



SPECIAL ISSUE ON BASIC NURSING CARE

Basic Nursing Care to Prevent Nonventilator Hospital-Acquired Pneumonia

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Abstract

Purpose: Nonventilator hospital-acquired pneumonia (NV-HAP) is an under-reported and unstudied disease, with potential for measurable outcomes, fiscal savings, and improvement in quality of life. The purpose of our study was to (a) identify the incidence of NV-HAP in a convenience sample of U.S. hospitals and (b) determine the effectiveness of reliably delivered basic oral nursing care in reducing NV-HAP.

Design: A descriptive, quasi-experimental study using retrospective comparative outcomes to determine (a) the incidence of NV-HAP and (b) the effectiveness of enhanced basic oral nursing care versus usual care to prevent NV-HAP after introduction of a basic oral nursing care initiative.

Methods: We used the International Statistical Classification of Diseases and Related Problems (ICD-9) codes for pneumonia not present on admission and verified NV-HAP diagnosis using the U.S. Centers for Disease Control and Prevention diagnostic criteria. We completed an evidence-based gap analysis and designed a site-specific oral care initiative designed to reduce NV-HAP. The intervention process was guided by the Influencer Model™ (see **Figure 2**) and participatory action research.

Findings: We found a substantial amount of unreported NV-HAP. After we initiated our oral care protocols, the rate of NV-HAP per 100 patient days decreased from 0.49 to 0.3 (38.8%). The overall number of cases of NV-HAP was reduced by 37% during the 12-month intervention period. The avoidance of NV-HAP cases resulted in an estimated 8 lives saved, \$1.72 million cost avoided, and 500 extra hospital days averted. The extra cost for therapeutic oral care equipment was \$117,600 during the 12-month intervention period. Cost savings resulting from avoided NV-HAP was \$1.72 million. Return on investment for the organization was \$1.6 million in avoided costs.

Conclusions: NV-HAP should be elevated to the same level of concern, attention, and effort as prevention of ventilator-associated pneumonia in hospitals.

Clinical Relevance: Nursing needs to lead the way in the design and implementation of policies that allow for adequate time, proper oral care supplies, ease of access to supplies, clear procedures, and outcome monitoring ensuring that patients are protected from NV-HAP.

Nonventilator hospital-acquired pneumonia (NV-HAP) is an underreported and understudied disease, with potential for measurable outcomes, fiscal savings, and improvement in quality of life (American Thoracic Society [ATS], 2005; Edis et al., 2009; Rotstein et al., 2008; Sopena & Sabria, 2005). U.S. hospitals are required to monitor ventilator-associated pneumonia; however, there are currently no requirements to monitor NV-HAP. The limited studies available indicate that NV-HAP is an emerging factor in prolonged hospital stays and significant patient morbidity and mortality (Centers for Disease Control and Prevention [CDC], 2013; Esperatti et al., 2010; Fortaleza, Abati, Batista, & Dias, 2009). HAP (a) adds an estimated additional \$40,000 to \$65,000 to the cost of care for each affected patient; (b) adds 7–9 days to the length of hospital stay; (c) significantly increases discharge to skilled nursing facilities instead of returning home; (d) has an attributable mortality rate as high as 50%; and (e) is associated with half of patients not being discharged back to their homes (ATS, 2005; Kalsekar, Amsden, Kothari, Shorr, & Zilberber, 2010; Kollef, 2007). Analysis indicates that preventing even 100 cases of NV-HAP may save up to \$4 million, 700–900 hospital days, and the lives of 20–30 patients (ATS, 2005). While HAP has received significant attention from healthcare quality review boards, their focus has been on intensive care unit (ICU)-level of care and ventilated patients who acquire pneumonia.

Preliminary Study to Determine the Incidence of NV-HAP

The aim of our preliminary study was to determine the incidence of unreported HAP among patients who are not ventilated in four hospitals and three healthcare systems. The CDC definition was used to identify hospital-acquired infections (HAIs). HAIs, such as NV-HAP, are those infections that are not present on admission and have symptoms of infection occurring ≥ 48 hr after admission to the hospital (CDC, 2013). Using convenience sampling, we selected three different types of acute care hospital systems to determine the presence of NV-HAP. The hospitals included a large, national health maintenance organization hospital (217 beds), a metropolitan area medical center with two hospital sites (650 beds), and a Department of Veterans Affairs Medical Center (202 beds) to sample the incidence of NV-HAP. To determine the incidence of HAP, not associated with ventilated care, we conducted retrospective chart reviews.

