Hospital Acquired Pneumonia Prevention: Intervention, Evaluation & Research (HAPPIER)

Overview and Toolkit for Implementation

Dian Baker PhD, RN, APRN
Contact information: dibaker@csus.edu

Karen K. Giuliano PhD, RN, FAAN
Contact information: kkgiuliano@umass.edu

April 15, 2019

HAPPIER©
Hospital-acquired Pneumonia Prevention:
Intervention, Evaluation & Research

Table of Contents

We would like to acknowledge our colleagues and research partners. Each has been and continues to be fundamentally important in our effort to reduce non-ventilator hospital acquired pneumonia (NVHAP):

Barbara Quinn, MSN, CNS-BC, RN for her past and continuing contributions to NVHAP research and implementation of evidence-based oral care at the bedside.

Shannon Munro, PhD, APRN, BC, NP from the Department of Veterans Affairs Medical Center, Salem, VA for generously sharing her implementation model and the data collected from her implementation efforts.

Dr. Victoria Ewan, PhD, MRCP, BMBS, B MedSci (hons)
Medical Consultant in Geriatric Medicine, James Cook University Hospital
Middlesbrough, United Kingdom for her important work on improving our understanding of the potential links between abnormal oral flora, oral hygiene, and hospital acquired pneumonia.

1 Background and Significance

1.1 Non-ventilator hospital-acquired pneumonia (NV-HAP)

Over the past decade, hospital-based quality improvement initiatives have been focused primarily on the prevention of ventilator-associated pneumonia (VAP), resulting in significant decreases in reported cases of VAP.[1] With the reduction in VAP, NV-HAP now has a larger overall impact on patient morbidity, mortality, and cost of care than VAP.[2-4] In a point-prevalence study conducted by the Center for Disease Control and Prevention in 2014, HAP (NV-HAP 62% of total HAP) was tied with surgical site infections as the leading cause of hospital-acquired infections.[5] **Current data just published by the CDC in 2018 now support HAP is the #1 HAI, with NV-HAP representing at least 60% of the cases.** [6] Review of data in 2012 from Pennsylvania Safety Authority supported that NV-HAP occurs on all types hospital units and had a higher impact on both cost and mortality than VAP.[2] This study was replicated in 2018 with similar findings.[7] The CDC and Pennsylvania studies demonstrate that patient harm from NV-HAP has persisted over time and that little has been done to reduce the incidence.

Analysis of the 2012 National Inpatient Sample dataset indicates that NV-HAP incidence of 1.6%, a rate of 3.63 per 1,000 patient days, associated mortality of 13.1%, and an actual hospital cost of care of $39,897.[4] When matched with equally sick controls, NV-HAP had an associated mortality of 15.5% vs. 1.6% in the matched cases.[3] An international review of the literature found that most HAP occurs outside of the ICU, and requires monitoring and protocols that vary from standard VAP prevention.[8] An associated mortality rate of 30% among NV-HAP patients was found by See and colleagues, far exceeding the associated mortality from other iatrogenic harm.[9] A review of hospitals in Spain found a 28% NV-HAP mortality rate.[10]

In patients with spinal injury, Kopp found that 47% suffered consequences of NV-HAP and were more likely to die, even 10 years after hospitalization.[11] Finally, researchers studying NV-HAP in 21 US hospitals found rates of 0.12-2.28 per 1,000 patient days (1,300 NV-HAP patients). Most NV-HAP infections (70.8%) were acquired outside of the ICU and 18.8% required an unplanned transfer into the ICU. [12] NV-**HAP is a leading cause of healthcare acquired infection in the US, which the CDC already recognized as a top 10 public health concern.** Michael Klompas, a leading pneumonia researcher, refers to NV-HAP as the **"next frontier in patient safety".**[13]

1.2 Etiology of NV-HAP

Pneumonia occurs when bacteria move from proximal sites, such as the oral microbiota, into the lung and incite an inflammatory response.[14-16] Researchers have found a critical relationship between oral microflora and HAP.[8,10,16] While HAP can be associated with multiple types of organisms, it is primarily caused by bacteria and viral organisms.[3] For example, bacteria found in patients with HAP have been matched with specific flora found in the oral cavity.[14,17] During the first 48 hours of hospitalization, especially in the absence of regular oral care, changes occur in an individual's oral microbiota that are associated with more virulent pneumonia causing organisms.[18] Respiratory pathogens such as *S aureus, P aeruginosa, Klebsiella pneumoniae, and Enterobacter cloacae* colonize the dental plaque and micro-aspirations contribute to inoculation of virulent organisms into the lungs, even in healthy adults.[19,20,21] Recognition of this relationship between the oral microbiota and HAP has led to a growing body of evidence which targets primary source control of HAP through cleaning of the oral biofilm.

1.3 Primary Source Control of NV-HAP

There is an established association between good oral hygiene and the prevention of ventilator-associated pneumonia (VAP)[14]. However, topical application of antimicrobial products is not always effective against bacteria embedded in oral biofilm thus, the simple mechanical removal with a toothbrush is a key feature in most NV-HAP prevention studies. Yet, the importance of primary source control (i.e., removal of germs from the mouth with oral care) is not always recognized or prioritized by nursing staff for patients not on a ventilator.

A review of the literature found several published studies which looked at the use of oral care for NV-HAP prevention. Weitzel reported that the rate of non-ventilated NV-HAP per 100 patient days decreased from 0.49 to 0.3 (38.8%) after implementation of an oral care program. The overall number of cases of NV-HAP was reduced by 37% during a 12-month intervention period. An estimated eight lives were saved, $1.72 million in costs were avoided, and 500 extra hospital days were averted.[22]

Kaneoka et al. found that tooth brushing alone reduces the relative risk of pneumonia and reduced the risk of fatal pneumonia in a meta-analysis of four randomized controlled trials (RRfixed, 0.61; 95% CI (0.40–0.92), p=.02; RRfixed, 0.41; 95% CI (0.23–0.71); p=.002 respectively).[23]

In a systematic review Sjogren examined the preventive effect of oral hygiene on pneumonia and respiratory tract infection in hospitalized elderly and nursing home residents. The authors concluded that mechanical oral hygiene has strong evidence to support a decrease in mortality risk from pneumonia and also has a clinically relevant preventive effect on non-fatal pneumonia. Mechanical oral hygiene consists primarily of brushing one's teeth after every meal

and at bedtime. These researchers estimated that approximately one in 10 cases of death from pneumonia may have been prevented by providing consistent mechanical oral hygiene.[24]

Bassim et al. found the odds of dying from pneumonia was three times higher in patients receiving no oral care.[25] Yoneyama and colleagues studied oral care and the incidence of pneumonia in 417 residents in 11 nursing homes during a 2-year study. The intervention group received oral care (toothbrushing for five minutes) after every meal. Dentures were brushed daily and cleaned weekly in both groups. The group receiving oral care after each meal had 15% fewer febrile days and a lower incidence of pneumonia compared to the control group.[26]

A comparative study conducted by Robertson and Carter evaluated the impact of an oral care protocol on hospitalized, non-ventilated, care-dependent neurosurgical patients who were at high risk for pneumonia. They studied 51 patients retrospectively who had received standard oral care, which was widely variable and inconsistent compared to 32 patients who prospectively received an enhanced oral care regimen. The enhanced oral care regimen included assessing the mouth every two to four hours, brushing teeth every 12 hours, and cleansing oral mucosa every two to four hours. Only RNs and LPNs were to provide oral care and training was provided to the nursing staff prior to implementation. A statistically significant reduction in NV-HAP was seen after 6 months, as evidenced by a NV-HAP 25.5% in the retrospective group and 6.33% in the prospective group ($p < .05$).[27]

