



Do No Harm: Mitigating Risk Factors for Non-Ventilator Pneumonia

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ADVANCING NURSING THROUGH KNOWLEDGE & INNOVATION



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Disclosures

- △ Consultant-Michigan Hospital Association Keystone Center
- △ Subject matter expert on CAUTI, CLABSI, HAPI, Sepsis, Safety culture for HRET/AHA
- △ Consultant and speaker bureau
 - △ Stryker's Sage business
 - △ LaJolla Pharmaceutical
 - △ Potrero Medical
- △ Baxter Advisory Board



Session Objectives



- 🔗 Create the link of patient advocacy to the basic nursing care
- 🔗 Define key fundamental evidence-based nursing care practices that reduce non-vent HAP
- 🔗 Discuss strategies to overcome barriers



Notes on Hospitals: 1859

“It may seem a strange principle to enunciate as the very first requirement in a Hospital that it should do the sick no harm.”

- Florence Nightingale

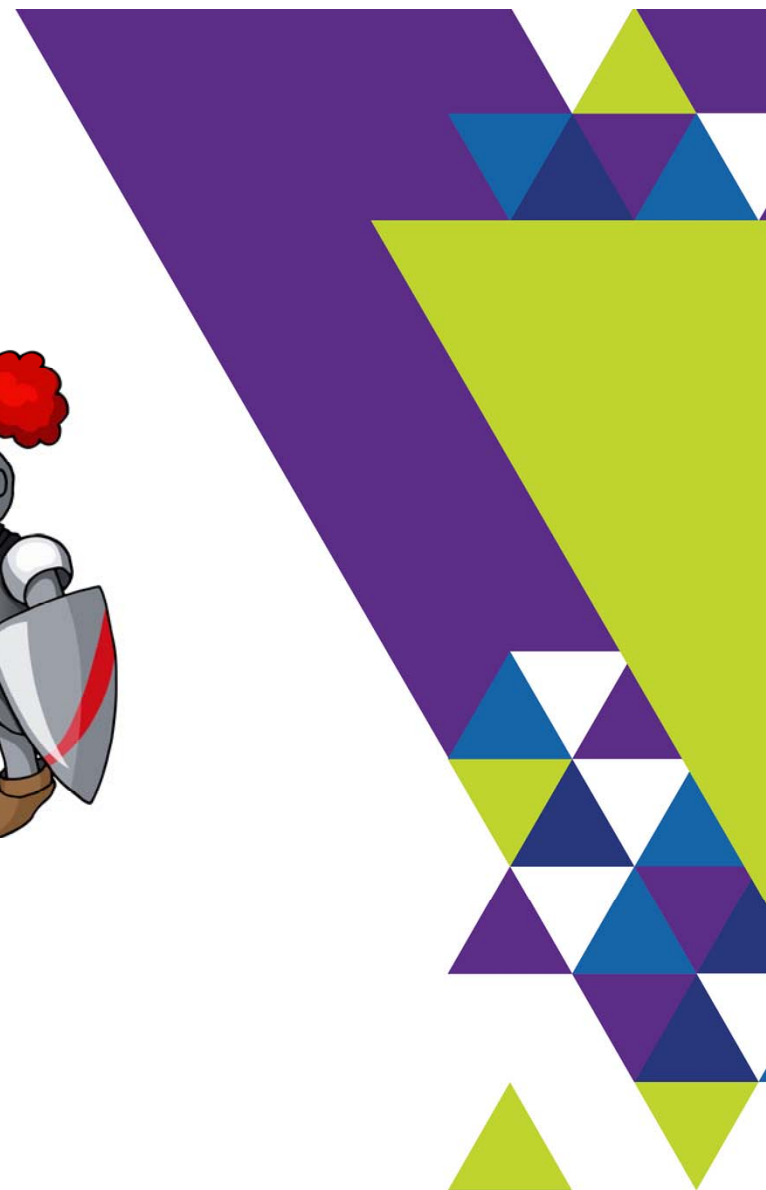
Advocacy = Safety



Protect The Patient From Bad
Things Happening on Your Watch



**Implement Interventional
Patient Hygiene**



Interventional Patient Hygiene

- Hygiene...the science and practice of the establishment and maintenance of health
- Interventional Patient Hygiene....nursing action plan directly focused on fortifying the patient's host defense through proactive use of evidence-based hygiene care strategies

**Hand
Hygiene**

**Comprehensive
Oral Care Plan**

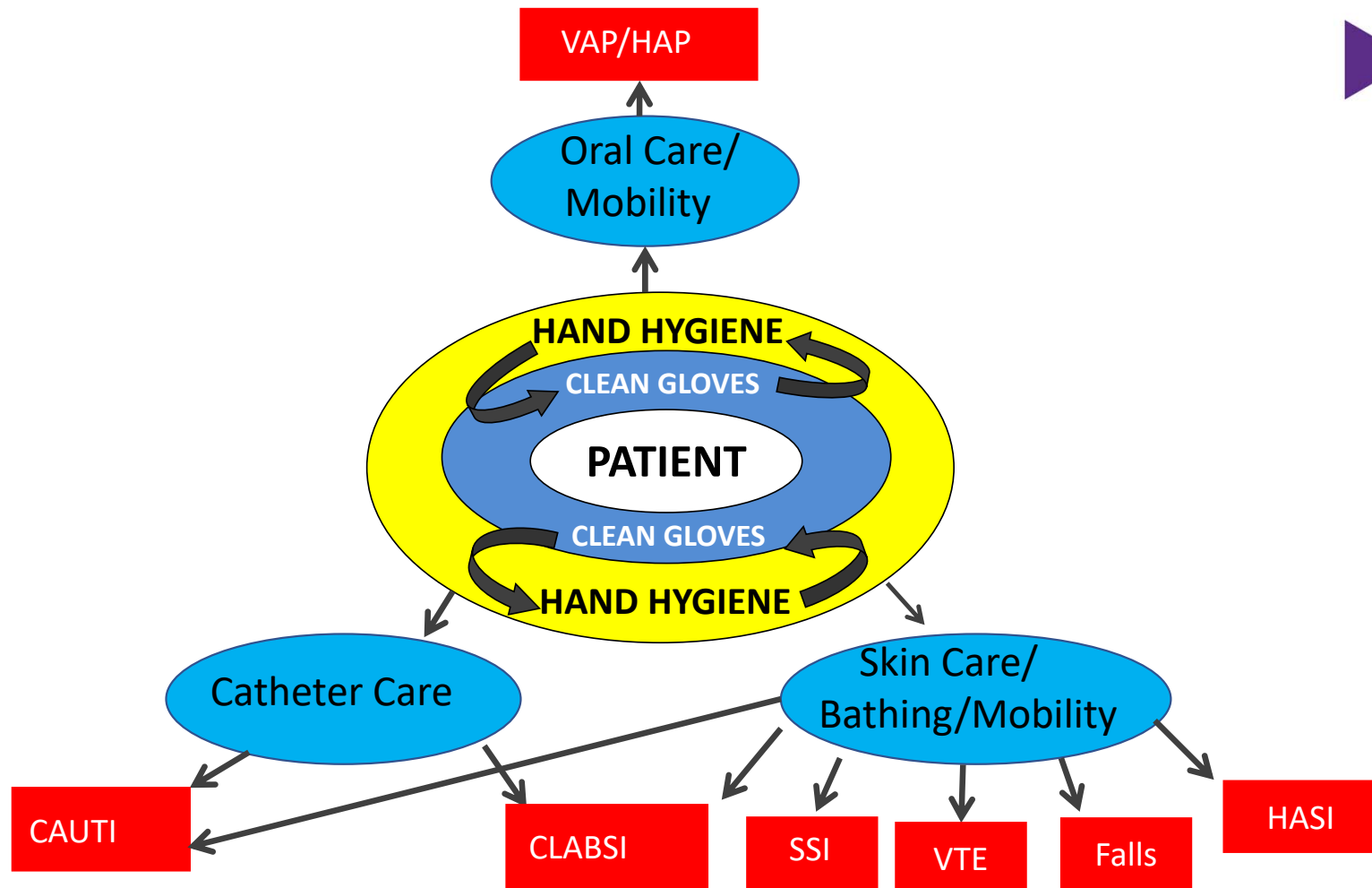
**Incontinence-
Associated
Dermatitis
Prevention
Program**