For the initial screening, researchers examined hospital records of all patients coded with a diagnosis of NV-HAP, not present on admission. Because the Department of Veterans Affairs Medical Centers has electronic med-

ical records, 10 years of chart audit review from 2002 to 2012 were included. For the other two hospitals, data were reviewed for the years 2010–2012. We used the International Statistical Classification of Diseases and Related Problems (ICD-9) codes for pneumonia not present on admission, and verified the diagnosis with a confirmatory x-ray demonstrating pulmonary infiltrate. Each hospital setting had a significant incidence of previously unreported NV-HAP (rates of 1.22–8.9 per 1,000 hospital days).

In our review of the literature, only one study was located that examined the incidence of NV-HAP in all hospital units of a U.S. hospital system. Davis and Finley (2012) reported a significant number of NV-HAP within the Pennsylvania care system. They reported that NV-HAP occurred on every type of hospital unit, had a higher incidence rate, more deaths, and higher costs than ventilator-associated pneumonia (Davis & Finley, 2012). While the use of ICD-9 coding and x-ray is not sufficient for an accurate diagnosis of pneumonia, the incidence found in our preliminary study and in the Pennsylvania report indicates that NV-HAP is a significant, yet unaddressed, issue in healthcare.

What Are the Risk Factors for NV-HAP?

Several factors may contribute to increased risks for HAP, including older patients with a low body mass index and signs of malnourishment; altered mental status; low albumin; dependent for activities of daily living; receiving central nervous system depressants or acid blocking medications; and presence of chronic or inadequately managed pain (Herzig, Howell, Ngo, & Marcantonio, 2009; Kieninger & Lipsett, 2009; Kollef, 2007; Sopena & Sabria, 2005; Tarsia, Aliberti, Cosentini, & Balsi, 2005).

In this analysis, researchers found predictors of NV-HAP similar to the risk factors listed earlier in this article. However, in two of the centers NV-HAP was found in patients with few to no risk factors that included patients on maternity wards and healthy young adults. Even with the narrowest analysis to capture at-risk patients, the identified risk factors included over 80% of hospital admissions. We concluded that targeting a subset of the patient population for bundled care would miss other patients also at risk for NV-HAP. NV-HAP risk factors are so varied that taking an at-risk approach to intervention would place a significant number of patients at continued risk. Risk analysis does not provide enough sensitivity and specificity to allow for a bundled care, patient risk-specific approach to intervention.

Nursing care bundles have demonstrated effectiveness in prevention of ventilator-associated pneumonia

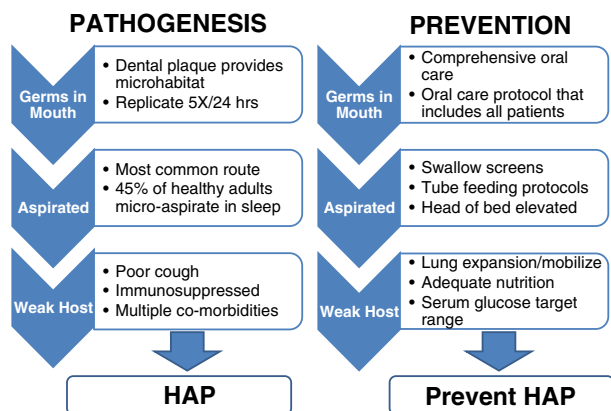


Figure 1. Pathogenesis and Prevention of Hospital-acquired Pneumonia (HAP).

(Fong et al., 2007; Fuchshuber et al., 2012; Wren, Martin, Yoon, & Bech, 2010). However bundled care is designed to be a small set of care interventions for a defined group of patients in a limited care setting such as intensive care units (Resar, Griffin, Haraden, & Nolan, 2012). If the intervention needs to be applied to a diverse group of patients in different locations, the interventions no longer meet the definition of bundled care. Because we found NV-HAP across all hospitals units and could not reasonably narrow risk factors, the researchers elected to focus on an oral care universal intervention, rather than bundled care, to combat the incidence of NV-HAP.