Single site published data from Sutter Medical Center, Sacramento, California found 115 adult cases of NV-HAP over a 12-month period, which included the death of a 57-year old previously healthy woman with no risk factors after routine surgery. These 115 cases translated to a rate of 1.22 per 1,000 patient days, 0.47 per 100 patient discharges, 1035 additional

hospital days, and 23 patient deaths. After implementation of a universally applied evidence-based oral care protocol at Sutter, the rate of NV-HAP per 100 patient days decreased from 0.49 to 0.3 (38.8%). The avoidance of NV-HAP cases resulted in an estimated 8 lives saved, $1.72M cost avoided, and 500 extra hospital days averted. The extra cost for evidence-based oral care supplies was $117,600. Initial cost savings resulting from avoided NV-HAP was $1.72 million for a return-on-investment of $1.6M.[28]

Finally, in a recently published review of the evidence to prevent NV-HAP, Lyons and Kollef (2018) found that oral care was the most likely intervention to decrease NV-HAP. [29] However, they also found numerous inconsistencies in the definitions and implementations of oral care interventions. This lack of consistency in oral care protocols and products has created barriers to effective translational and comparative research. **To optimize efficacy and safety, it is necessary to shift the perspective of healthcare providers from thinking of oral care as comfort care, to oral care as therapeutic intervention, and oral care products as therapeutic intervention devices.**

Despite studies published over the last 10 years, there are virtually no hospital requirements to monitor or report cases of NV-HAP, so most hospitals are unaware of their own incidence. Nor are there requirements to monitor source control (i.e., oral care) for NV-HAP. There are numerous unintended adverse consequences of missed oral care including sepsis (pneumonia is the most frequent infective source of sepsis), increased length of stay, higher costs, and decreased quality of life. Further complicating this picture is the rise of antibiotic resistance. Joint Commission does not issue survey deficiencies for poor oral hygiene; however, they recognize the importance of this missed care opportunity when it is required documentation by the hospital.

Providing evidence-based oral care with therapeutic products addresses the most common modifiable risk factor for pneumonia (i.e., germs in the mouth)

1.4 HAPPI Replication

Prevention of NV-HAP is a patient safety concern that our work group has have been working on for several years. Provided here are some representative examples of HAPPI success. In all cases, this success has been led by nurses with integral involvement of the interdisciplinary team (infection prevention, nursing assistants, respiratory therapists, speech-language therapists, nursing and hospital management, and supply chain).

The nation's largest integrated health care system, the Veterans Health Administration (VHA), manages the care of over 8 million Veterans across 153 medical centers. [33]

A team at the **Salem VA Medical Center (VAMC) led by Shannon Munro, PhD, NP** partnered with the HAPPI research team, examined over 12 years of retrospective and prospective data, and found that an oral care regimen significantly reduces the risk of developing NV-HAP, thus shortening hospital stays, reducing direct health care costs, lowering the need for a higher level of care (e.g. intensive care and discharge to long term care), and saving lives. [33,34]

At the first VA pilot site, the community living center (CLC) units at Salem VAMC, the incidence rate of NV-HAP decreased from 105 cases to 8.3 cases per 1,000 patient days (decreased NV-HAP by 92%) in the first year, yielding an estimated cost avoidance of $1.76 million and 8 lives saved. [33] The population of the CLC units is primarily composed of elderly Veterans with complicated chronic health problems requiring rehabilitation and long-term care. **Veterans on the CLC units were 10.7 times less likely to develop NV-HAP with consistent oral care than patients receiving standard nursing care.** [33]

The **Houston VAMC** replicated the practice in 2017 and reduced the rate of NV-HAP in the coronary care unit and step-down unit (165 admissions per month) from 11 cases to 0 cases per 1,000 patient days and saved an estimated hospital cost of $480,000 and two patient lives in six months. [33]

These successful outcomes at the original VA pilot sites led to funding from the VHA Diffusion of Excellence Initiative, VHA Office of Strategic Integration, and the Veterans Engineering Resource center to support continued expansion efforts as quality improvement. [34] Across all reporting units in 8 VA hospitals in Virginia, North Carolina, and Texas, a predicted 225 cases were avoided as of May 31, 2019. Should we extrapolate the data, there is a cost avoidance estimate of **$8.9M and 40 Veteran lives saved.** Nationwide VA deployment is underway in 37 VA hospitals including 113 medical-surgical, ICU, CLC, and mental health units.

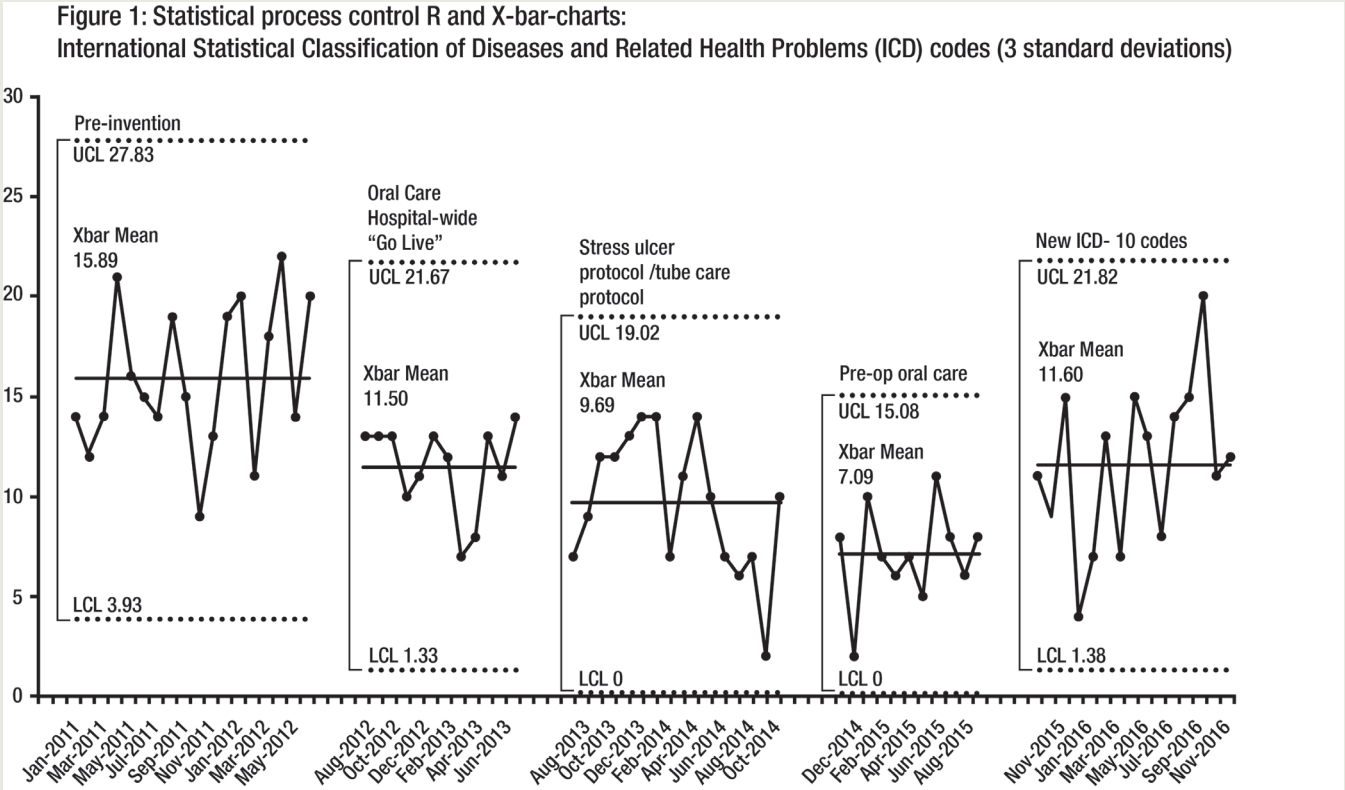
The VA established a national Hospital-acquired Pneumonia Prevention by Engaging Nurses (HAPPEN) program and VHA oral care implementation toolkit under the leadership of Dr. Munro. The HAPPEN toolkit is available for download by interested hospital systems.

