The Next Big Adventure: Prevention of Non-Ventilator Hospital Acquired Pneumonia

Kathleen Vollman
ADVANCING NURSING THROUGH KNOWLEDGE & INNOVATION

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Disclosures

- Consultant-Michigan Hospital Association Keystone Center
- Subject matter expert CAUTI, CLABSI, HAPU, Sepsis, Safety culture
- Consultant and speaker bureau
  - △ Stryker's Sage business
  - △ LaJolla Pharmaceutical
  - △ Potrero Medical
- Baxter Healthcare 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

Polling Question

- What is your current role?

  1. Frontline nurse
  2. Infection preventionist
  3. Infection preventionist director
  4. Doctor/Medic
  5. Epidemiologist
  6. Other

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."
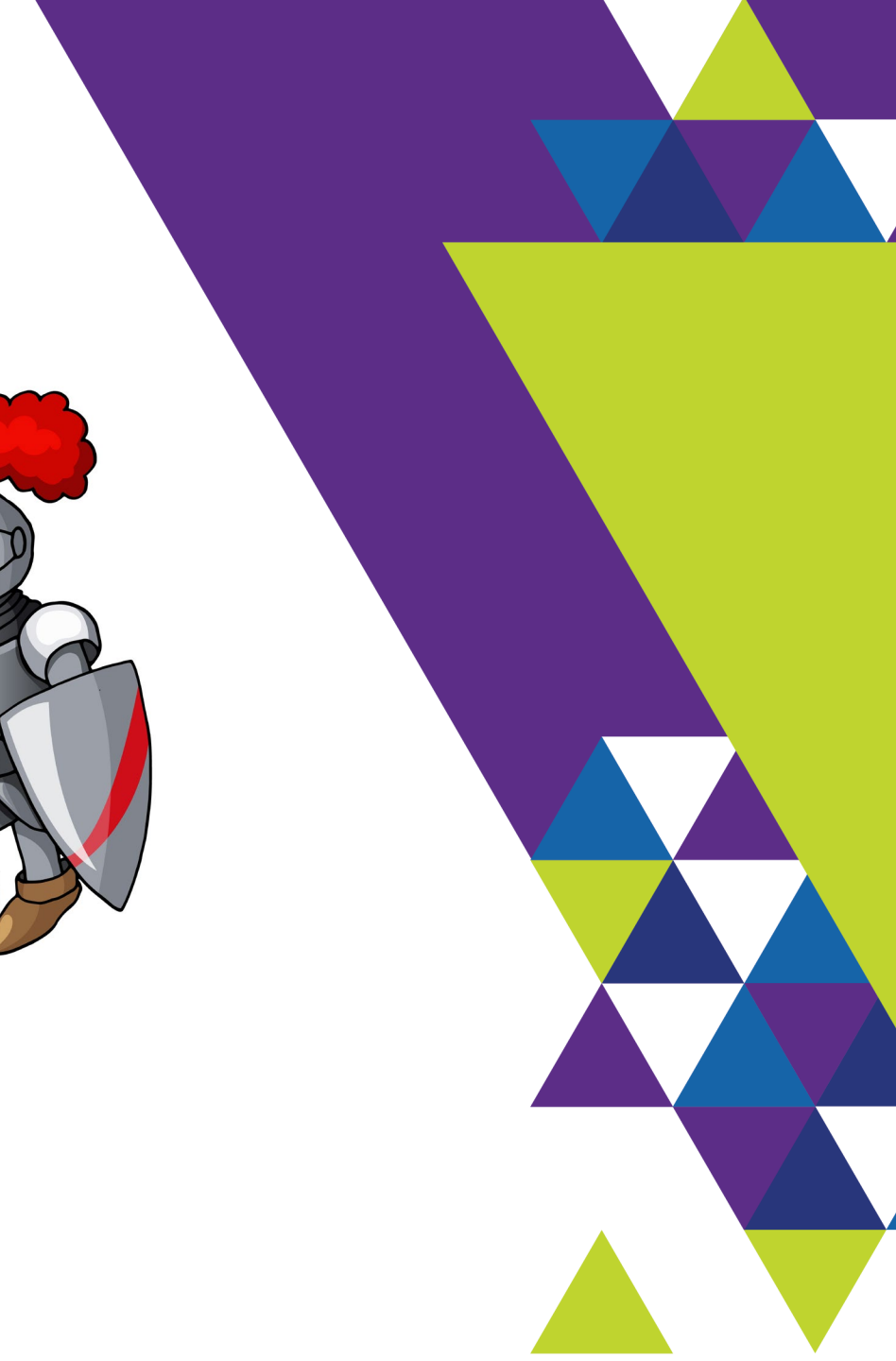
- Florence Nightingale