**Bathing &
Assessment**

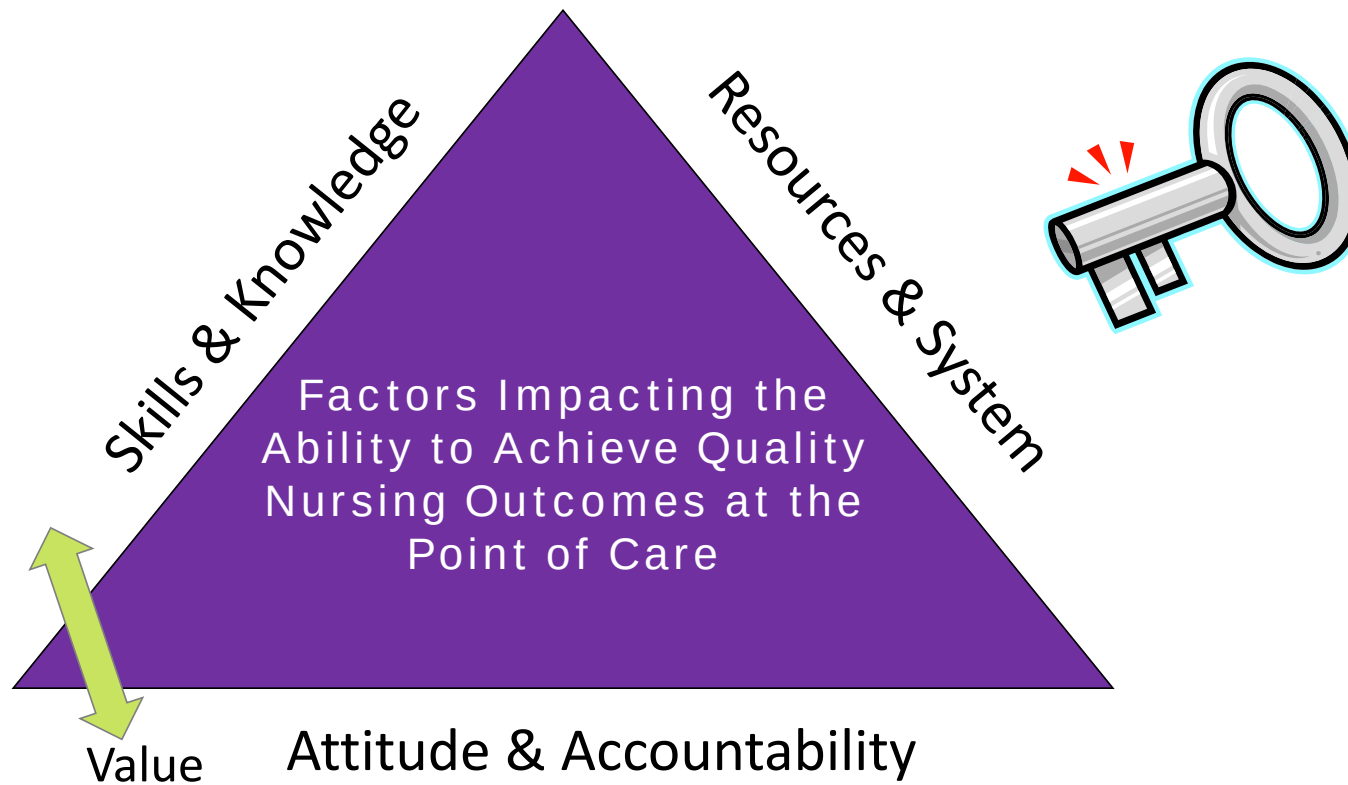
**Pressure
Injury Risk
Reduction**

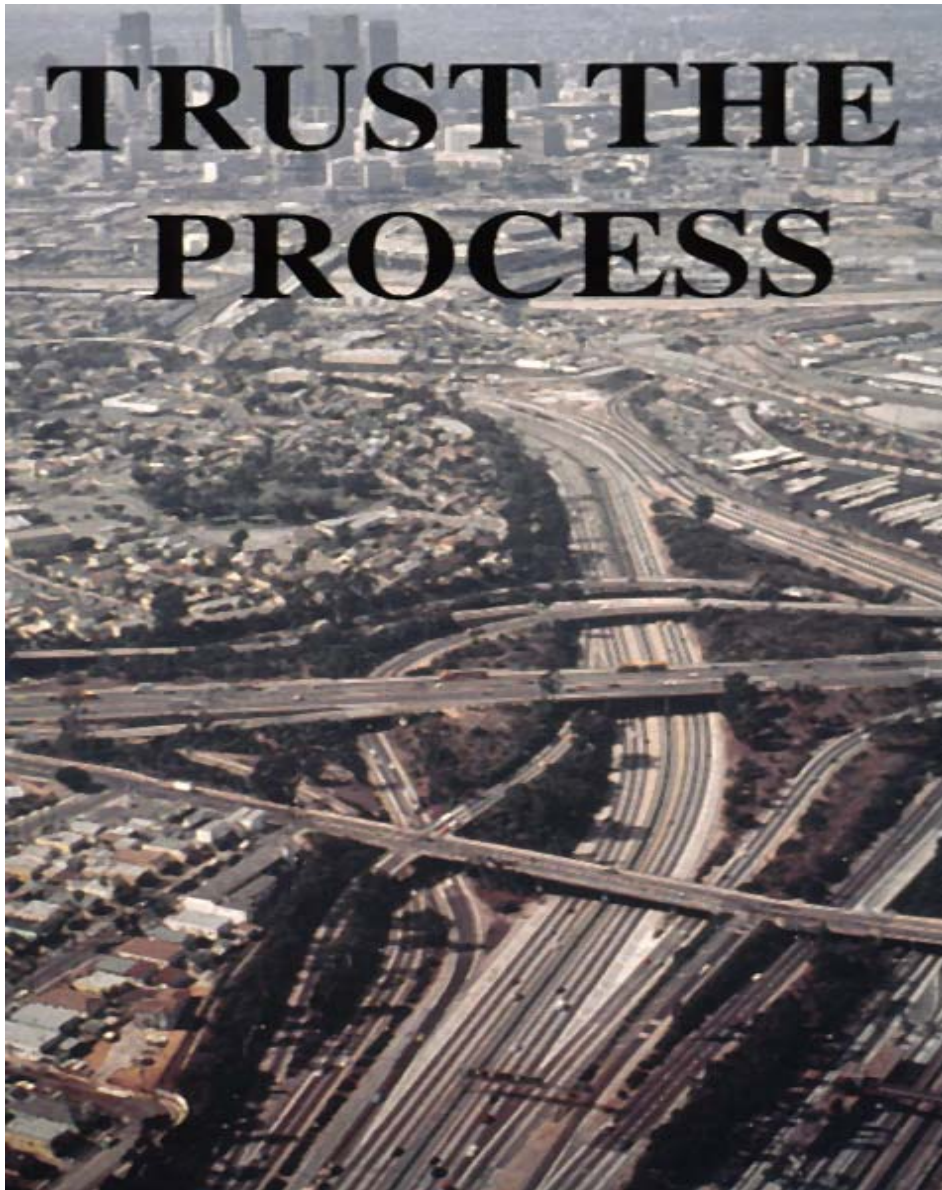
**Catheter
Care**

INTERVENTIONAL PATIENT HYGIENE(IPH)



Achieving the Use of the Evidence





Non-Vent Pneumonia: Addressing Risk Factors



Build the Will: NV-HAP Causes Harm

- 🔗 HAP 1st most common HAI in U.S.
- 🔗 1 in every 4 hospital infections are pneumonia
 - △ 60% non-ventilator
- 🔗 Increased mortality → 15.5%-30.9%
 - △ 8 ½ x more likely to die than equally sick patients who did not get non-vent HAP

Magill SS, et al. NEJM 2018;379:1732-1744
Micek ST, et al. Chest. 2016 Nov;150(5):1008-1014.
Baker D, Quinn B et al. J Nurs Care Qual, 1-7.
Giuliano K, et al. Am J of Infect Control. 2018;46:322-327
Davis J et al. Pa Patient Safety Advisory, 2018;15(3)
Strassle PD, et al. Infect Control Hosp Epidemiol. 2020 Jan;41(1):73-79.
Lacerna CC, et al. Infec control & Hosp Epidemiology 2020;41, 547-552



Build the Will: NV-HAP Causes Harm

🔗 Increased morbidity → 50% are not discharged home

- △ Extended LOS → 7-9 days
- △ Increased Cost → \$36K to \$54K per case
- △ 2x likely for readmission <30 day
- △ 46% ↑ ICU utilization
- △ Increase antibiotic utilization

Magill SS, et al. NEJM 2018;379:1732-1744
Micek ST, et al. Chest. 2016 Nov;150(5):1008-1014.
Baker D, Quinn B et al. J Nurs Care Qual, 1-7.
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Strassle PD, et al. Infect Control Hosp Epidemiol. 2020 Jan;41(1):73-79.
Lacerna CC, et al. Infec control & Hosp Epidemiology 2020;41, 547-552



Relative Harm: Most Common HAIs



Type	% Prevalence	% Mortality	Cost
CAUTI	13%	1.5%	\$1,108
CLABSI	5-10%	12%	\$33,618
SSI	22%	3%	\$19,305
HAP	22%	19%	\$40,000

Hospital-Acquired Pneumonia:

Non-Ventilated versus Ventilated Patients in Pennsylvania

Purpose:

- 🔗 Compare VAP and NV-HAP incidence, outcomes

Methods:

- 🔗 Pennsylvania Database queried
- 🔗 All nosocomial pneumonia data sets (2009-2016)

Results:

Table 1. Pennsylvania Nosocomial Pneumonia Incidence and Number of Patients with NV-HAP or VAP Who Died

Year	Number of NV-HAP Patients	Number of NV-HAP Patients Who Died	Percentage of Patients with NV-HAP Who Died (Confidence Interval)	Number of VAP Patients	Number of VAP Patients Who Died	Percentage of Patients with VAP Who Died (Confidence Limit)
2009	1,977	364	18.41 (16.52–20.3)	922	163	17.68 (14.96–20.39)
2010	1,848	366	19.81 (17.78–21.83)	737	144	19.54 (16.35–22.73)
2011	1,780	318	17.87 (15.9–19.83)	643	127	19.75 (16.32–23.19)
2012	1,620	307	18.95 (16.83–21.07)	571	112	19.61 (15.98–23.25)
2013	1,528	285	18.65 (16.49–20.82)	767	160	20.86 (17.63–24.09)
2014	1,419	256	18.04 (15.83–20.25)	901	199	22.09 (19.02–25.16)
2015	1,427	277	19.41 (17.13–21.7)	912	218	23.90 (20.73–27.08)
2016	1,380	280	20.29 (17.91–22.67)	980	221	22.55 (19.58–25.52)
Total	12,979	2453	18.89%	6433	1344	20.89%

- Mortality
- Incidence
- Total deaths
- Total cost
- Wide-spread



NV-HAP SMCS Research Findings: 2010

Incidence:

- ▲ 115 adults
- ▲ 62% non-ICU
- ▲ 50% surgical
- ▲ Average age 66
- ▲ Common comorbidities:
 - CAD, COPD, DM, GERD
- ▲ Common Risk Factors:
 - Dependent for ADLs (80%)
 - CNS depressant meds (79%)

24,482 patients and 94,247 pt days

Cost:

- ▲ \$4.6 million
- ▲ 23 deaths
- ▲ Mean Extended LOS 9 days
- ▲ 1,035 extra days



HAPPI-2 Incidence of Non-Ventilator Hospital-Acquired Pneumonia

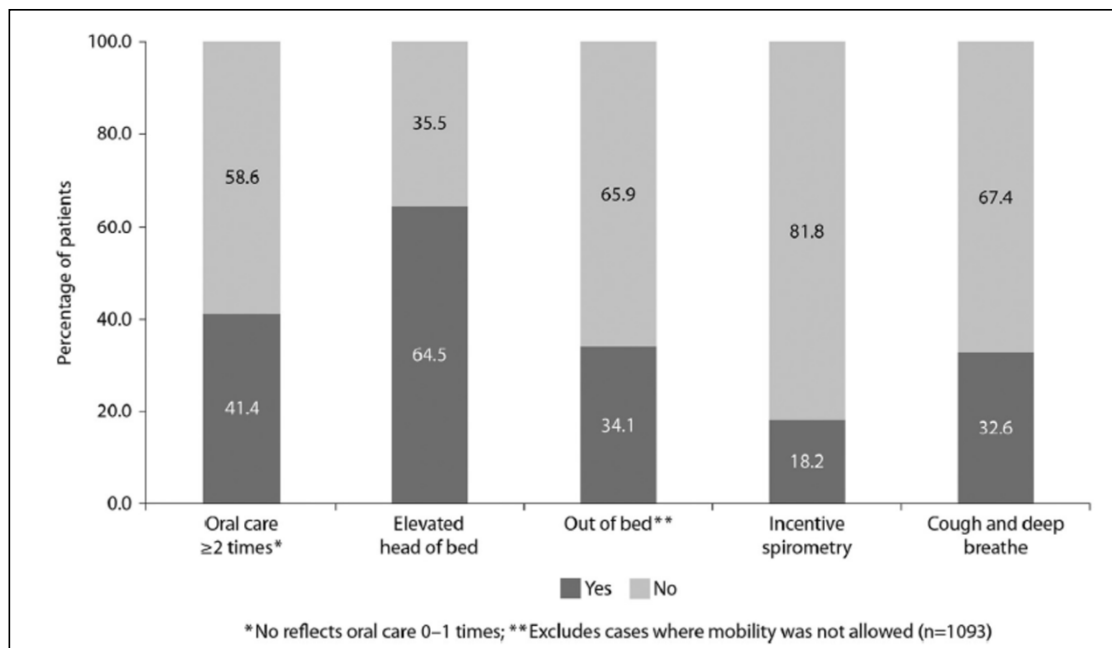


- ▲ Multicenter retrospective chart review
- ▲ Extracted NV-HAP cases per the 2014 ICD-9-CM codes for pneumonia not POA and the 2013 CDC case definition
- ▲ 21 hospitals completed data collection
- ▲ Measured nursing care missed 24hrs before diagnosis
- ▲ Non-vent HAP occurred on every unit



HAPPI-2 Incidence of Non-Ventilator Hospital-Acquired Pneumonia

Missed nursing care 24 hours prior to Non-Vent HAP dx.