Sparrow Hospital (Lansing, Michigan): With two rounds of grant funding from Delta Dental of Michigan, Sparrow Hospitals developed a nurse-driven oral care protocol (NDOCP) using our HAPPI protocol. Variables included age, hospital length of stay, white blood cell count at pneumonia diagnosis, admission type, sex, mortality and presence of confusion for patients with NV-HAP in both the pre and intervention groups, along with compliance to the NDOCP and the incidence NV-HAP. There were significantly more NV-HAP cases pre-NDOCP than post-NDOCP (95% CI $p < .05$; pre-52 versus post-26, $X2=12.8[df=1]$, $p=.0004$). NV-HAP rates were 2.84 per 1,000 discharges (pre- NDOCP) and 1.41 per 1,000 discharges (post-NDOCP).

Significant group differences were found in mortality and logistic regression indicated that group membership was significant in predicting death.[31]

Sutter Medical Center, Sacramento, California, has continued to document success with the use of HAPPI protocols and these results have been published. [32] Sutter Health Systems is now in the process of implementing HAPPI system-wide (24 hospitals)

Sutter Medical Center, Sacramento, California, 2011-2016



2 HAPPIER Toolkit Overview

2.1 American Dental Association approved Oral Care Protocol for Acute Care Hospitals

- Complete oral health assessment that includes swallow assessment first. Determine if a bite block is required and if a swallow evaluation is indicated.
- Always use Personal Protective Equipment (PPE) when assisting patients with mouth care, including gloves, mask, and face shield.
- Document oral care in the patient record.
- Disposable swabs should not replace tooth brushing. They are for comfort care, one-time use only; do not leave soaking in a cup for reuse later.

Maintain adequate oral hydration when possible to maximize salivary flow

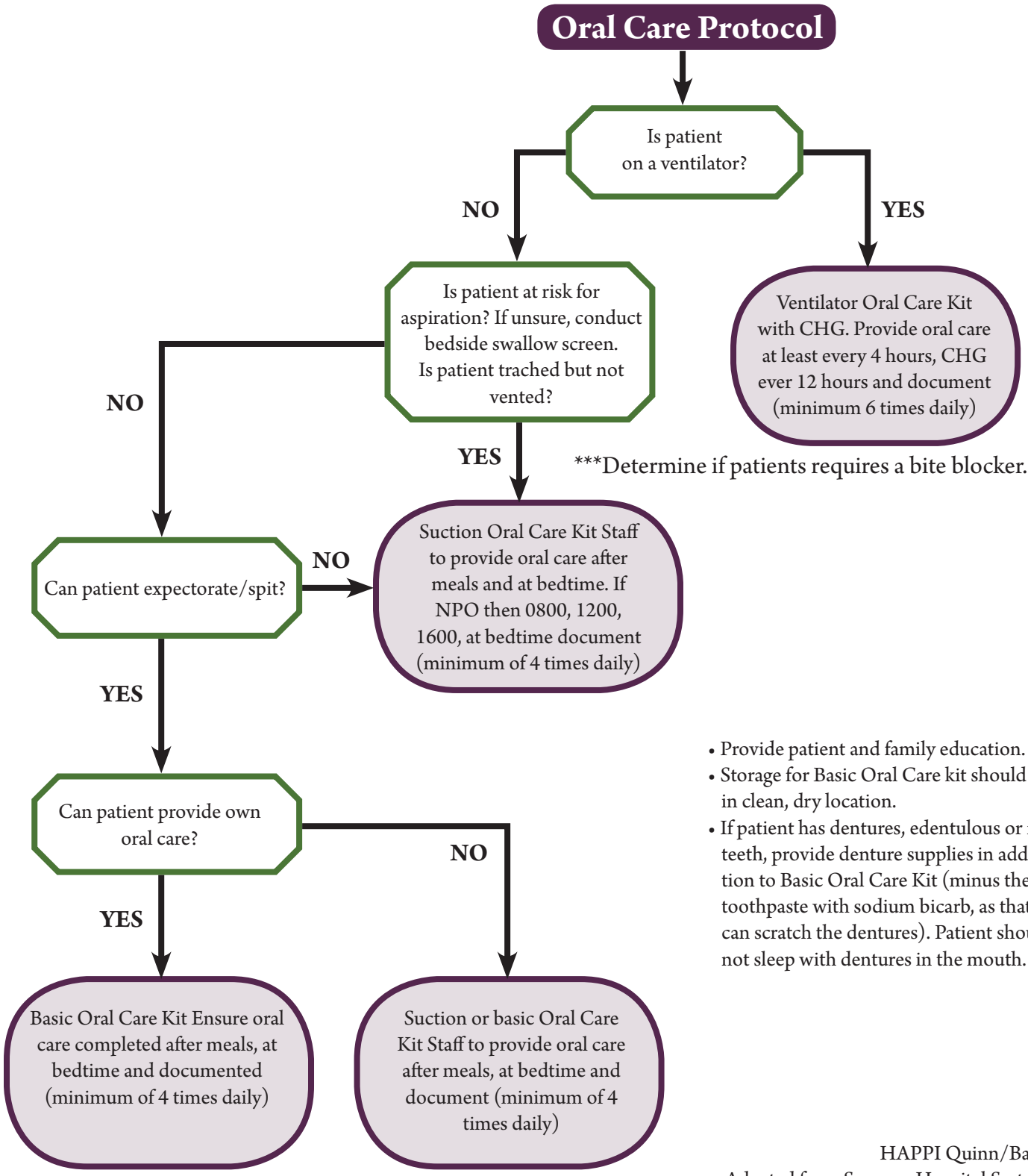
*Oral care protocol (Baker and Quinn, 2017: email dibaker@csus.edu for permission) Approved by the American Dental Association Board of Trustees, 2017
*2018 Chlorhexidine new studies with mixed results about chlorhexidine