Advocacy = Safety

Protect The Patient From Bad Things Happening on Your Watch

Implement Interventional Patient Hygiene

Interventional Patient Hygiene

Hand Hygiene

Catheter Care

- Hygiene...the science and practice of the establishment and maintenance of health

- Interventional Patient Hygiene....nursing action plan directly focused on fortifying the patients host defense through proactive use of evidence-based hygiene care strategies

Comprehensive Oral Care Plan
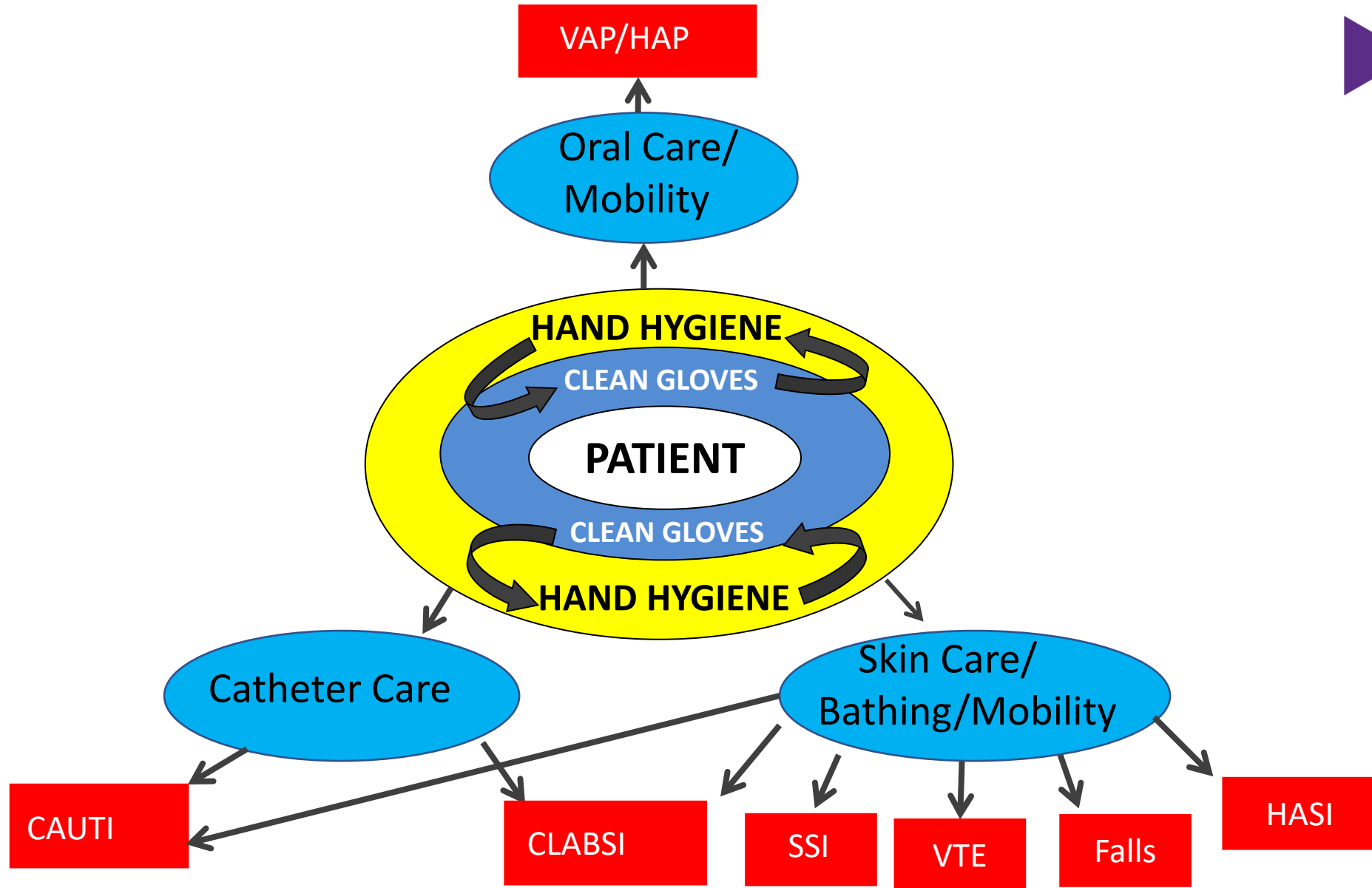
Incontinence Associated Dermatitis Prevention Program