Basic Oral Health Nursing Care and Prevention of Pneumonia

Hospitalization is associated with deterioration in oral health. Deterioration in oral health status leads to an increased risk for HAI and increased length of hospital stay and costs, and can impact a patient's well-being and quality of life (Terezakis, Needleman, Kumar, Moles, & Agudo, 2011). Because there are physiological and mechanical pathways between the oral cavity and lung tissue, disruption of oral health places patients at risk for pneumonia. Bacteria found in dental plaques have been found to be the causative agent in HAP in several studies, with a reduction in pneumonia incidence following institution of an oral care regimen for patients (CDC, 2013; Raghavendran, Mylotte, & Scannapeico, 2007). Aspiration is also a causative factor in pneumonia, with 45% of healthy individuals reported to aspirate during sleep (Kollef, 2007; Sarin, Balasubramaniam, Corcoran, Laudenbach, & Stoopler, 2008; Tablan, Anderson, Besser, Bridges, & Hajjeh, 2003). The risk for pneumonia from aspiration is compounded by periodontal disease, dental

caries, poor oral hygiene, altered mental status, and feeding and swallowing issues (Terpenning, 2005). Improved oral care also reduces the risk for aspiration pneumonia in addition to other types of pneumonia (**Figure 1**; Sarin et al., 2008; Tada & Miura, 2012).

Feider, Mitchell, and Bridges (2010) found a statistically significant difference between several oral care policy recommendations and reported oral care practices among intensive care nurses. These studies indicate that to have an effective pneumonia prevention program, nurses require additional education on the importance of oral care for all patients, as well as how to safely and effectively provide oral care.

Prevention of Pneumonia: Focus on Basic Nursing Care

Based on findings from the pilot study that NV-HAP occurs across many geographic regions in the United States and across various types of medical care systems, we launched a pilot study in one of the hospital systems to determine if improvements of basic nursing care could impact NV-HAP rates. This pilot intervention study occurred in an urban community, not-for-profit, two-hospital campus, 650-bed medical center system.

The first step in the design of our pilot study was to ensure we had an accurate diagnosis of HAP based on CDC diagnostic criteria (e.g., in addition to confirmatory x-ray, presence of leukocytosis and fever; CDC, 2013). We found 115 adults with NV-HAP (as compared to 198 cases using preliminary screening of ICD-9 codes and x-ray alone). During the same year (2010), the two hospitals had only one case of ventilator-associated pneumonia.

Ventilator-associated HAP has received significant health policy and insurance company attention. As a result, the incidence of ventilator-associated pneumonia was significantly reduced using "bundles" of care intervention. These bundles, used in the medical center ICUs, include the following nursing interventions: (a) elevate the head of the bed, (b) mobilize patients, and (c) implement comprehensive oral care. When a patient is on the ventilator, these interventions are expected in ICU-level nursing care delivery systems and reliably carried out. However, a detailed chart analysis revealed that these same nursing care interventions were missing for many NV-HAP patients. Of the 115 NV-HAP cases reviewed, there was a lack of documentation of basic nursing care. In the 24 hr prior to the onset of NV-HAP, 84% did not receive coaching to cough and deep breathe each shift, 73% did not receive oral care each shift, 59% were not mobilized each shift, 34% did not have the head of the

	Motivation (Why?)	Ability (How?)
Personal	<ul style="list-style-type: none"> ■ Make it matter to them Education including case studies from their hospital units/ personal stories of patients who acquired NV-HAP ■ Make it personal Data from their specific units demonstrating the NV-HAP cases and the missed/undocumented care data 	<ul style="list-style-type: none"> ■ Make sure each person knows what to do and how to do it Complete a gap analysis Hospital wide education that included doctors, nurses and support personnel such as patient care technician and nurse's aides. ■ Standardize and simplify Standardized new protocols with clear, step by step procedures, including more challenging oral care such as denture care and patients with inadequate swallowing or mental confusion
Social	<ul style="list-style-type: none"> ■ Enlist formal and informal leaders Cast a wide net for the interprofessional team, engage and empower them to make change- ensure that power brokers and key decision makers for fiscal decisions are included and well informed ■ Strengthen your relationships to staff Include front line staff, provide follow – up and data; reward good work 	<ul style="list-style-type: none"> ■ Give staff authority / ownership Create oral care protocol and clinical pathways for oral care Nurses teaching nurses, nurse's aides helping and supporting nurse's aides Staff participates in how each unit would help to improve oral care rates Staff participates in audits
Structural	<ul style="list-style-type: none"> ■ Measure and provide regular feedback Celebrate success Units provided with dashboard displays of oral care documented and NV-HAP data Information includes personal case stories from the unit 	<ul style="list-style-type: none"> ■ Make it easy to do the right thing at the right time New oral care supplies, bundled into care unit- Supplies ordered on time and easily available Make documentation easy and convenient Oral care supplies with food trays Patient education on food tray, hand outs, and in hospital elevators