Patient Type	Equipment	Procedure*	Frequency
Self-care and staff-assist. Able to expectorate (spit).	• Soft toothbrush • Toothpaste, plaque removing • Antiseptic oral rinse, alcohol-free • Mouth moisturizer • If available, dental floss or interdental cleansers	1. Set patient up at sink or in bed with all equipment. 2. Instruct patient to brush teeth for 1-2 minutes. Brush the tongue. 3. Instruct patient to swish and spit antiseptic oral rinse. 4. If available, have patients use floss or interdental cleansers. 5. May moisturize interior of mouth and lips using a swab, PRN. 6. Discard disposable equipment/ swab in appropriate receptacle.	After each meal and before bedtime. If patient is NPO, oral care should be done morning, mid-day, evening, and bedtime.
Dependent for oral care. Not able to expectorate (spit). At risk for aspiration.	• Suction tooth-brush & swab • Antiseptic oral rinse, alcohol-free • Mouth moisturizer	1. Moisten suction toothbrush/ swab in antiseptic oral rinse. 2. Connect suction toothbrush/ swab to continuous suction. 3. Brush the teeth 1-2 minutes. Brush the tongue. 4. Suction debris from mouth. 5. Apply moisturizer using a swab, to the interior of the oral cavity and the lips. 6. Discard disposable equipment/ swab in appropriate receptacle	Same as above

Patient Type	Equipment	Procedure*	Frequency
Dependent on oral care. Patient on a ventilator.	• Suction toothbrush & swab • Oral cleansing solution • Mouth moisturizer • Chlorhexidine oral rinse* * only if ordered, current literature does not provide clear evidence for use of CHG.	1. Provide suction, PRN, to remove oropharyngeal secretions that can migrate down the tube and settle on top of the cuff. 2. Obtain suction toothbrush/swab and moisten with oral cleansing solution. 3. Connect Suction toothbrush/ swab to continuous suction. 4. If chlorhexidine is used, remove the debris and cleanse the gums, tongue, and inside of cheeks with the solution-saturated swab, 2X per day. 5. Suction debris from mouth. 6. Apply moisturizer using a swab, to the interior of the oral cavity and the lips. 7. Discard disposable equipment/ swab in appropriate receptacle.	Every 4 hours and PRN oral debris.
Denture Care or patients with no teeth. *Whenever patient is sleeping, clean dentures and place in antiseptic solution*	• Denture cup, labeled • Denture brush is preferred when available, otherwise soft toothbrush • Denture cleanser (for soaking only) • Antiseptic rinse, alcohol-free • Optional: denture adhesive	1. After removing dentures, place in a labeled denture cup. 2. Brush the palate, buccal surfaces, gums, and tongue with soft bristle toothbrush. 3. Patient can swish and spit antiseptic rinse or use swab to apply. 4. Line the sink with paper towel and add water to cushion the dentures in case you drop them. Carefully brush dentures with warm water. DO NOT USE TOOTHPASTE as this may scratch the surface of the dentures. 5. Clean and dry equipment and return to patient's bedside table. 6. Assist patient in inserting dentures into mouth. 7. After HS mouth care, soak dentures in a commercial cleanser in the denture cup. 8. If patient needs denture adhesive to hold firmly in place, follow manufacturer directions.	After each meal and at bedtime.

2.2 HAPPI Oral Care Flowchart, Adapted from Sparrow Hospital Systems

RN provides oral assessment to determine: (1) status of oral health and identify any issues that require attention, (2) if MD notification is indicated, (3) type and frequency of oral care, and (4) if a swallow screen is required.



- Provide patient and family education.
- Storage for Basic Oral Care kit should be in clean, dry location.
- If patient has dentures, edentulous or no teeth, provide denture supplies in addition to Basic Oral Care Kit (minus the toothpaste with sodium bicarb, as that can scratch the dentures). Patient should not sleep with dentures in the mouth.

HAPPI Quinn/Baker
Adapted from Sparrow Hospital Systems

2.3 HAPPI ICD-10 Pneumonia Codes Chart

ICD-10 Chart: Pneumonia

First step: NOT PRESENT ON ADMISSION CODE Y-95 THEN ICD-10 code

Code Title	ICD-10
Adenoviral pneumonia	J12.0
Parainfluenza virus pneumonia	J12.2
Pneumonia due to SARS	J12.81
Pneumonia due to Hemophilus influenza	J14
Pneumonia d/t Klebsiella	J15.0
Pneumonia d/t Pseudomonas	J15.1
Pneumonia d/t Staphylococcus	J15.20
Pneumonia due to Methicillin susceptible Staphylococcus aureus	J15.211
Pneumonia d/t Methicillin resistant Staphylococcus aureus	J15.212
Pneumonia due to other staphylococcus	J15.29
Pneumonia d/t Strep B	J15.3
Pneumonia d/t Other Strep.	J15.4
Pneumonia d/t e. Coli	J15.5
Pneumonia d/t Other gram negative bacteria	J15.6
Pneumonia d/t Mycoplasma pneumonae	J15.7
Other bacterial pneumonia	J15.8
Bacterial pneumonia, unspecified	J15.9
Pneumonia d/t other specified infectious organisms	J16.8
Pneumonia in diseases classified elsewhere	J17
Bronchopneumonia, unspec.	J18.0
Lobar pneumonia	J18.1
Hypostatic pneumonia, unspec.	J18.2
Other pneumonia, organism unspec.	J18.8
Pneumonia, unspec. Organism *This group also includes Community acquired pneumonia – therefore work with coding department to be sure that Y-95 is *not* coded when coded for J18.9 is coded and the *reason is for community acquired pneumonia*	J18.9
Y-95 nosocomial hospital acquired condition	

Your institution may also want to refine and clarify the clinical definition of pneumonia. The National Healthcare Safety Network (NHSN) from the CDC have been studied and found to be reliable markers for HAP (See et al. 2016).

2.4 CDC-Modified Confirmation Tool (Not Immune Compromised)

NV-HAP based on the following criteria: all "Yes" level criteria must be satisfied

Yes	**Criteria**	
1 or more criteria met ☐	__Patient with underlying diseases[1] has **2 or more** serial x-rays with one of the following: __New or progressive and persistent infiltrate[2] __Consolidation[2] __Cavitation[2]	__Patient without underlying disease[1] has **1 or more** serial x-rays with one of the following:
1 or more criteria met ☐	__Fever (100.4 F) with no other cause __Leukopenia (<4,000 WBC/mm^3) or leukocytosis (≥12,000 WBC/mm3) __Altered mental status with no other cause in ≥70 y.o.	
2 or more criteria met ☐	__New onset of purulent sputum[3] or change in character of sputum, or increased respiratory secretions, or increased suctioning requirements __New onset or worsening cough, or dyspnea, or tachypnea[4] __Rales or bronchial breath sounds[5] __Worsening gas exchange (e.g., O_2 desats) increased O_2 requirement	
☐	Mechanical ventilation NOT in place 48 hours prior to pneumonia diagnosis	

Definitions: 1. Underlying disease: pulmonary or cardiac disease such as respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema from decompensated HF, or COPD. Because some of these non-infectious conditions may simulate the presentation of pneumonia, these patients need more than one definitive CXR (CDC 2003).
2. Infiltrate, consolidation, cavitation: There are many ways of describing the radiographic appearance of pneumonia (airspace disease, focal opacification, patchy areas of increased density, etc.). These types of descriptive wording should be seriously considered as potentially positive findings and should be correlated with signs, symptoms, and lab results.
3. Purulent sputum: Secretions from the lungs, bronchi, or trachea that contain >25 neutrophils and <10 squamous epithelial cells per low power field (x100). May be described qualitatively as "many WBCs" or "Few squames."
4. Dyspnea: Shortness of breath; Tachypnea: Respiration rate > 25 breaths/minute
5. Rales or bronchial breath sounds: Breath sounds (rattle, crackles)

