Nordic languages. Authority opinions and reports of expert committees were excluded, as were studies on subjects with mechanical ventilation or tube feeding.

### Sampling Size:
191 publications were considered eligible, then scrutinized by the inclusion and exclusion criteria, then 15 publications remained used.

### Methods and Interventions:
The objective of this study was to investigate the preventive effect of oral hygiene on pneumonia and respiratory tract infection, focusing on elderly people in hospitals and nursing homes, by systemically reviewing effect estimates and methodological quality of randomized control trials.

This study supported evidence that tooth brushing and the usage of oral rinses greatly assists the prevention of VAP. It also concludes that having an oral regime is imperative in the preventing the spread of dangerous microorganisms.

Data used for this study may have been over scrutinized because it only included RCTs. While many other types existed the usage of only 15 increases the possibility of falsely excluding relevant sources.
| Journal Of Nursing Studies&volume=49&issue=1&date=2012101&atitle=Effect of continuous oral suctioning on the development of ventilator-associated pneumonia: a pilot randomized controlled trial.&spage=1333&pages=1333-41&sid=EBSCO:MEDLINE&aulast=Chow| publications used for this study were arranged in a hierarchy of strength of evidence; systematic reviews of RCTs were considered to be type 1, RCTs were type 2, and studies with a nonrandomized design were type 3. Studies that registered below type 3 evidence were not included in the study. Country of origin, intervention studied, journal of publication, main conclusions, publication year, strength of evidence, and study design were also assessed in the sources of this study. Outcomes: The result of the study concludes that the RCTs provide strong evidence that mechanical oral hygiene decreases mortality risk from pneumonia and seems to have a clinically relevant preventive effect on nonfatal pneumonia in dependent elderly individuals. |
| LOE: I |