HAPPI-2 Incidence of Non-Vent Hospital-Acquired Pneumonia

Results:

🌈 1,300 NV-HAP (0.12-2.28 per 1,000 pt days)

- △ 15.8% mortality
- △ 50% < 66 yrs old
- △ 63% non-surgical
- △ 70.8% outside the ICU
- △ 27.3 % in ICU
- △ 18.8% transferred to ICU
- △ 37.3% LOS >20 days
- △ 57.7% LOS > 15 days
- △ 40.6% admitted from home were discharged back to home
- △ 19.3% readmitted within 30 days
- △ \$36.4 -\$52.56 million in extra costs

- Med-Surg (43.1%; n = 560)
- Telemetry (8.5%; n = 111)
- Progressive (7.2%; n = 93)
- Oncology (4.9%; n = 64)
- Orthopedic (2.8%; n = 37)
- Neurology (1.5%; n = 19)
- Obstetric (0.2%; n = 3)

Epidemiology of Non-Ventilator Hospital Acquired Pneumonia in US

- 🔗 The 2012 US national inpatient sample dataset was used to compare an NV-HAP group to 4 additional group cohorts:
 - Pneumonia on admission
 - General hospital admissions
 - Matched on mortality & disease severity
 - Ventilator-associated pneumonia (VAP)
- 🔗 Secondary outcome: compare HLOS, total hospital charges, and mortality between the NV-HAP group and the 4 | group cohorts

Epidemiology of Non-Ventilator Hospital Acquired Pneumonia in US



- Incidence of NV-HAP was 1.6%, (3.63 per 1,000 pt days)
- NV-HAP was associated with:
 - Increased total hospital charges
 - Longer hospital length of stay
 - Greater likelihood of death



Compared to all groups except patients with VAP



Is Pneumonia Part of the Sepsis Picture?

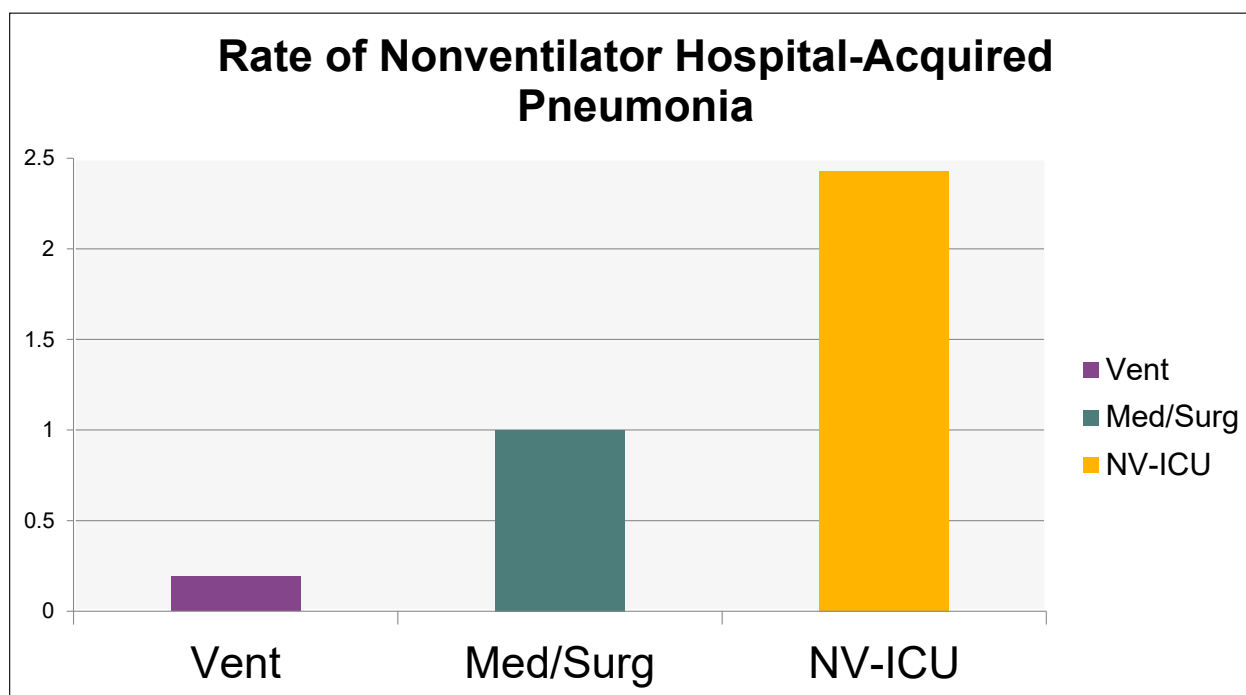
30-50% of sepsis cases may initiate with pneumonia

Site of infection	Frequency %		Mortality %	
	Male	Female	Male	Female
Respiratory	41.8	35.8	22.0	22.0
Bacteremia	21.0	20.0	33.5	34.9
Genitourinary	10.3	18.0	8.6	7.8
Abdominal	8.6	8.1	9.8	10.6
Device related	1.2	1.0	9.5	9.5
Wound/ soft tissue	9.0	7.5	9.4	11.7
Central nervous system	0.7	0.5	17.3	17.5
Endocarditis	0.9	0.5	23.8	28.1
Other/ unspecified	6.7	8.6	7.6	6.5

Risk of developing sepsis 28x greater with NVHAP than with pneumonia on admission



Where is the Highest Risk for NV-HAP?



NV-HAP per 1000 patient days

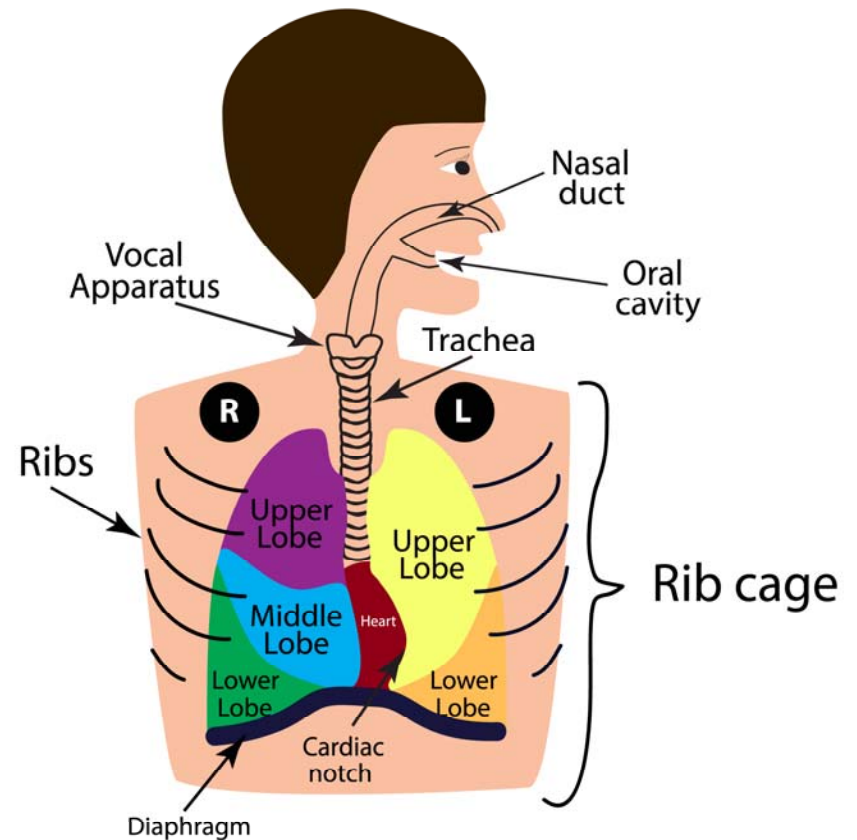
Addressing the risk-factors
associated with NV-HAP
through evidence based
fundamental nursing care
strategies



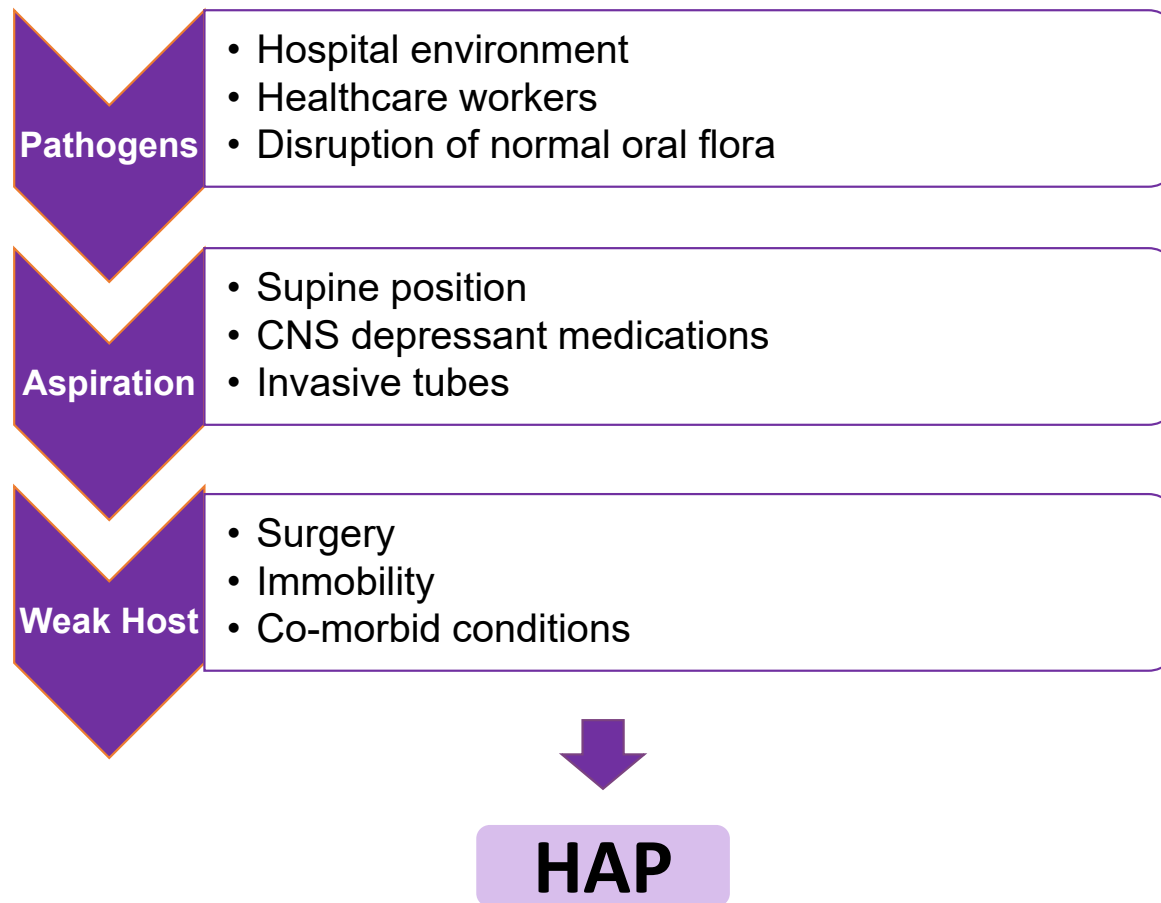
Single Ecosystem

- Entire respiratory tract is one ecosystem
 - Upper-nasal and oral cavities
 - Lower-alveoli
- Not sterile environment
- Oral flora changes in hospitalized patients
- Relationship between dental plaque and pulmonary lavage fluid

Huffnagle GB, et al. Mucosal Immunol. 2017 Mar;10(2):299-306
Johanson WG, et al. N Engl J Med. 1969 Nov 20;281(21):1137-40
Heo SM, et al. Clin Infect Dis. 2008 Dec 15;47(12):1562-70.