2.5 CDC-Modified Confirmation Tool (Immune Compromised)

Site ID_____ Case ID_____

Non Ventilator Hospital Acquired Pneumonia (NV-HAP) - CDC-modified Confirmation Tool

Immune compromised case

Yes	**Criteria for Immunocompromised patients:** (those with one of the following) a. neutropenia (absolute neutrophil count <500/mm3) b. leukemia c. lymphoma d. HIV with CD4 count <200 e. splenectomy f. early post transplantation g. cytotoxic chemotherapy h. on high-dose steroid daily for 2 weeks (e.g. >40mg of prednisone or its equivalent: >160mg hydrocortisone, >32mg methylprednisolone, >6mg dexamethasone, >200mg cortisol
1 or more criteria met ☐	__Patient <u>with underlying diseases</u>[1] has **2 or more** serial x-rays with one of the following: __New or progressive and persistent infiltrate[2] __Consolidation[2] __Cavitation[2] __Patient <u>without underlying disease</u>[1] has **1 or more** serial x-rays with one of the following:
1 or more criteria met ☐	__Fever (100.4 F) with no other cause __Altered mental status with no other cause in ≥70 y.o. __New onset of purulent sputum[3], or change in character of sputum, or increased respiratory secretions, or increased suctioning requirements __New onset or worsening cough, or dyspnea, or tachypnea[4] __Rales or bronchial breath sounds[5] __Worsening gas exchange (e.g., O_2 desats (e.g., $PaO_2/Fio_2 \leq 240$), increased O_2 req, increased ventilation demand) __Hemoptysis[6] __Pleuritic chest pain[7]

1 of the criteria met in either A, B, or C ☐	___Positive blood culture not related to another infection[8] ___Positive pleural fluid culture ___Positive quantitative culture[9] from minimally contaminated LRT specimen (e.g., BAL or protected specimen brushing) ___ ≥5% BAL-obtained cells contain intracellular bacteria on direct microscopic exam (e.g. Gram stain) ___Histopathologic exam shows 1 of the following: ___Abscess formation or foci of consolidation with intense PMN accumulation in bronchioles and alveoli ___Positive quantitative culture[9] of lung parenchyma ___Evidence of lung parenchyma invasion by fungal hyphae or pseudohyphae
☐	___Positive culture of virus or Chlamydia from respiratory secretions ___Positive detection of viral antigen or antibody from respiratory secretions (e.g., EIA, FAMA, shell vial assay, PCR) ___4-fold rise in paired sera (IgG) for pathogen (e.g., influenza viruses, Chlamydia) ___Positive PCR for Chlamydia or Mycoplasma ___Positive micro-IF test for Chlamydia ___Positive culture or visualization by micro-IF of Legionella spp. From respiratory secretions or tissue ___Detection of Legionella pneumophila serogroup 1 antigens in urine by RIA or EIA ___4-fold rise in L.pneumophilia antibody titer to ≥1:128 in paired acute and convalescent sera by indirect IFA
☐	___Matching positive blood and sputum cultures with Candida spp[10,11] ___Evidence of fungi or Pneumocytis carinii from minimally contaminated LRT specimen (e.g., BAL or protected specimen brushing) from one of the following: ___Direct microscopic exam ___Positive culture of fungi
☐	Mechanical ventilation NOT in place 48 hours prior to pneumonia diagnosis

Definitions:

1. Underlying disease: pulmonary or cardiac disease such as respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema from decompensated HF, or COPD. Because some of these non-infectious conditions may simulate the presentation of pneumonia, these patients need more than one definitive CXR (CDC 2003).
2. Infiltrate, consolidation, cavitation: There are many ways of describing the radiographic appearance of pneumonia (airspace disease, focal opacification, patchy areas of increased density, etc.). These types of descriptive wording should be seriously considered as potentially positive findings and should be correlated with signs, symptoms, and lab results.
3. Purulent sputum: Secretions from the lungs, bronchi, or trachea that contain >25 neutrophils and <10 squamous epithelial cells per low power field (x100). May be described qualitatively as "many WBCs" or "Few squames."
4. Dyspnea: Shortness of breath; Tachypnea: Respiration rate > 25 breaths/minute
5. Rales or bronchial breath sounds: Breath sounds (rattle, crackles)
6. Hemoptysis: blood in sputum
7. Pleuritic chest pain: pain with breathing
8. Care must be taken to determine the etiology of pneumonia in a patient with positive blood cultures and radiographic evidence of pneumonia, especially if the patient has invasive devices in place such as IV or urinary catheter. (e.g. if patient has a UTI and grows out e.coli in both urine and blood, this would NOT meet criteria for positive CXR and positive blood culture, since there is another source of infection rather than pneumonia)
9. See "Threshold Values for Cultured Specimens", below. Note: ET aspirate is NOT a minimally contaminated specimen and does not meet the lab criteria.
10. Blood and sputum collection must be collected within 48 hours of each other.
11. Acceptable semi quantitative or nonquantitative cultures of sputum: collection by deep cough, induction, aspiration, or lavage. If quantitative cultures are available, refer to algorithms that include such specific lab findings. Abbreviations:

- 1. BAL – bronchoalveolar lavage 2. EIA – enzyme immunoassay 3. FAMA – fluorescent-antibody staining of membrane antigen 4. IRA – immunofluorescent antibody 5. LRT – lower respiratory tract
- 6. PCR – polymerase chain reaction 7. PMN – polymorphonuclear leukocyte 8. RIA – radioimmunoassay

Threshold values for cultured specimens in the diagnosis of pneumonia

Specimen collection/technique	Value
Lung parenchyma*	$\geq 10^4$ cfu/g tissue
Bronchoscopically obtained specimens	
Bronchoalveolar lavage	$\geq 10^4$ cfu/mL
Protected BAL	$\geq 10^4$ cfu/mL
Protected specimen brushing	$\geq 10^4$ cfu/mL
Nonbronchoscopically obtained (blind) specimens	
Bronchoalveolar lavage	$\geq 10^4$ cfu/mL
Protected BAL	$\geq 10^4$ cfu/mL

cfu – colony-forming units
*Open-lung biopsy specimens and immediate post-mortem specimens obtained by transthoracic or trans bronchial biopsy

2.6 Working with Coding Department

It is essential that coding department become part of the team to ensure that surveillance data is accurate and that there is internal consistency in the coded data. Some hospitals have developed an alert for pneumonia coding to double check the accuracy of the Y-95 – nosocomial hospital acquired condition code. The importance of noting not present on admission status is critical in determining quality and safety of hospital care.

2.7 HAPPI Prevention Gap Assessment

Non Ventilator Hospital Associated Pneumonia (NV-HAP) Prevention Gap Assessment

Location:_____ Date:_____

Source Control	Yes/No	What is the gap?	Where is the gap?
Do you have a comprehensive oral care program/policy for all types of patients on all units?			What are the missing units?
If you have an oral care protocol, does it include instruction to remove dentures when patients are sleeping?			
Are you using oral-care products that match recommendations by American Dental Association (ADA): • Soft-bristled toothbrush? • These common hard-bristle toothbrushes found in many hospital do not meet ADA standards			
• Toothpaste with dentifrice and/or fluoride? Dentifrice acts to break up biofilm and plaque that harbor germs and many toothpastes found in hospitals do not contain a dentifrice			
• Is dental floss or interdental cleansers available for self-care patients?			