Figure 2. Influencer Model™ applied to Oral Care and NV-HAP (VitalSmarts, Provo, Utah, USA. www.vitalismarts.com).

bed elevated each shift, and 28% were not documented to have good pain control. Because these patients were not on a ventilator, and not identified as high risk for pneumonia, they did not reliably receive preventive care interventions.

Kalisch, Landstrom, and Williams (2009) found an alarming amount of missed or undocumented care (as high as 70%) across hospital systems in their study of various types of missed care. They went on to define missed nursing care as a basic nursing error of omission. Based on the missed or undocumented nursing

care found in this analysis, a pilot study was launched to (a) determine the effectiveness of reliably delivered oral care in reducing NV-HAP and (b) inform a system-wide roll-out of effective oral care interventions to reduce NV-HAP.

Methods

The research design was a descriptive, quasi-experimental study using retrospective comparative outcomes from 1 year pre-intervention (May 2012) to 1 year

post-intervention (April 2013). The aim was to determine the effectiveness of enhanced basic nursing care versus usual care to prevent NV-HAP. We followed the Consolidated Standards of Reporting Trials (CONSORT) research methods and reporting for pragmatic trials and the Promoting Action on Research Implementation in Health Services (PARIHS) framework guidelines (Hutchinson, Wilkinson, Kent, & Harrison, 2011; Zwarenstein et al., 2009). The intervention process was guided by the Influencer Model™ (see **Figure 2**) and participatory action research (**Figure 2**; Minkler & Wallerstein, 2003; Patterson, Grenny, Maxfield, McMillan, & Switzler, 2007). The preliminary data study was approved by the institutional review board at each of the three hospitals, and the pilot study was also approved by the institutional review board at the pilot intervention site.

Interprofessional Collaboration

Interprofessional teams in Australia have been effective in improving oral care in aged care facilities led by nurses (Blinkforn, Weingarten, Boivin, Plain, & Kay, 2011). Based on their findings, an interprofessional team was formed for this study that included at-the-bedside, frontline registered nurses, registered dietitians, infection control, respiratory therapists, nursing administration, physicians, rehabilitative services, manager of material supplies, and an academic-community partnership with a school of nursing. The team was led by a clinical nurse specialist. The interprofessional team, the Hospital Acquired Pneumonia Prevention Initiative, met twice a month to design the pilot protocols and monitor outcomes. The team consulted with dentists from our local dental society to ensure we were using the American Dental Association standards for best practices in oral care. A gap analysis was completed by comparing best practices from a review of the literature to current nursing practices. Nurses and nursing assistants were also surveyed regarding their current care practices to establish a baseline of usual care practices and to determine barriers to change for interventions likely to prevent NV-HAP. After completion of the gap analysis, we implemented an enhanced oral care nursing protocol designed to reduce NV-HAP.

The CDC recommends a focus on modifiable risk factors for HAP as the best way to prevent this HAI (CDC, 2013). The team narrowed their focus by studying the most common risk factors and choosing a high-impact, basic nursing care intervention: oral care. For example, a weak host has risk factors such as advanced age and multiple comorbidities that are not modifiable. Chest physiotherapy including incentive spirometry has limited evidence-based support for significantly reducing

HAP (Overend et al., 2001; Pasquina, Tramer, Granier, & Walder, 2006). Preventing aspiration of oral secretions may also help to prevent pneumonia. Nurses reduce aspiration through interventions such as elevating the head of the bed above 30 degrees and following evidence-based enteral feeding protocols. However, although head of bed elevation slows micro-aspiration in critical patients, it does not prevent it altogether. Even 45% of healthy adults micro-aspirate during sleep (Lee et al., 2010). Therefore, the team concluded that the most modifiable, first change in nursing care would be to decrease the bacterial load in the mouth with comprehensive oral care.