Risk Factors for Pneumonia



Where does Pneumonia Start: Oral Bacteria during Hospitalization & Illness



Oral cavity

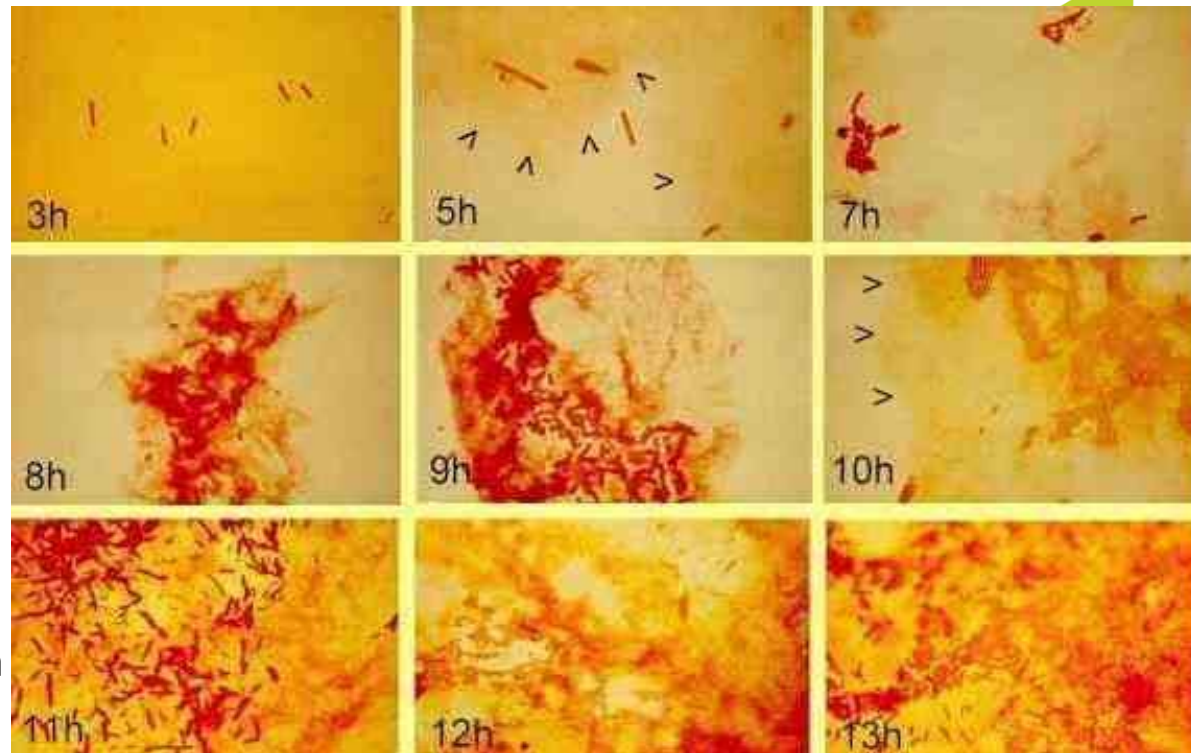
- △ > 1 billion oral microbes
- △ 700-1000 species
- △ Replicate's 5 x in 24hr period

Disruption of Microbiome

- △ Plaque, gingivitis, tooth decay
- △ Reduced salivary flow/change in pH

24-48 hours for HAP pathogens in mouth

If aspirated =100,000,000 bacteria/ml saliva into lungs



Scannapieco FA, Stewart EM, Mylotte JM.. *Crit Care Med.* 1992;20:740-745.
Langmore, S. et.al. (1998) *Dysphagia.* 13, 69-81
Loesche, W. 2012
<http://helios.bto.ed.ac.uk/bto/microbes/biofilm.htm>

Oral Cavity & VAP

- 89 critically ill patients
- Examined microbial colonization of the oropharynx through out ICU stay
- Used pulse field gel electrophoresis to compare chromosomal DNA
- Results:
 - △ Diagnosed 31 VAPs
 - △ 28 of 31 VAPs the causative organism was identical via DNA analysis

- 49 elderly nursing home residents admitted to the hospital
- Examined baseline dental plaque scores & microorganism within dental plaque
- Used pulse field gel electrophoresis to compare chromosomal DNA
- Results
 - △ 14/49 adults developed pneumonia
 - △ 10 of 14 pneumonias, the causative organism was identical via DNA analysis

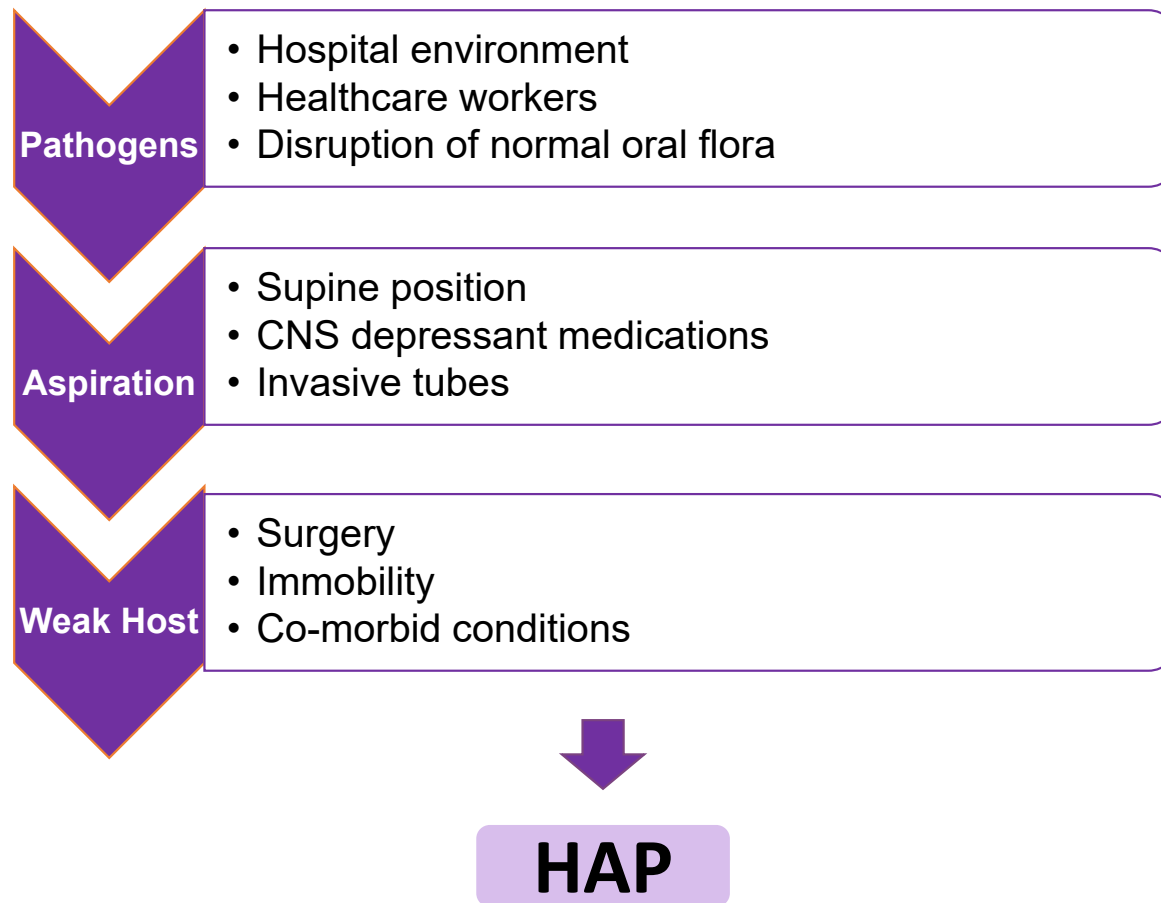


Role of Salivary Flow

- Provides mechanical removal of plaque and microorganisms
- Innate & specific immune components (IgA, cortisol, lactoferrin)
- Patients receiving mechanical ventilation have dry mouth which in turn contributes to accumulation of plaque & reduced distribution of salivary immune factors



Risk Factors for Pneumonia



Micro Aspiration during Sleep in Healthy Subjects



🔺 Prospective duplicate full-night studies

🔺 10 normal male's 22-55 years of age

🔺 Methods:

- Radioactive 99 mTc tracer inserted into the nasopharynx
- Lung scans following final awakening
- No difference in sleep efficacy between 2 study nights

🔺 Results:

50%

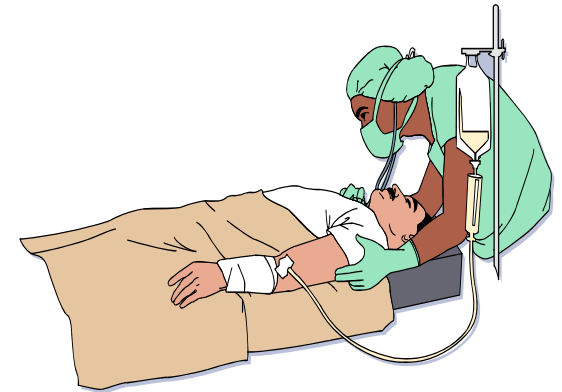
In the lung parenchyma



Body Position: Supine versus Semi-recumbent (30-45 degrees)

Methodology

- 19 mechanically ventilated patients
- 2 period crossover trial
- Study supine and semirecumbent positions over 2 days
- Labeled gastric contents (Tc 99m sulphur colloid)
- Measured q 30 min content of gastric secretions in endobronchial tree in each position
- Sampled ET secretions, gastric juice & pharyngeal contents for bacteria



Body Position: Supine versus Semi-recumbent

Results:

Radioactive contents higher in endobronchial secretions in supine patients

Time dependent:

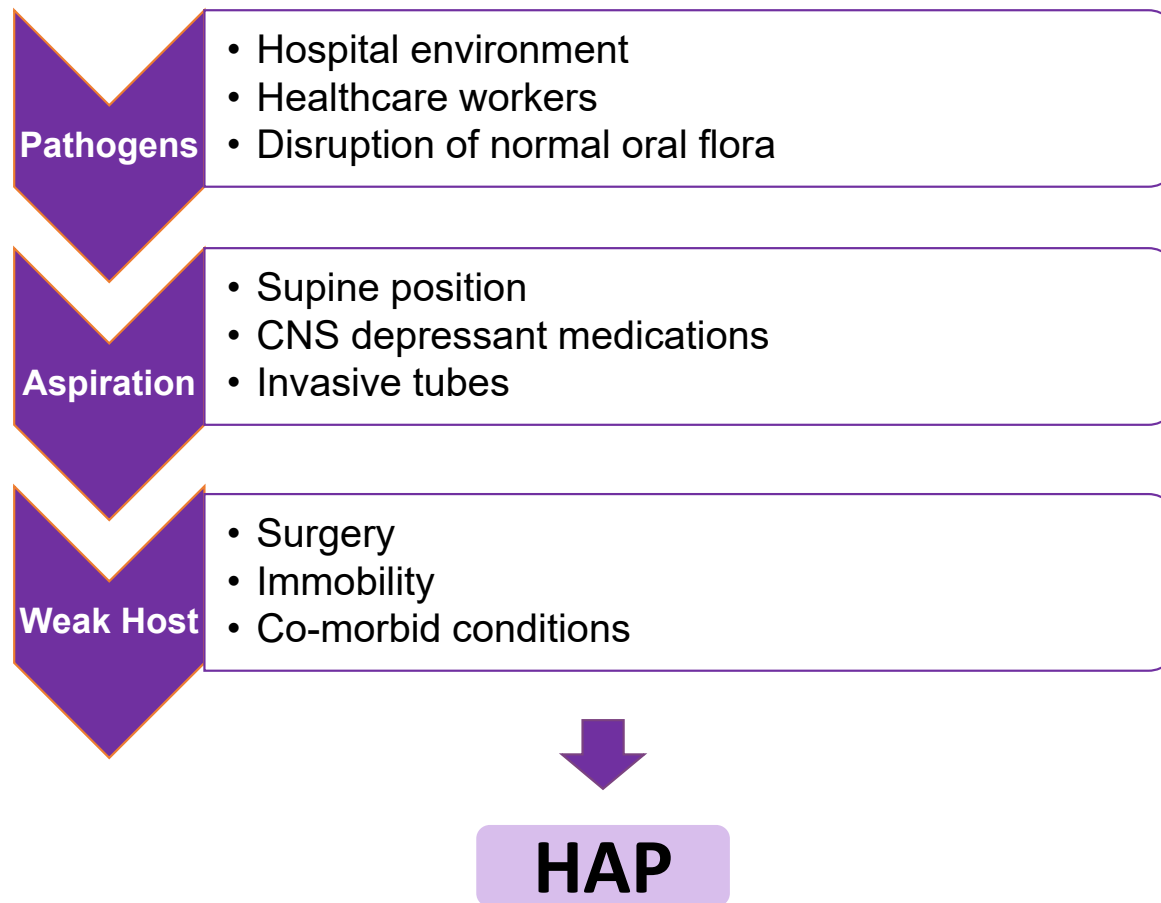
- Supine: 298cpm/30min vs. 2592cpm/300min
- HOB: 103cpm/30min vs. 216cpm/300min



Same microbes cultured in all 3 areas

- HOB: 32%
- Supine: 68%

Risk Factors for Pneumonia



Weak Host: Who is at Highest Risk?

- Male
- Elderly
- Surgical
- ICU
- Chronic disease
 - DM, CHF, CKD, COPD, alcoholism

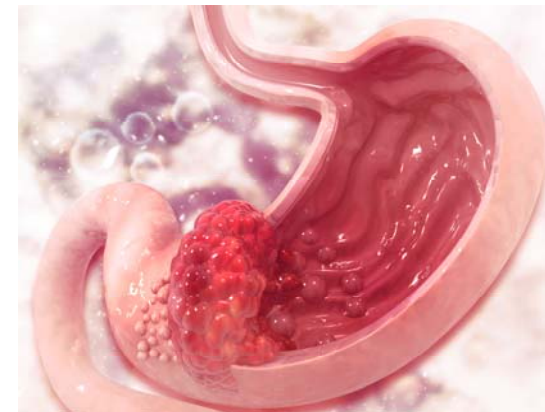
- Immunocompromised
- More than 6 medications
- Low albumin
- On antibiotics
- Dependent for ADLs
- Smokers



Stewardship of Stress Ulcer Prophylaxis (SUP)



- 🔗 The most common complication of SUP is pneumonia
- 🔗 ICU enteral fed patients –
 - △ no benefit & may increase risk for pneumonia (Huang study)
 - △ Avoid unnecessary use
- 🔗 Acute Stroke patients (Systematic Review & Meta-Analysis)
 - △ Acid suppressive medications are an important contributor to pneumonia development, especially PPIs
- 🔗 May lead to loss of protective bacteriostatic effect of gastric acid
- 🔗 Higher risk of Clostridium difficile infection when combined with antibiotics



Systematic Review of Inpatient Mobilization



- 🔍 Literature review of research studies that provides evidence to the consequences of mobilizing or not mobilizing hospitalized adult patients
- 🔍 36 studies were included
- 🔍 Findings in four theme areas:
 - △ Physical outcomes include pain relief, reduced deep vein thrombosis, less fatigue, less delirium, less pneumonia, improved physical function (no relationship to falls)
 - △ Psychological outcomes include less anxiety, ↓ depressive mood, ↓ distress symptoms, ↑ comfort and ↑ satisfaction
 - △ Social outcomes include ↑ quality of life and more independence
 - △ Organizational outcomes include ↓ length of stay, ↓ mortality and ↓ cost



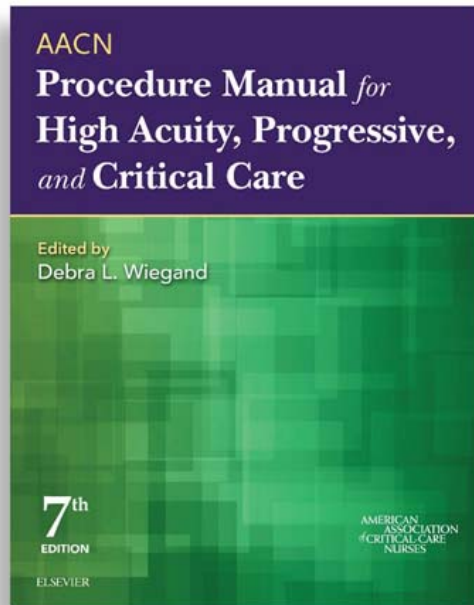
What about Incentive Spirometry?

- Commonly prescribed to improve lung function for patients with surgery, pneumonia, rib fractures, etc.
- No evidence that Incentive Spirometry is effective in the prevention of pulmonary complications in upper abdominal surgery or CABG (Cochrane 2012 & 2014)
- Postop IS did not demonstrate any effect for bariatric surgery patients on postop hypoxemia, SaO₂ level, or postop pulmonary complications (JAMA Surg 2017)





AACN Procedural Manual-7th Ed



Procedure 4: Endotracheal Tube Care and Oral Care

Authors:

Kathleen M Vollman

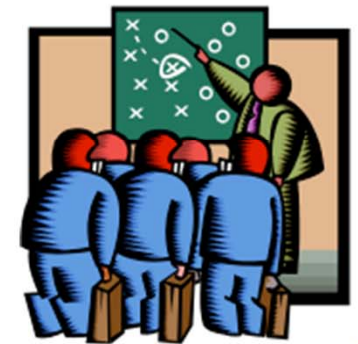
Mary Lou Sole

Barbara Quinn

SMCS HAP Prevention Plan

Phase 1: Oral Care

- Formation of new quality team: Hospital-Acquired Pneumonia Prevention Initiative (HAPPI)
- New oral care protocol to include non-ventilated patients
- New oral care products and equipment for all patients
- Staff education and in-services on products
 - Monthly audits



Gap Analysis



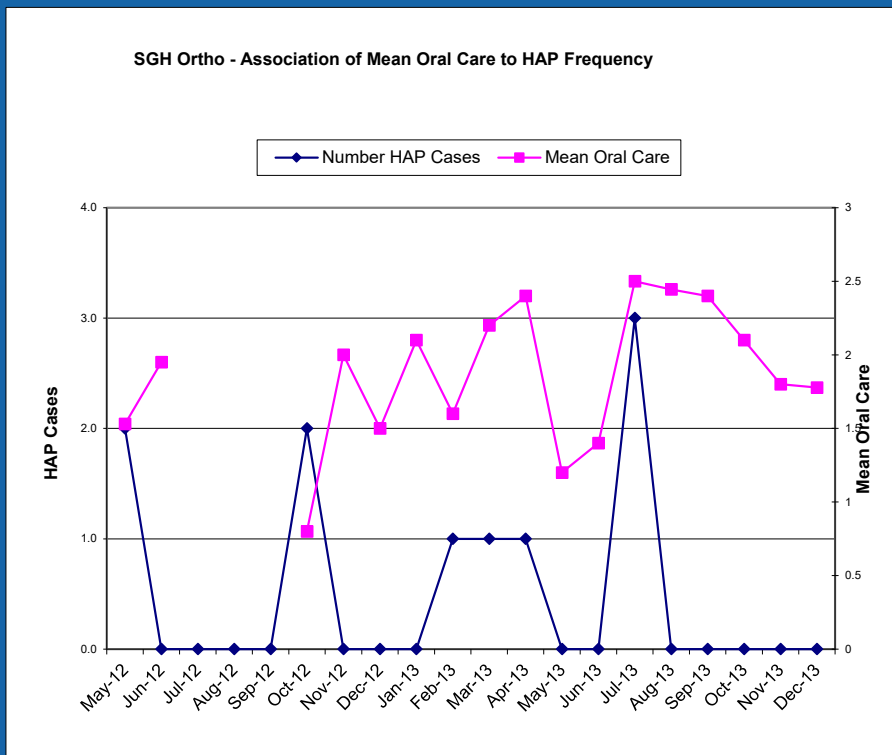
Best Practice	Our Gaps	Action To Take
Comprehensive oral care for all (CDC, SHEA)	ICU vent patients only	Develop inclusive oral care protocol
Oral CHG (0.12%) periop adult CV surgery and vent pts. (CDC, ATS, IHI)	Not using CHG on these patients	Added to preprinted orders, and to protocol
Therapeutic oral care tools (ADA)	Poor quality oral care tools; Absence of denture care supplies	New tools and supplies.



Protocol – Plain & Simple

Patient Type	Tools	Procedure	Frequency
Self Care / Assist	Brush, paste, rinse, moisturizer • Soft-bristled toothbrush • Toothpaste with dentifrice • Antiseptic mouth rinse (alcohol-free) • Moisturizer (Petroleum-free)	Provide tools Brush 1-2 minutes Rinse	4X / day
Dependent / Aspiration Risk	Suction toothbrush kit (4)	Package instructions	4X / day
Dependent / Vent	ICU Suction toothbrush kit (6) • CHG for vent & cardiac surgery patients	Package instructions	6X / day
Dentures	Denture cup, brush Cleanser Adhesive	Remove dentures & soak Brush gums, mouth Rinse	4X / day

Provide Meaningful Data



Ortho Unit had ZERO HAP cases in the last 4 months of 2013!!

Great WORK!!

Remember, the goal is to provide and document oral care after each meal and before bedtime.