Source Control	Yes/No	What is the gap?	Where is the gap?
• Is your antiseptic rinse alcohol-free? To remove any germs and particular hidden in gums and cervices that may allow germs to multiple			What are the missing units?
• Petroleum-free mouth moisturizer, available as needed? Dry lips and mouth cracks harbor germs			
• Denture care products? • Denture cleanser/adhesive/ storage container • Denture brush (a special dental brush designed to clean dentures) Include suction toothbrushes / other equipment for special needs patients and patients at high risk for aspiration on the general care wards/ for example med/surg units?			
Do you have bite guards available when indicated for dependent oral care patients?			
Do you use oral chlorhexidine gluconate for any patient populations in your hospital? Note: There are emerging studies indicating possible harm from use of CHG in ventilator patients. More studies are required on CHG to determine risk and benefits.			If yes: what types? Pt on Vent only_____ Or Patients in: ICU_____M/S _____Oncology____ Ortho _____Neuro__ Tele__ Other____

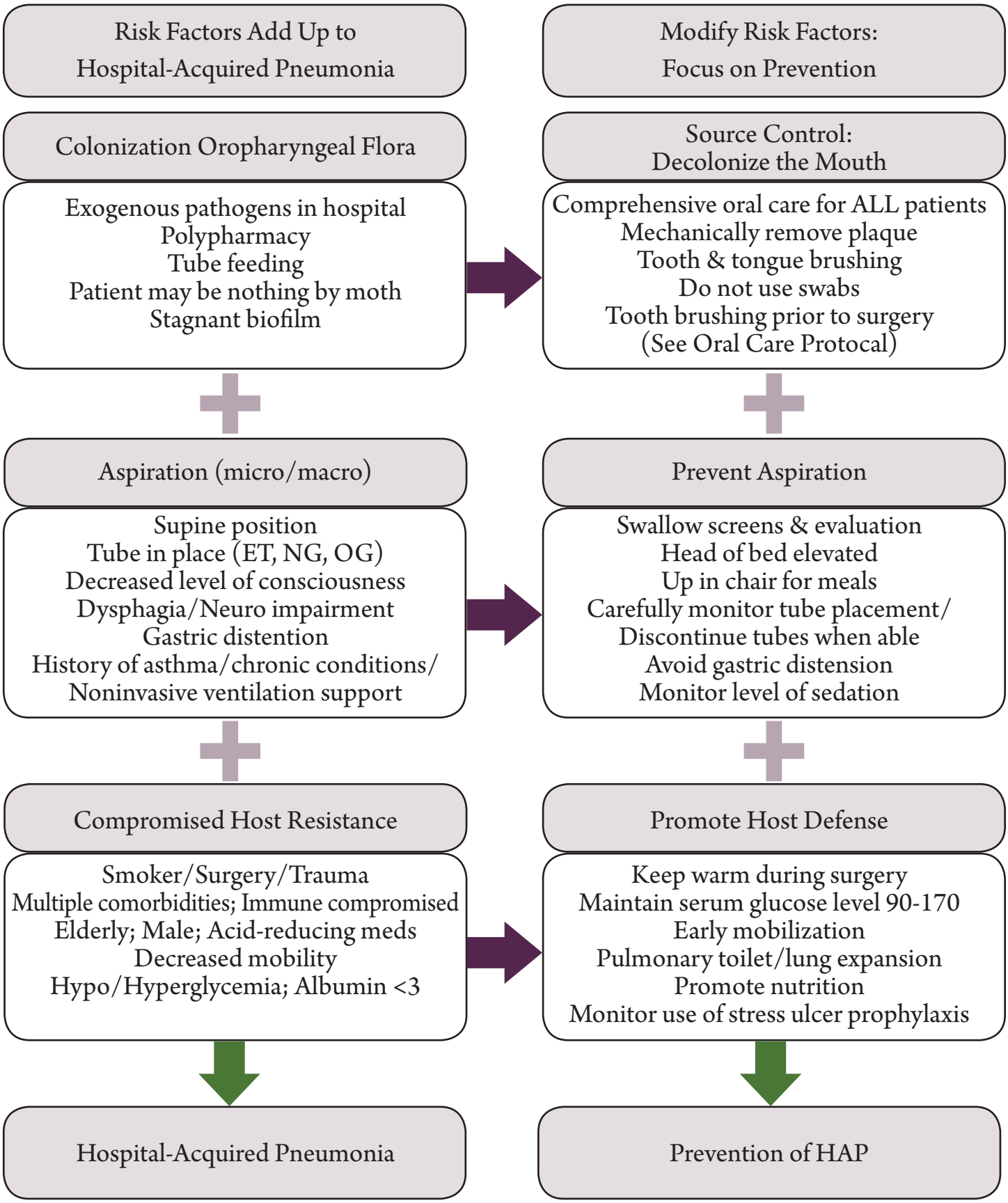
Source Control for Surgical Patients	Yes/No	What is the gap?	Where is the gap?
Do you have a standard of oral care that includes brushing teeth for all patients prior to surgery in peri-op?			
Is oral care part of the peri-op check off list?			
Do you use oral chlorhexidine gluconate during the perioperative period on surgery patients? If so, on what type of cases? Note: There are emerging studies indicating possible harm from use of CHG in ventilator patients. More studies are required on CHG to determine risk and benefits			If yes, what type of peri-operative patients? Cardiac only_____ Ortho _____ All surgical patients_____ Other_____ • to date, evidence is only for CV surgery patients
Does your hospital have a protocol to keep patients warm, before, during, and after surgery?			
Surveillance and Documentation			
Do you conduct surveillance for NV-HAP?			
Do you monitor oral care frequency to determine trends?			
Is there an easy location for documenting oral care (dependent and independent) up to 6 times/ day for VAP			
Competency and Education			
Do nurses and nurses' aides/ patient care technicians' complete competency training on hire and annually on oral care procedures and protocols?			

	Yes/No	What is the gap?	If using an oral care assessment, what type or standard?
Are RNs trained to use a standardized oral care assessment to determine type and frequency of oral care?			
Are nurses trained to complete a swallow assessment and how to make a referral for a SLP evaluation?			
Is general training and competency checks completed for staff about prevention of HAP? Consider also SLP, RT, OT, PT, and other interdisciplinary staff			
Patient and Family Education and Engagement			
Are patient and families engaged in the effort to prevent NV-HAP?			
Are patients and families given information to prevent pneumonia while in the hospital?			
Additional Considerations to Prevent NV-HAP			
Do you have specific policy, protocols, and procedures to:			
Elevate HOB 30-45 degrees if the patient is at high risk for aspiration?			
Encourage all post op patients to take deep breaths, move in bed & ambulate, unless contraindicated?			
Use incentive spirometry on post op patients? If so, what specific type of cases?			
Evaluate the need for continued use of tubes (ET, trach, enteral feeding tubes) and discontinue them if no longer clinically indicated?			

	Yes/No	What is the gap?	If using an oral care assessment, what type or standard?
Increase host defense by administering a pneumococcal vaccination?			
Increase host defense by administering a pneumococcal vaccination?			
Evaluate and monitor use of stress ulcer prophylaxis (SUP) histamine receptor 2 (H2)-blocking agents and/or PPIs to ensure that these agents discontinued as soon as they are no longer clinical indicated?			
Are antibiotics administered for pneumonia (all types) monitored as part your hospital antibiotic stewardship program?			