Staff Education

Based on the Influencer Model™, it was predicted that behavior would not change unless nursing staff understood the importance of oral care in the prevention of NV-HAP. Therefore, mandatory education with all nursing assistants, who perform the majority of oral care in the hospital, was provided. Classes were designed with a hands-on focus and included lunch and expert speakers, including dentists, to highlight their important team role in preventing NV-HAP. Registered nurses were also educated through scheduled staff meetings, eLearning, and unit in-services. At-the-bedside, frontline staff partnered in the design of the curriculum and provided recommendations for successful implementation on the units.

Make the Interventions Easy to Do

The gap analysis revealed a need for new and improved oral care equipment. For example, nursing assistants stated that they were not utilizing commonly found hospital toothbrushes because the bristles fell out into the mouths of their patients. They were hesitant to attempt oral care on patients with a decreased level of consciousness because they were concerned the patient would aspirate. New therapeutic equipment was purchased, including higher quality soft-bristled, curved toothbrushes, toothpaste that contained sodium bicarbonate to remove plaque, alcohol-free antiseptic mouth rinse, nonpetroleum lip moisturizer, and suction toothbrush sets for patients at risk for aspiration.

Involve Frontline Staff, Patients, and Families

A nurse-led intervention study in Singapore found that new oral protocols could improve patients' oral health in high-dependency units when frontline nurses were engaged in the process of change (Chan, Lee, Poh, Ling, & Prabhakaran, 2011). We also engaged at-the-bedside,

frontline staff as co-creators of training and in the development of a new oral care protocol that was user friendly. The oral care protocol was expanded to include all patients, not just those on a ventilator in the ICU. The new protocol included a chart at-a-glance format with pictures of products, specific procedures, and frequency of oral care for each type of patient. The new protocol included provision of oral care for all adult nonventilator patients four times per day; for patients able to eat, after each meal and before bedtime; and for patients not eating or on tube feedings, oral every 6 hr. New patient and family education materials were developed. Posters with oral care health information were displayed in the hospital elevators. Documentation forms were revised to include easy-to-locate daily oral assessment and oral care.

Process Monitoring

To monitor the key process indicator, an increase in protocol-standard oral care, we designed an audit tool that included direct observations and chart review. Observational and chart audits took place across the hospital on 11 separate units for a total 110 patient audits each month. In addition, each month, the electronic record was queried for all adult cases of pneumonia, not present on admission. Identified cases of NV-HAP were then reviewed to ensure they met the CDC definition of NV-HAP.

Results and Limitations

Education on the importance of oral care and the prevention of NV-HAP was required for all nurses and nursing assistants. All of the nursing staff was expected to implement the new protocols on each adult unit. Training was provided for approximately 100 nursing assistants and over 1,000 registered nurses from every unit and every shift throughout the two hospitals, representing over 90% of the nursing staff. New oral care equipment was stocked on the units, and the new protocols were started first on the non-ICU units because they had the greatest incidence of NV-HAP in our baseline data ($n = 80$). The ICU was targeted for intervention when a more detailed analysis indicated that although the total number of NV-HAP cases in the ICU was lower ($n = 35$), the rate was highest for the nonventilated patients in the ICU (1 per 1,000 patient days on medical-surgical units vs. 2.4 per 1,000 nonventilated patient days in the ICU). During the last 3 months of the intervention period, oral care frequency increased to a mean of 3.5/24 hr in the ICU, and NV-HAP was reduced by almost 50% (mean of 3.9/month to 2/month). For the first time since measuring NV-HAP, there was one month with zero cases. Over-

all, oral care frequency at least once each shift increased from 27% to 80%. Oral care for nonventilated patients in the ICU has increased by > 500% (0.54 vs. 3.4/24-hr period).