Oral Care Knowledge & Attitude Survey:



Method:

- Staff survey
- Pre – Post education

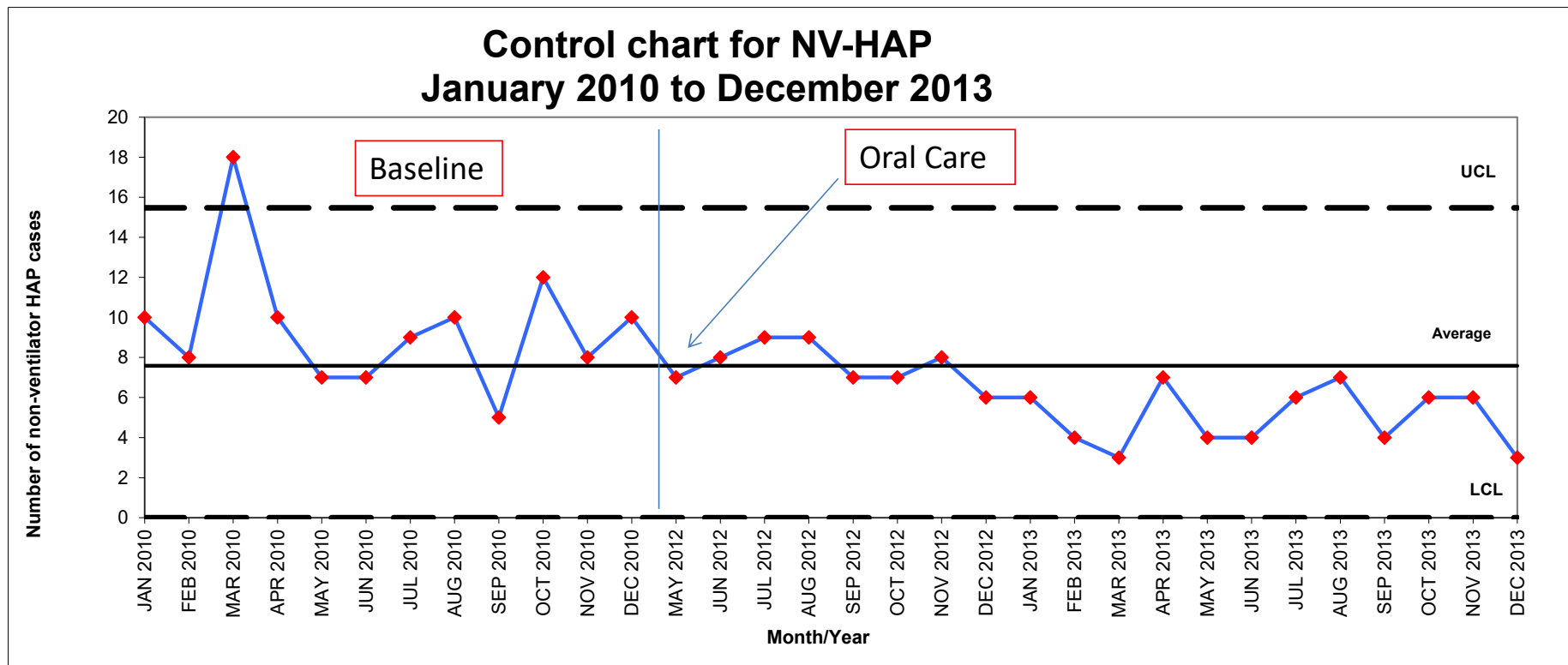
Results:

- Awareness of oral care protocol (77%)
- Priority of care for NAs (96%)
- RN perception that their patients received oral care (300%)

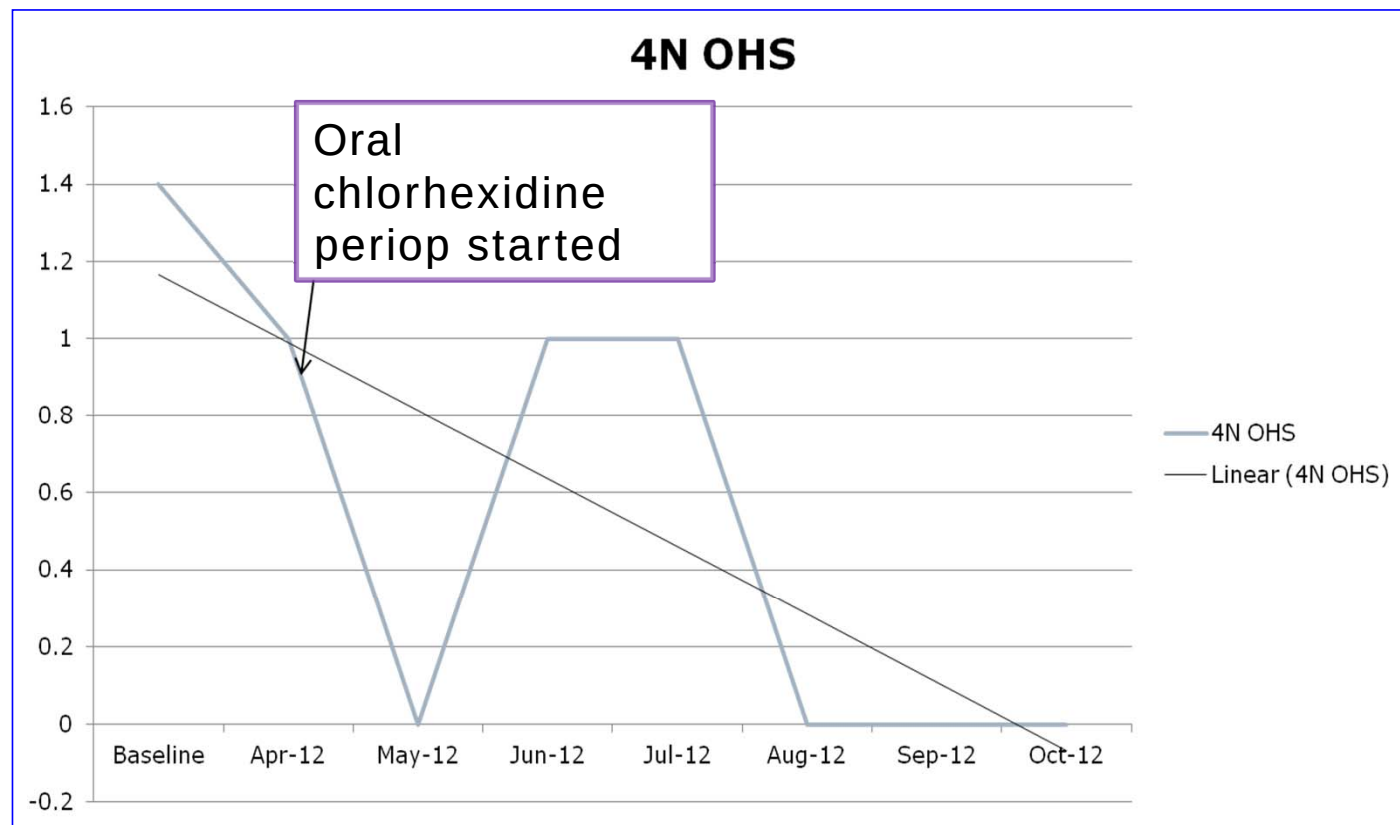


NV-HAP Incidence

50 % Decrease from Baseline



Open Heart Surgery Patients: NV-HAP Reduced 75%





Return on Investment

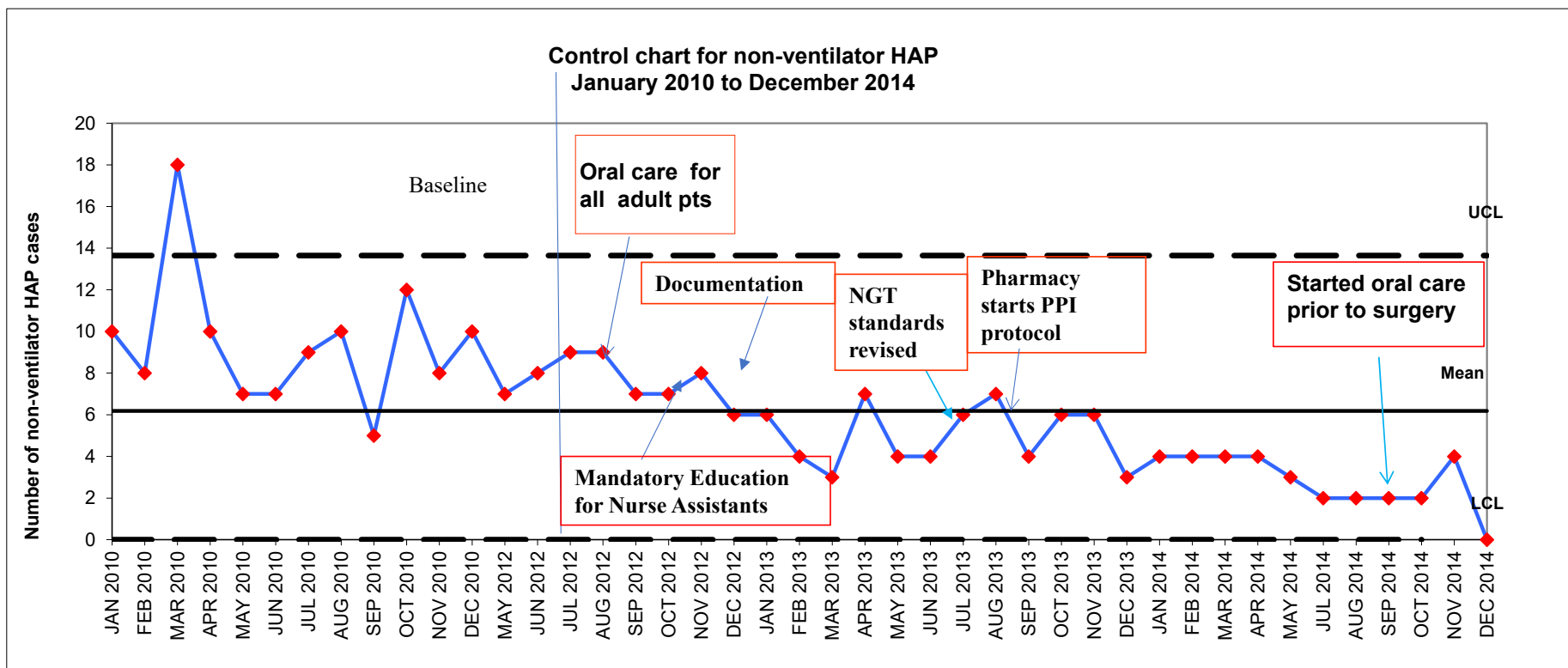
- 60 NV-HAP avoided Jan 1 – Dec. 31 2013
- \$2,400,000 cost avoided
- 117,600 cost increase for supplies
- \$2,282,400 return on investment