2.8 Modifiable Risk Factors

To Prevent Hospital-Acquired PNA: Focus on *Modifiable* Risk Factors



Created by Barbara Quinn, MSN, CNS-BC

3 Open-access resources

3.1 AJIC, The Epidemiology of Non-Ventilator Hospital-Acquired Pneumonia in the United States

https://www.ajicjournal.org/article/S0196-6553(17)31056-8/fulltext

3.2 AJIC, Hospital Acquired Pneumonia Incidence of Non-Ventilator Hospital-Acquired Pneumonia in the United States

https://www.ajicjournal.org/article/S0196-6553(17)31042-8/fulltext

What is the harm?

Incidence → **How common is NV-HAP?**
- 1 in every 4 hospital infections is pneumonia (CDC 2018)
- Majority of these are NV-HAP

Associated Mortality → **How many patients may die?**
- 15.5 to 30.9% (Davis, Micek, Quinn, Baker, Giuliano)
- 8 ½ X more likely to die than equally ill patients who do not acquire PNA (Micek 2016)

More and more literature in scientific journals over last 7 years noting the harm

Morbidity → **What other harm besides death?**
- Increases hospital stay by 7-9 days = MILLIONS OF DOLLARS (Micek, Giuliano, Baker)
- #1 associated cause of sepsis (Angus, 2013 NEJM; Mayr, 2014 Virulence)
- Increases incidence of long-term care post discharge (Baker & Quinn,2018)

Cost → **How many healthcare dollars are being spent?**
- Overuse of antibiotics for a potentially preventable infection (antibiotic stewardship)
- $28K - $43K per case of NV-HAP
- Readmissions (20%); ICU utilization (46%); Long term care (25%) (Baker & Quinn, 2018)

Centers for Disease Control and Prevention
2016
Included HAIs first time in its
TOP TEN
public health concerns:

CDC's Magill et al. (2018). New point-prevalence study on HAIs (Nov. 1, 2018 NEJM)

HAP #1 HAI with NV-HAP 60%

Making HAP, with NV-HAP majority of cases in US hospitals

1 in 4 hospital-acquired infections

CDC (2018) Prevention Status Report

Prevent PNA

Oral Care 4-2

4 - Brush teeth 4X day while in the hospital, at meal time and bedtime

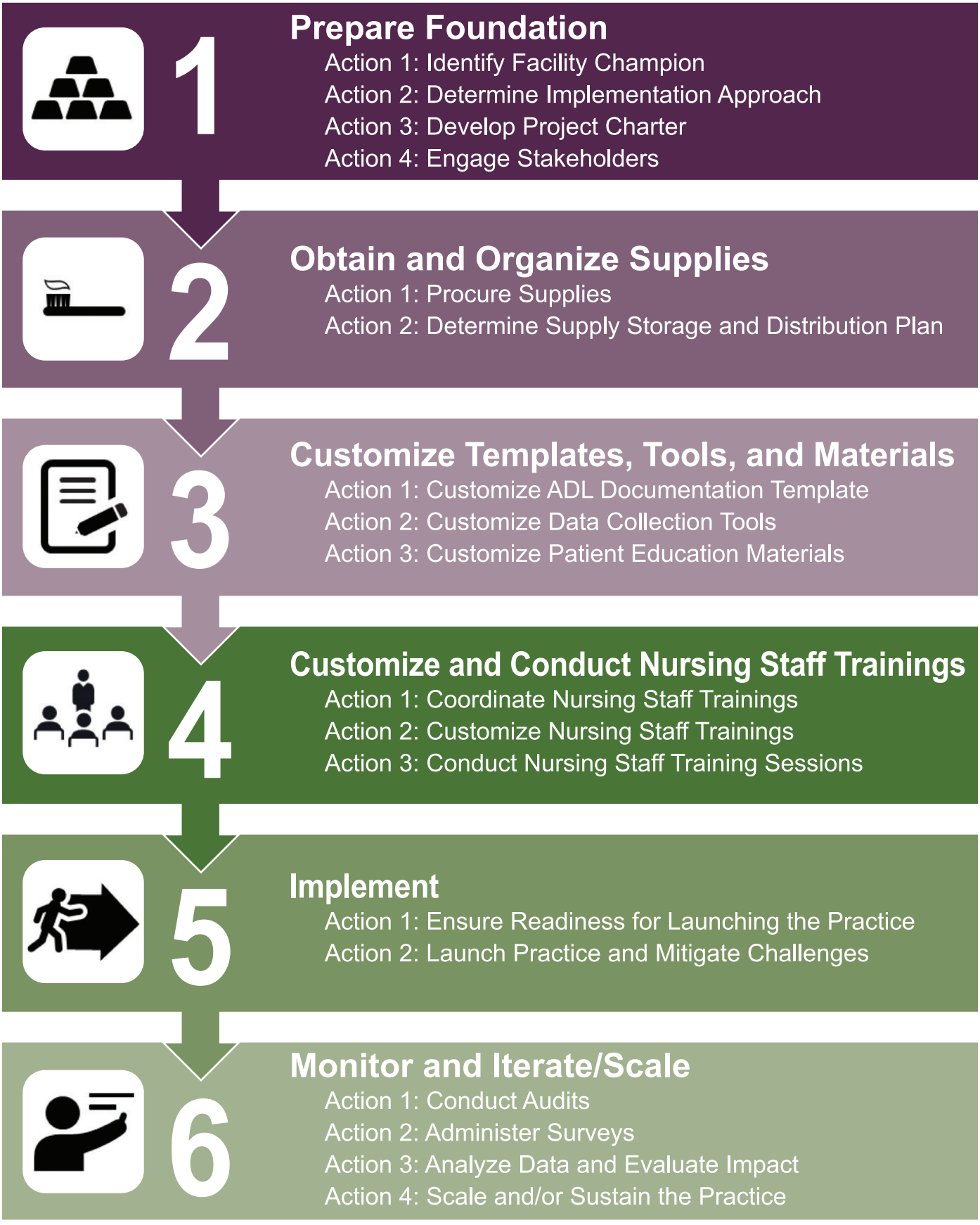
2 - Use antiseptic mouth rinse 2x/ day

Mobility

Out of bed for meals, walk as tolerated

If in bed = head of bed up at 30 degrees or more

Six Steps to Implementation Process



Munro, S., & Baker, D. (2018).
Reducing missed care opportunities to prevent non-ventilator hospital-acquired pneumonia at the Department of Veterans Affairs. Applied Nursing Research, 44, 48-53.