The rate of NV-HAP per 1,000 patient days decreased from 1.25 to 0.81 (35.2%). The rate of NV-HAP per 100 patient days decreased from 0.49 to 0.3 (38.8%). The overall number of cases of NV-HAP was reduced by 37% during the 12-month intervention period (115 vs. 72). The avoidance of 43 NV-HAP cases resulted in an estimated eight lives saved, \$1.72 million cost avoided (based on \$40K each case), and 500 extra hospital days averted (ATS, 2005). In addition, there was a substantial return on investment. The extra cost for therapeutic oral care equipment was \$117,600 during the 12-month intervention period. Cost savings resulting from avoided NV-HAP was \$1.72 million. Thus, return on investment for the organization was \$1.6 million in avoided costs.

Hospitals are dynamic, rapidly changing environments; therefore, establishing a link between the introduction of an oral care protocol and new equipment and NV-HAP is difficult. Pragmatic trials are useful when randomized, controlled trials would not be ethical or practical. In the pilot study, researchers used the CONSORT pragmatic guidelines in a 1-year pre- and post-intervention design; however, this was a short time for a hospital system. It has not been determined if unknown, coinciding factors influenced the incidence of NV-HAP. Hospital admission rates and types were closely monitored, and no differences between the pre-intervention and post-intervention time periods in hospital admission patterns or types of diagnosis were observed. It is also possible that physicians experienced a Hawthorne effect, knowing that HAP was being monitored more carefully in the hospital. However, we determined clear process indicators that nursing care had changed and the evidence-based oral care equipment was in place. The decrease in NV-HAP pre- and post-intervention can be correlated with monitoring, month to month, the implementation of the new protocols.

Discussion

Evidence-based practices for basic nurse care can be regarded as part of the continuous quality improvement programs required for hospitals. By using a strong theoretical framework—the Influencer ModelTM—and participatory action, this study design provided a strong foundation to address the complexity of changing basic nurse practices across a two-campus, 600+ bed medical care system. Nurses are highly motivated to provide the right care when they are supported and included in care decisions. Kalisch et al. (2009) found that lack of knowledge,

resources, time, communication issues, and unclear protocols contributed to missed basic nursing care. This study addressed these barriers. The importance of an interprofessional team that included all managers and departments in the hospitals cannot be understated. For example, material management was critical in how the new supplies were ordered, distributed, and maintained on the floors. Audits and process monitoring, including dashboard posting of results and celebrating successes, are also essential to sustain improvements in basic nursing care. The team improved rates of basic nursing care and reduced NV-HAP; however, NV-HAP continues to occur in the hospital. The next steps will include dissemination of the oral protocol initiative to other hospitals. We will also continue analysis to ease pathways that support basic nursing care and implement an early mobility protocol.

Conclusions

This is the first study focusing on universal basic oral nursing care for prevention of NV-HAP across an entire acute care hospital system. Nurses need clear protocols, correct equipment, resources for patient education, a team approach, and administrative support to fully implement basic nursing care required to prevent HAP. NV-HAP needs to be elevated to the same level of concern, attention, and effort as prevention of ventilator-associated pneumonia in hospitals. Healthcare organizations should be aware of NV-HAP as another important source of HAI that can be reduced.

Relevance to Practice

There is a lack of research information on the how nursing care provided or missed at the bedside impacts fiscal and time resources for care. This oversight directly impacts patient well-being and quality of life. The U.S. Center for Medicare and Medicaid Services has identified some types of basic nursing related to pressure ulcers, ventilator-associated pneumonia, catheter-associated urinary tract infections, central line-associated bloodstream infection, and others for non-reimbursement in hospitals where these negative patient outcomes occur (CDC, 2013). We anticipate that closer monitoring and reimbursement changes may also occur for NV-HAP in the future. Nursing needs to lead the way in the design and implementation of policies that allow for adequate time, proper oral care supplies, ease of access to supplies, clear procedures, and outcome monitoring to ensure that patients are also protected from NV-HAP. The interprofessional team that addressed NV-HAP created a vision statement that summarized what was learned in this study,

“We are preventing pneumonia and saving lives, one clean mouth at a time.”