8 lives saved

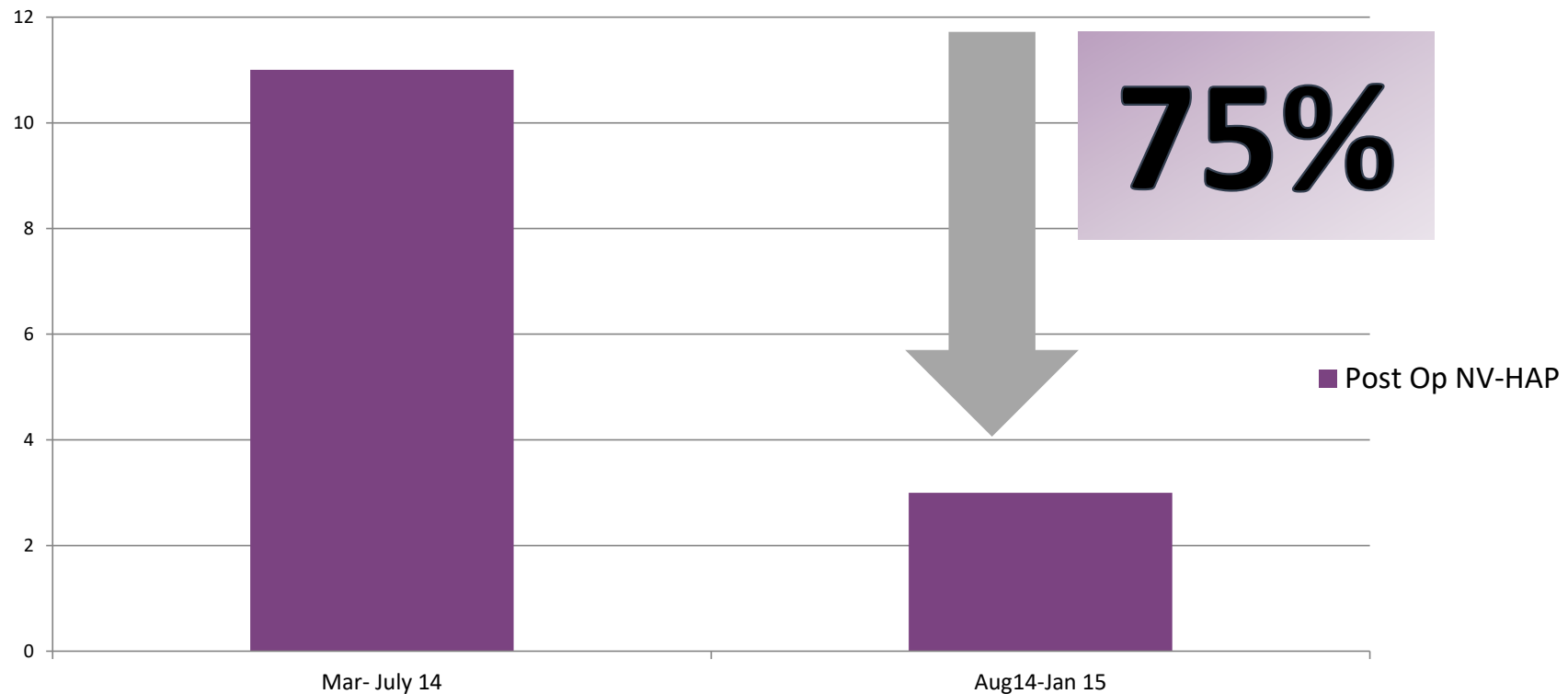
PRICELESS



NV-HAP ↓ 70% from baseline!



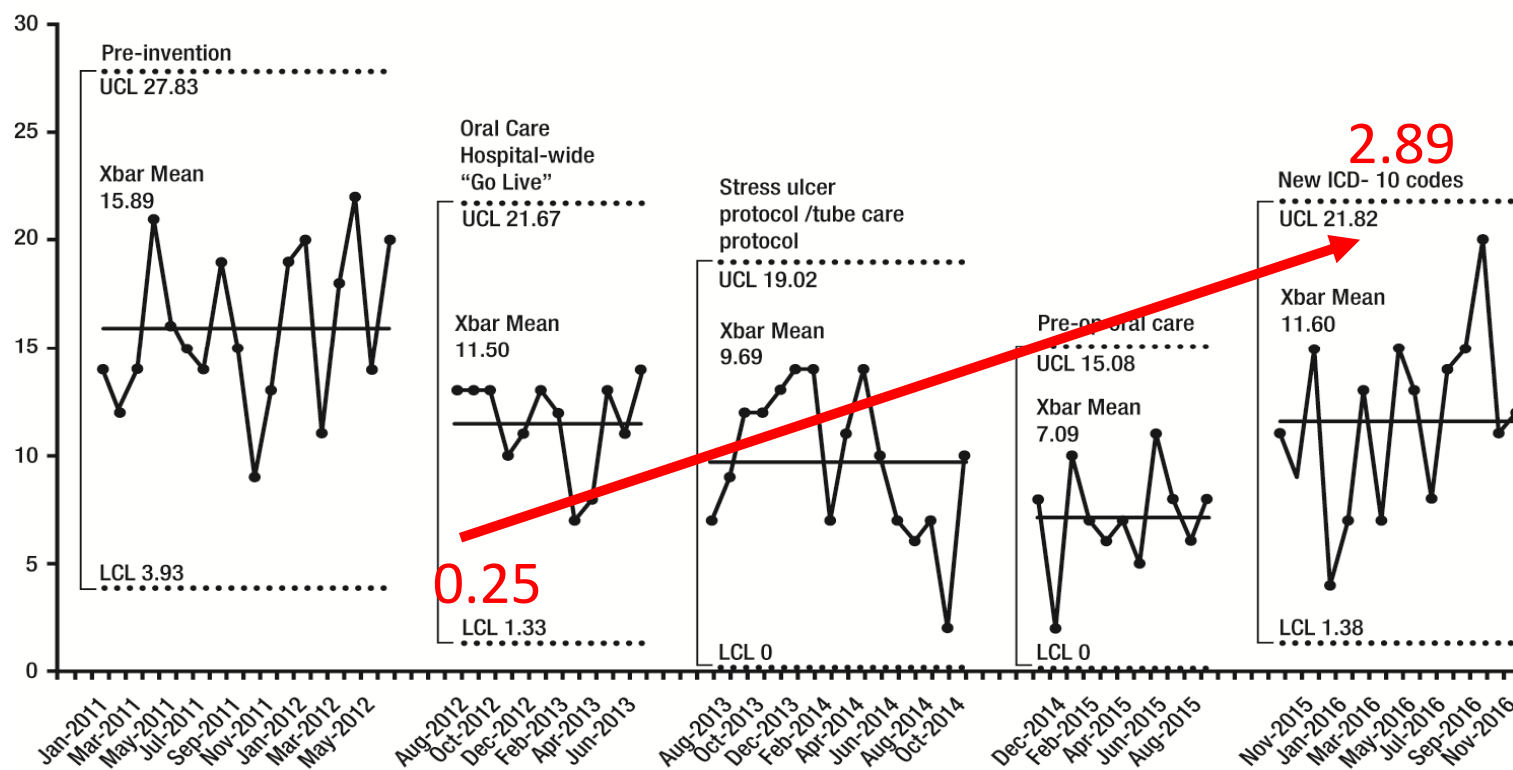
Post-Operative NV-HAP (all adult inpatient surgery) Incidence 6 months Pre-Oral Care vs. 6 Months After



Quinn B, Presented at AACN NTI, Houston, Tx, 2017

Sustainability Hospital Wide Oral Care from .25 to 2.89 (almost 3x a day)

Figure 1: Statistical process control R and X-bar-charts:
International Statistical Classification of Diseases and Related Health Problems (ICD) codes (3 standard deviations)



Outcomes:

From the Beginning to 2014

🌀 Between May 2012 and December 2014

🌀 Sutter Medical Center avoided 164 cases of NV-HAP:

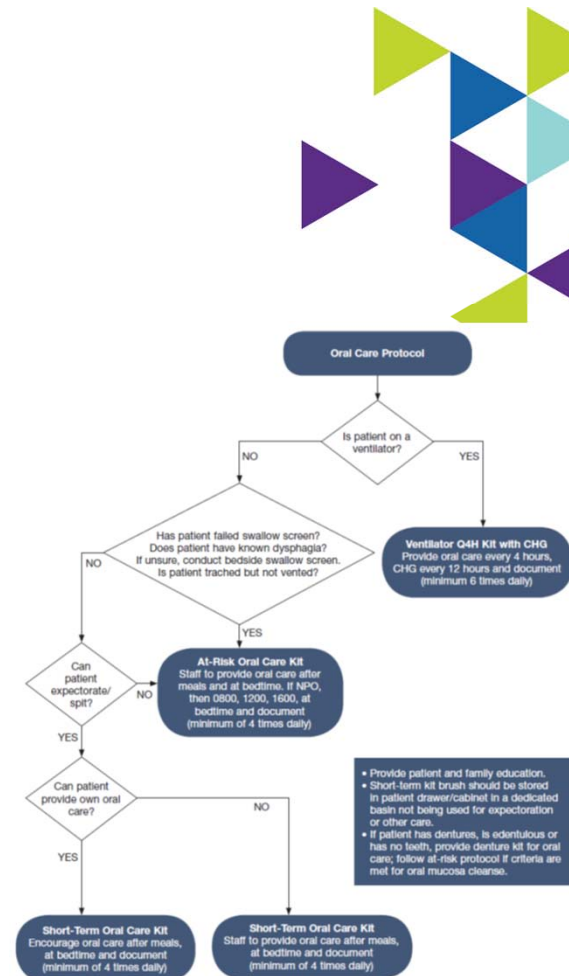
△ **\$5.9 million**

△ **31 lives**

△ **656-1476 extra days in the hospital**

Nurse Driven Oral Care Protocol to Improve NV-HAP

- 🔗 QI project, 650 bed level 1 trauma center
- 🔗 Data measure retrospectively/prospectively using ICD 9 & 10 codes not POA for NV-HAP and VAP
- 🔗 7 months baseline, 7 months intervention
- 🔗 Method:
 - △ Evaluated current practice, the literature and oral care supplies
 - △ Pilot program with new oral care protocols/supplies for self care, assisted oral care and ventilator oral care
 - △ Expanded to whole hospital post pilot area



Results

Staff adherence to protocol 76% (36%-100%)

NV-HAP

△ Baseline: 202 charts/52 NV-HAP's-20 deaths

△ Post: 215 charts/26 NV-HAP's (p< 0.0001)-4 deaths

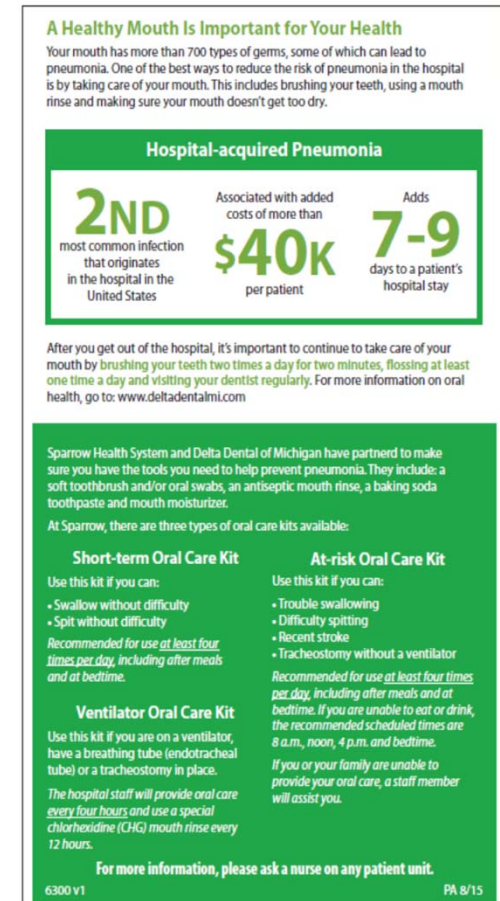
VAP

△ Baseline: 56 VAE's/ 12 VAP's (2.87 per 1000 vent days)

△ Post: 49 VAE's/3 VAP's (1.26 per 1000 vent days)

50% reduction in NV-HAP, avoided 16 deaths
& 1.4 million dollars

Figure 2. Patient Education Information Sheet



A Healthy Mouth Is Important for Your Health

Your mouth has more than 700 types of germs, some of which can lead to pneumonia. One of the best ways to reduce the risk of pneumonia in the hospital is by taking care of your mouth. This includes brushing your teeth, using a mouth rinse and making sure your mouth doesn't get too dry.