4 References

1. DiBiase LM, Weber DJ, Sickbert-Bennett EE, Anderson DJ, Rutala WA. The growing importance of non-device-associated healthcare-associated infections: a relative proportion and incidence study at an academic medical center, 2008-2012. *Infection Control & Hospital Epidemiology.* 2014;35(02):200-202.
2. Davis J, Finley E. The breadth of hospital-acquired pneumonia: Non-ventilated versus ventilated patients in Pennsylvania. *Pennsylvania Patient Safety Advisory.* 2012;9(3):99-105.
3. Micek ST, Chew B, Hampton N, Kollef MH. A case-control study assessing the impact of nonventilated hospital-acquired pneumonia on patient outcomes. *CHEST Journal.* 2016;150(5):1008-1014.
4. Giuliano KK, Baker D, Quinn B. The epidemiology of nonventilator hospital-acquired pneumonia in the United States. *American journal of infection control.* 2017.
5. Magill SS, Edwards JR, Bamberg W, et al. Multistate point-prevalence survey of health care–associated infections. *New England Journal of Medicine.* 2014;370(13):1198-1208.
6. Magill SS, O'Leary E, Janelle SJ, et al. Changes in Prevalence of Health Care–Associated Infections in US Hospitals. New England Journal of Medicine. 2018;379(18):1732-1744.
7. Davis JW, Findley E. A Second Breadth: Hospital-Acquired Pneumonia in Pennsylvania, Nonventilated versus Ventilated Patients. 2018;15(3):1-12.
8. Di Pasquale M, Aliberti S, Mantero M, Bianchini S, Blasi F. Non-intensive care unit acquired pneumonia: a new clinical entity? *International journal of molecular sciences.* 2016;17(3):287.
9. See I, Chang J, Gualandi N, et al. Clinical Correlates of Surveillance Events Detected by National Healthcare Safety Network Pneumonia and Lower Respiratory Infection Definitions—Pennsylvania, 2011–2012. *Infection control & hospital epidemiology.* 2016;37(07):818-824.
10. Sopena N, Heras E, Casas I, et al. Risk factors for hospital-acquired pneumonia outside the intensive care unit: a case-control study. *Am J Infect Control.* 2014;42(1):38-42.
11. Kopp MA, Watzlawick R, Martus P, et al. Long-term functional outcome in patients with acquired infections after acute spinal cord injury. *Neurology.* 2017;88(9):892-900.
12. Baker D, Quinn B. hospital Acquired Pneumonia Prevention Initiative-2: Incidence of nonventilator hospital-acquired pneumonia in the United States. *American journal of infection control.* 2018;46(1):2-7.
13. Klompas M. Hospital-Acquired Pneumonia in Nonventilated Patients: The Next Frontier. *Infection control and hospital epidemiology*. 2016;37(7):825-826.
14. Gomes-Filho IS, Passos JS, Seixas da Cruz S. Respiratory disease and the role of oral bacteria. *Journal of oral microbiology.* 2010;2(1):5811.
15. Scannapieco FA. The oral microbiome: its role in health and in oral and systemic infect *Clinical Microbiology Newsletter.* 2013;35(20):163-169.

16. Scannapieco FA, Shay K. Oral health disparities in older adults: oral bacteria, inflammation, and aspiration pneumonia. *Dental clinics of North America.* 2014;58(4):771-782.

17. Heo S-M, Haase EM, Lesse AJ, Gill SR, Scannapieco FA. Genetic relationships between respiratory pathogens isolated from dental plaque and bronchoalveolar lavage fluid from patients in the intensive care unit undergoing mechanical ventilation. *Clinical Infectious Diseases.* 2008;47(12):1562-1570.

18. Abele-Horn M, Dauber A, Bauernfeind A, et al. Decrease in nosocomial pneumonia in ventilated patients by selective oropharyngeal decontamination (SOD). *Intensive care medicine.* 1997;23(2):187-195.

19. Gleeson K, Maxwell SL, Eggli DF. Quantitative aspiration during sleep in normal subjects. *Chest.* 1997;111(5):1266-1272.

20. Huxley EJ, Viroslav J, Gray WR, Pierce AK. Pharyngeal aspiration in normal adults and patients with depressed consciousness. *The American journal of medicine.* 1978;64(4):564-568.

21. Didilescu AC, Skaug N, Marica C, Didilescu C. Respiratory pathogens in dental plaque of hospitalized patients with chronic lung diseases. *Clinical oral investigations.* 2005;9(3):141-147.

22. Weitzel, T., Robinson, S. B., & Holmes, J. (2006). Preventing nosocomial pneumonia: routine oral care reduced the risk of infection at one facility. *AJN The American Journal of Nursing,* 106(9), 72A-72E.

23. Kaneoka, A., Pisegna, J. M., Miloro, K. V., Lo, M., Saito, H., Riquelme, L. F., . . . Langmore, S. E. (2015). Prevention of Healthcare-Associated Pneumonia with Oral Care in Individuals Without Mechanical Ventilation: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Infect Control Hosp Epidemiol,* 36(8), 899-906. doi:10.1017/ice.2015.77

24. Sjogren, P., Nilsson, E., Forsell, M., Johansson, O., & Hoogstraate, J. (2008). A systematic review of the preventive effect of oral hygiene on pneumonia and respiratory tract infection in elderly people in hospitals and nursing homes: effect estimates and methodological quality of randomized controlled trials. *J Am Geriatr Soc,* 56(11), 2124-2130. doi:10.1111/j.1532-5415.2008.01926.x

25. Bassim CW, Gibson G, Ward T, et al. Modification of the risk of mortality from pneumonia with oral hygiene care. J Am Geriatr Soc 2008:56 (9), 1601-1607. doi: 10.1111/j.1532-5415.2008.01825.x.

26. Yoneyama, T., Yoshida, M., Ohrui, T., Mukaiyama, H., Okamoto, H., Hoshiba, K., . . . Sasaki, H. (2002). Oral care reduces pneumonia in older patients in nursing homes. *J Am Geriatr Soc,* 50(3), 430-433.

27. Robertson, T., & Carter, D. (2013). Oral intensity: reducing non-ventilator-associated hospital-acquired pneumonia in care-dependent, neurologically impaired patients. *Can J Neurosci Nurs,* 35(2), 10-17.

28. Quinn, B., Baker, D. L., Cohen, S., Stewart, J. L., Lima, C. A., & Parise, C. (2014). Basic Nursing Care to Prevent Nonventilator Hospital-Acquired Pneumonia. *Journal of Nursing Scholarship,* 46(1), 11-19.

29. Lyons, P. G. & Kollef, M. H. Prevention of hospital-acquired pneumonia. *Current Opinion in Critical Care* 24, 370-378, doi:10.1097/MCC.0000000000000523 (2018).

30. Munro, S. et al. Implementation and Dissemination of a Department of Veterans Affairs Oral Care Initiative to Prevent Hospital-Acquired Pneumonia Among Nonventilated Patients. *Nursing Administration Quarterly* 42, 363-372, doi:10.1097/NAQ.0000000000000308 (2018).

31. Warren, C., Medei, M. K., Wood, B. & Schutte, D. A Nurse-Driven Oral Care Protocol to Reduce Hospital-Acquired Pneumonia. *AJN, American Journal of Nursing* 119, 44-51, doi:10.1097/01.NAJ.0000553204.21342.01 (2019).

32. Baker, D., Quinn, B. Ewan, V., Giuliano, K. (2018). Sustaining quality improvement: Long-term reduction of non-ventilator hospital-acquired pneumonia. *Journal of Nursing Care Quality.*

33. Munro, S., Baker, D. (2018). Reducing missed oral care opportunities to prevent non-ventilator associated hospital acquired pneumonia at the Department of Veterans Affairs. *Applied Nursing Research,* 44, 48-53. Doi: 10.1016/j.apnr.2018.09.004

34. Munro S, Baker D. (July 2019). Integrating oral healthcare into patient management to prevent hospital-acquired pneumonia- A team approach. *Michigan Dental Association Journal, 48-57.*