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Clinical Resources

- National Institute on Aging: Taking Care of Your Teeth and Mouth: <http://www.nia.nih.gov/health/publication/taking-care-your-teeth-and-mouth>
- American Dental Association: Mouth Healthy: <http://www.mouthhealthy.org>
- University of Kentucky: Nursing Home Oral Health: <http://www.uky.edu/NursingHomeOralHealth/>

References

- American Thoracic Society. (2005). Guidelines for the management of adults with hospital acquired, ventilator associated, and healthcare associated pneumonia. *American Journal of Respiratory Therapy*, 171, 388–416.
- Blinkforn, F. A., Weingarten, L., Boivin, L., Plain, J., & Kay, M. (2011). An intervention to improve the oral health of residents in an aged care facility led by nurses. *Health Education Journal*, 71(4), 527–535.
- Centers for Disease Control and Prevention. (2013). *National health safety network. Hospital-associated infections definitions: Surveillance definition of healthcare-associated infection and criteria for specific types of infections in the acute care setting*. Retrieved from <http://www.cdc.gov/nhsn/pdfs/pscmanual/17pscnosindef.current.pdf>.
- Chan, E. Y., Lee, Y. K., Poh, T. H., Ling, I. H., & Prabhakaran, L. (2011). Translating evidence into nursing practice: Oral hygiene for care dependent adults. *International Journal of Evidence-Based Healthcare*, 9, 172–183.