Hospital-acquired Pneumonia

2ND most common infection that originates in the hospital in the United States

Associated with added costs of more than **\$40k** per patient

Adds **7-9** days to a patient's hospital stay

After you get out of the hospital, it's important to continue to take care of your mouth by brushing your teeth two times a day for two minutes, flossing at least one time a day and visiting your dentist regularly. For more information on oral health, go to: www.deltadentalmi.com

Sparrow Health System and Delta Dental of Michigan have partnered to make sure you have the tools you need to help prevent pneumonia. They include: a soft toothbrush and/or oral swabs, an antiseptic mouth rinse, a baking soda toothpaste and mouth moisturizer.

At Sparrow, there are three types of oral care kits available:

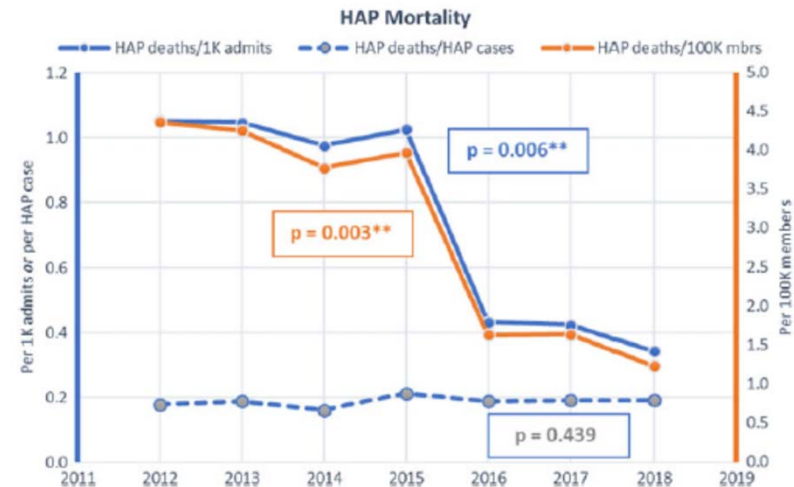
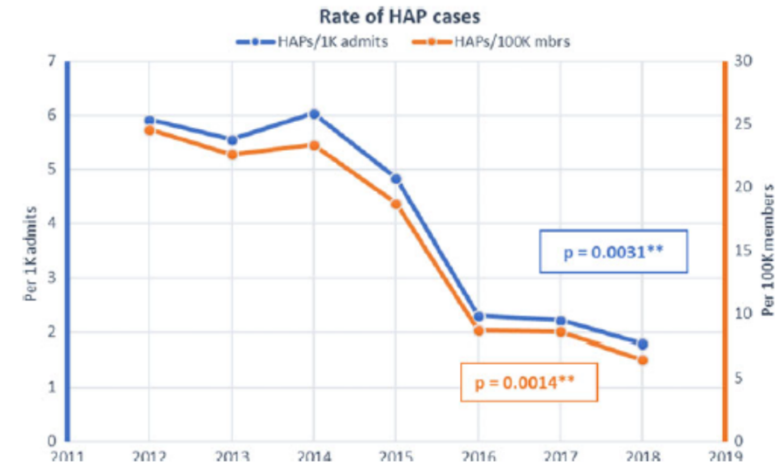
Short-term Oral Care Kit	At-risk Oral Care Kit
Use this kit if you can: • Swallow without difficulty • Spit without difficulty Recommended for use <u>at least four times per day</u> , including after meals and at bedtime.	Use this kit if you can: • Trouble swallowing • Difficulty spitting • Recent stroke • Tracheostomy without a ventilator Recommended for use <u>at least four times per day</u> , including after meals and at bedtime. If you are unable to eat or drink, the recommended scheduled times are 8 a.m., noon, 4 p.m. and bedtime. If you or your family are unable to provide your oral care, a staff member will assist you.
Ventilator Oral Care Kit Use this kit if you are on a ventilator, have a breathing tube (endotracheal tube) or a tracheostomy in place. The hospital staff will provide oral care every four hours and use a special chlorhexidine (CHG) mouth rinse every 12 hours.	

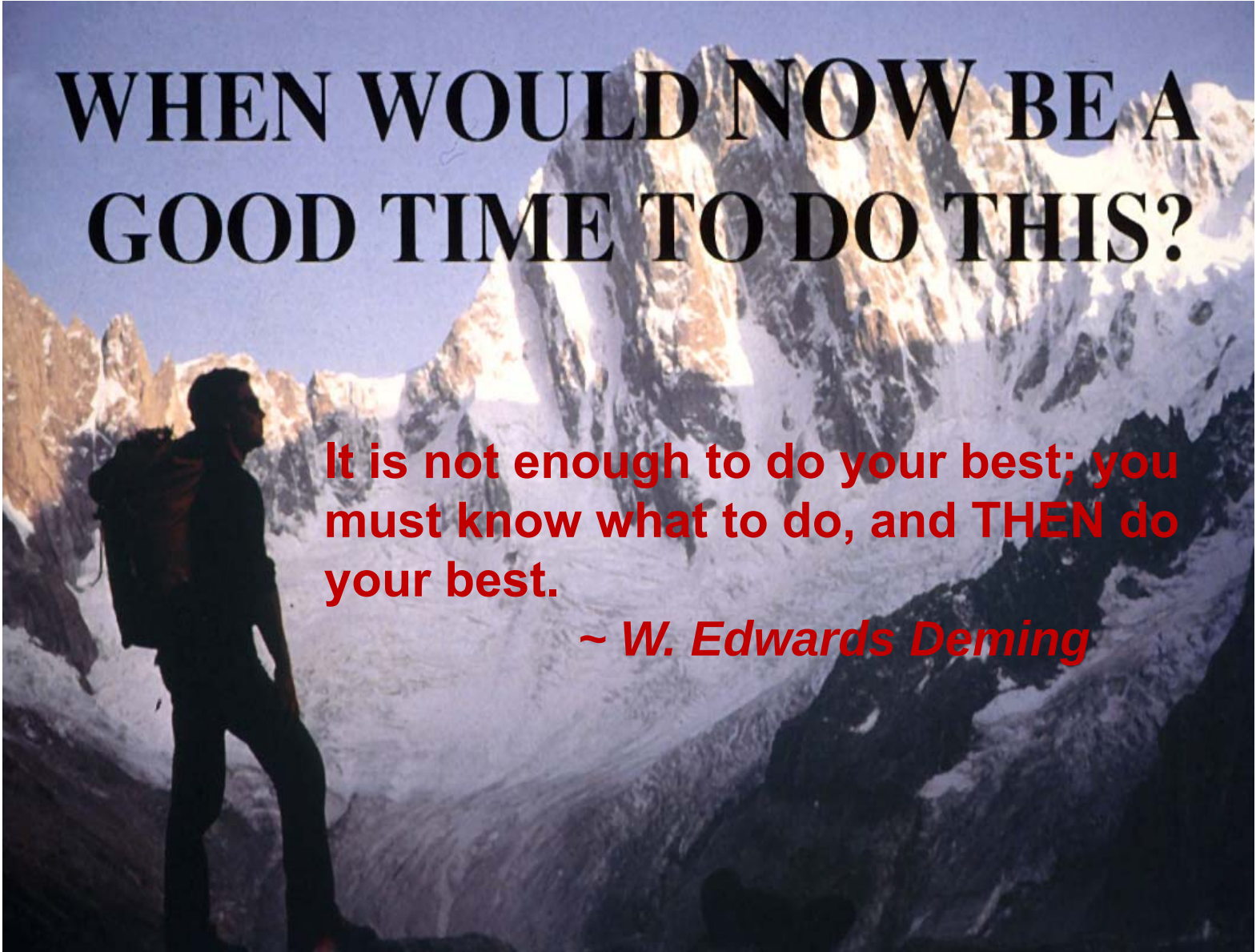
For more information, please ask a nurse on any patient unit.

6300 v1 PA 8/15

A Successful Program to ↓ NVHAP in a Large Hospital System

- 21 hospital system
- Longitudinal observational design
- Intervention
 - △ Upright for meals, mobilization, swallow evaluation, sedation restrictions, rigorous oral care, feeding tube care (ROUTE)
- Additional results
 - △ Reduction in antibiotic days
 - Carbapenem, quinolone, aminoglycoside & vancomycin
 - △ ↓ Benzodiazepine use





WHEN WOULD NOW BE A GOOD TIME TO DO THIS?

It is not enough to do your best; you must know what to do, and THEN do your best.

~ W. Edwards Deming

3 Steps YOU can Take to Address NV-HAP



Slide courtesy of Barb Quinn

Two Options for Measuring NV-HAP Baseline and Outcome Metric



A. International Classification of Diseases (ICD-10) for Pneumonia AND Not Present on Admission

- △ J12 – 18.9 minus CAP, VAP, Pneumonitis

- △ Use for tracking only

B. ICD 10 NVHAP + NHSN definition for NVHAP

- △ More labor-intensive; more accurate



Metrics for NVHAP

- 🔗 Percent NVHAP ($\text{\#NVHAP} / \text{\#patients} \times 100$)
- 🔗 NVHAP/1000 pt days ($\text{\#NVHAP} / \text{\# pt days} \times 1000$)
- 🔗 NVHAP Count
- 🔗 No national benchmark so set internal goal
- 🔗 Current literature: 1.22 – 5.9 / 1000 pt days



Future State--Objective Surveillance Definitions for NV-HAP: Clinical Indicators in the EHR

	Worsening oxygenation	≥3 days of new antibiotics	Temp > 38°C	White Blood Cell Count <4 or >12	Chest-X-Ray or CT Chest	Respiratory culture
Definition #1	✓					
Definition #2	✓	✓				
Definition #3	✓	✓	Either			
Definition #4	✓	✓	✓			
Definition #5	✓	✓	✓	✓		
Definition #6	✓	✓	✓	✓	✓	
Definition #7	✓	✓	Either		✓	
Definition #8	✓	✓	✓	✓	✓	✓
Definition #9	✓	✓	Either		Either	
Definition #10	✓	✓	✓	✓	Either	

Identified 0.6 event per 100 admission and associated with a 6 fold higher risk of death compared with matched controls

Process Metrics for NV-HAP (examples)

🔗 Reducing germs in mouth:

- △ Frequency of oral care delivered / per patient day

🔗 Reducing aspiration risk:

- △ % patients with swallow screens complete
- △ % patients on continuous TF with HOB >30 degrees
- △ % patients up in chair for meals

🔗 Strengthen host defenses

- △ % non-ICU patients with daily mobilization
- △ % patients with BG 100-180
- △ % patients not on stress ulcer prophylaxis
- △ % patients on enteral feeding who receive >80% of ordered calories





2. GAP Analysis

3. Manage the Change

 Utilize a scientific model to provide structure Include:

- △ Sponsorship support
- △ Communication
- △ Education for staff and patients/families
- △ Engagement of staff
- △ Feedback
- △ Accountability



**Forbid yourself to be deterred by
poor odds just because your
mind has calculated that the
opposition is too great. If it were
easy, everyone would do it.**



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