- Davis, J., & Finley, E. (2012). The breadth of hospital-acquired pneumonia: Non-ventilated versus ventilated patients in Pennsylvania. *Pennsylvania Patient Safety Advisory*, 9(3), 99–105.
- Edis, C., Hatipoglu, O. N., Yilman, I., Eker, A., Tansel, O., & Sut, N. (2009). Hospital-acquired pneumonia developed in non-intensive care units. *Respiration*, 78(4), 416–422.
- Esperatti, M., Ferrer, M., Theessen, A., Liapikou, A., Valencia, M., Saucedo, L. M., Torres, A. (2010). Nosocomial pneumonia in the intensive care acquired by mechanically ventilated versus nonventilated patients. *American Journal of Respiratory Critical Care Medicine*, 182, 1533–1539.
- Feider, L. L., Mitchell, P., & Bridges, E. (2010). Oral care practices for orally intubated critically ill adults. *American Journal of Critical Care*, 19(2), 175–183.
- Fields, L. B. (2008). Oral care intervention to reduce incidence of ventilator associated pneumonia in the neurologic intensive care unit. *Journal of Neuroscience Nursing*, 40(5), 291–298.
- Fong, J. J., Cecere, K., Unterborn, J., Garpestad, E., Klee, M., & Devlin, J. W. (2007). Factors influencing variability in compliance rates and clinical outcomes among three different severe sepsis bundles. *Annals of Pharmacotherapy*, 41, 929–936.
- Fortaleza, C. M., Abati, P. A., Batista, M. R., & Dias, A. (2009). Risk factors for hospital-acquired pneumonia in nonventilated adults. *Brazilian Journal of Infectious Diseases*, 13(4), 284–288.
- Fuchshuber, P. R., Greif, W., Tidwell, C., Klemm, M. S., Frydel, C., Wali, A., . . . Clopp, M. P. (2012). The power of the national surgical quality improvement program, achieving a zero pneumonia rate in general surgery patients. *Permanente Journal*, 16(1), 39–45.
- Herzig, S. J., Howell, M. D., Ngo, L. H., & Marcantonio, E. R. (2009). Acid-suppressive medication use and the risk for hospital-acquired pneumonia. *Journal of the American Medical Association*, 301(20), 2120–2128.
- Hutchinson, A. M., Wilkinson, J. E., Kent, B. K., & Harrison, M. B. (2011). Using the promoting action on research implementation in health services framework to guide research use in the practice setting. *Worldviews on Evidence-Based Nursing*, 1, 59–61.
- Kalisch, B. J., Landstrom, G., & Williams, R. A. (2009). Missed nursing care: Errors of omission. *Nursing Outlook*, 57, 3–9.
- Kalsekar, I., Amsden, J., Kothari, S., Shorr, A. F., & Zilberber, M. D. (2010). Economic and utilization burden of hospital-acquired pneumonia (HAP): A systematic review and meta-analysis. *Chest*, 138(4, meeting abstracts), 739A.
- Kieninger, A., & Lipsett, P. (2009). Hospital-acquired pneumonia: Pathophysiology, diagnosis, and treatment. *Surgical Clinics of North America*, 89(2), 439–461.
- Kollef, M. H. (2007, September). Prevention of postoperative pneumonia. *Hospital Physician, Surgical Patient Care Series*, 47–60.
- Lee, J. S., Collar, H. R., Raghu, G., Sweet, M. P., Hays, S. R., Campos, G. M., & King, T. (2010). Does chronic microaspiration cause idiopathic pulmonary fibrosis? *American Journal of Medicine*, 123(4), 304–311.
- Minkler, M., & Wallerstein, N. (Eds.). (2003). *Community-based participatory research for health*. San Francisco, CA: Jossey-Bass.
- Overend, T. J., Anderson, C. M., Lucy, S. D., Bhatia, C., Jonsson, B. I., & Timmermans, C. (2001). The effect of incentive spirometry on postoperative pulmonary complication: A systematic review. *Chest*, 120, 971–978.
- Pasquina, P., Tramer, M. R., Granier, J., & Walder, B. (2006). Respiratory physiotherapy to prevent pulmonary complications after abdominal surgery. *Chest*, 130, 1887–1899.
- Patterson, K., Grenny, J., Maxfield, D., McMillan, R., & Switzler, A. (2007). *Influencer: The power to change anything*. New York, NY: McGraw-Hill.
- Raghavendran, K., Mylotte, J. M., & Scannapeico, F. A. (2007). Nursing home-associated pneumonia, hospital-acquired pneumonia and ventilator-associated pneumonia: The contribution of dental biofilms and periodontal inflammation. *Periodontology*, 44, 164–177.
- Resar, R., Griffin, F. A., Haraden, C., & Nolan, T. W. (2012). Innovation series 2012: Using care bundles to improve health care quality. *Institute for Healthcare Improvement*. Retrieved from <http://www.ihc.org/knowledge/Pages/IHIWhitePapers/UsingCareBundles.aspx>
- Rotstein, C., Evans, G., Born, A., Grossman, R., Light, R. B., Magder, S., & Zhanel, G. G. (2008). Clinical practice guidelines for hospital acquired pneumonia and ventilator associated pneumonia in adults. *Canadian Journal of Infectious Diseases and Medical Microbiology*, 19(1), 19–53.
- Sarin, J., Balasubramaniam, R., Corcoran, A. M., Laudenbach, J. M., & Stoopler, E. T. (2008). Reducing the risk of aspiration pneumonia among elderly patients in long term care facilities through oral health interventions. *Journal of the American Medical Directors Association*, 9(2), 128–135.
- Sopena, N., & Sabria, M. (2005). Multicenter study of hospital-acquired pneumonia in non-ICU patients. *Chest Journal*, 127(1), 213–219.
- Tablan, O. C., Anderson, L. J., Besser, R., Bridges, C., & Hajjeh, R. (2003). Guidelines for preventing healthcare-associated pneumonia, 2003: Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. *Morbidity and Mortality Recommendation Report*, 53(RR-3), 1–36. Retrieved from <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm>
- Tada, A., & Miura, H. (2012). Prevention of aspiration pneumonia with oral care. *Archives of Gerontology and Geriatrics*, 55, 16–21.

- Tarsia, P., Aliberti, S., Cosentini, R., & Balsi, F. (2005). Hospital-acquired pneumonia. *Breathe*, *1*(4), 298–301.
- Terezakis, E., Needleman, I., Kumar, N., Moles, D., & Agudo, E. (2011). The impact of hospitalization on oral health: A systematic review. *Journal of Clinical Periodontology*, *28*(7), 628–636.
- Terpenning, M. (2005). Geriatric oral health and pneumonia risk. *Aging and Infectious Diseases*, *40*, 1807–1810.
- Wren, S. M., Martin, M., Yoon, J. K., & Bech, F. (2010). Postoperative pneumonia-prevention program for the inpatient surgical ward. *Journal of the American College of Surgeons*, *210*(4), 491–495.
- Zwarenstein, M., Treweek, S., Gagnier, J. J., Altman, D. G., Tunis, S., Haynes, B., . . . Practihc groups. (2009). Improving the reporting of pragmatic trials: an extension of the CONSORT statement. *British Medical Journal*, *337*(a2390), 1–8.