Pressure Ulcer Prevention

Bathing & Assessment

INTERVENTIONAL PATIENT HYGIENE(IPH)

Vollman KM. Intensive Crit Care Nurs, 2013;22(4): 152-154

Achieving the Use of the Evidence

Factors Impacting the Ability to Achieve Quality Nursing Outcomes at the Point of Care

Skills & Knowledge

Resources & System

Value

Attitude & Accountability
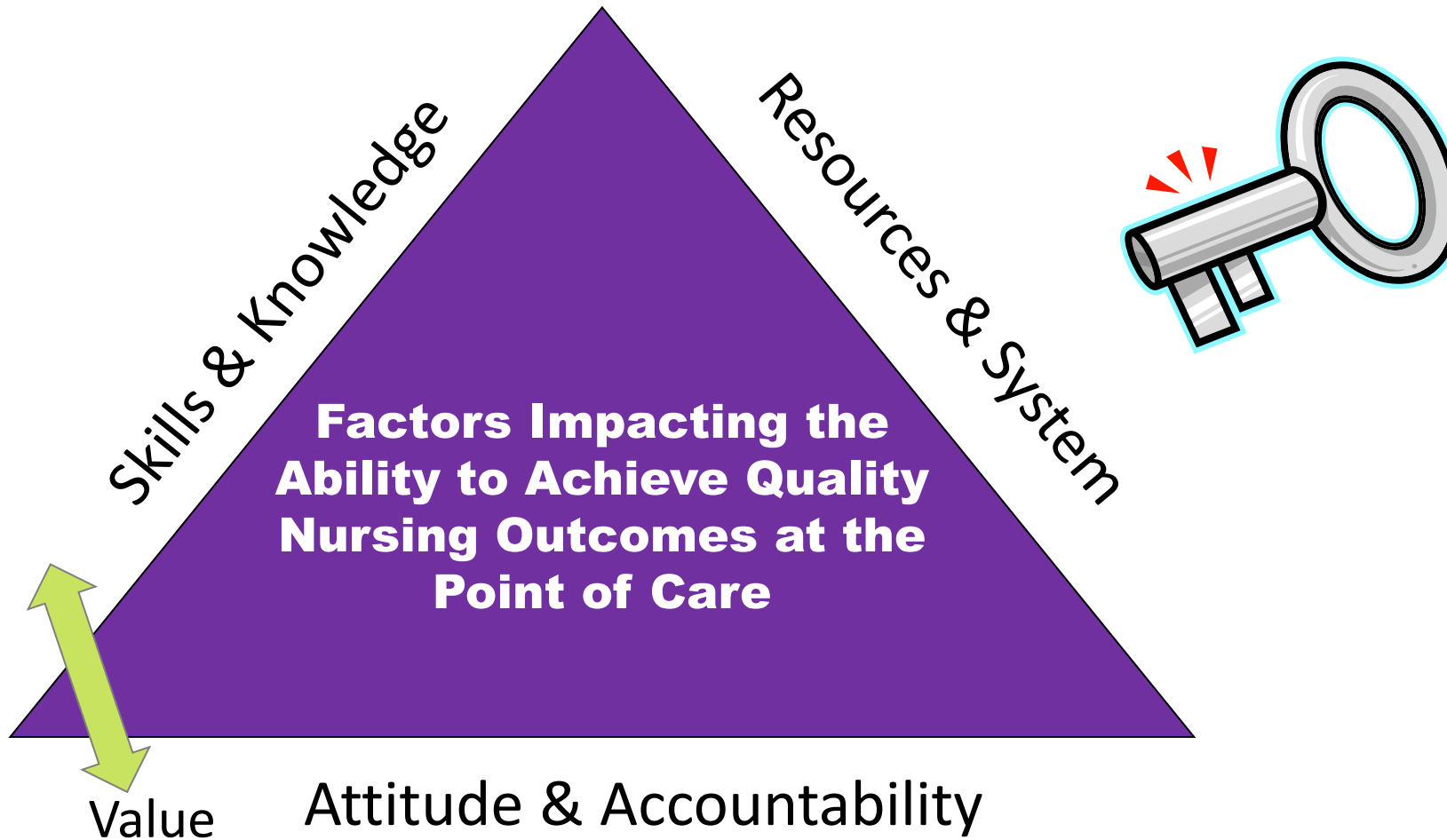
Missed Nursing Care

- "Any aspect of required patient care that is omitted (either in part or whole) or significantly delayed."

- A predictor of patient outcomes

- Measures the process of nursing care

SORRY WE MISSED YOU!

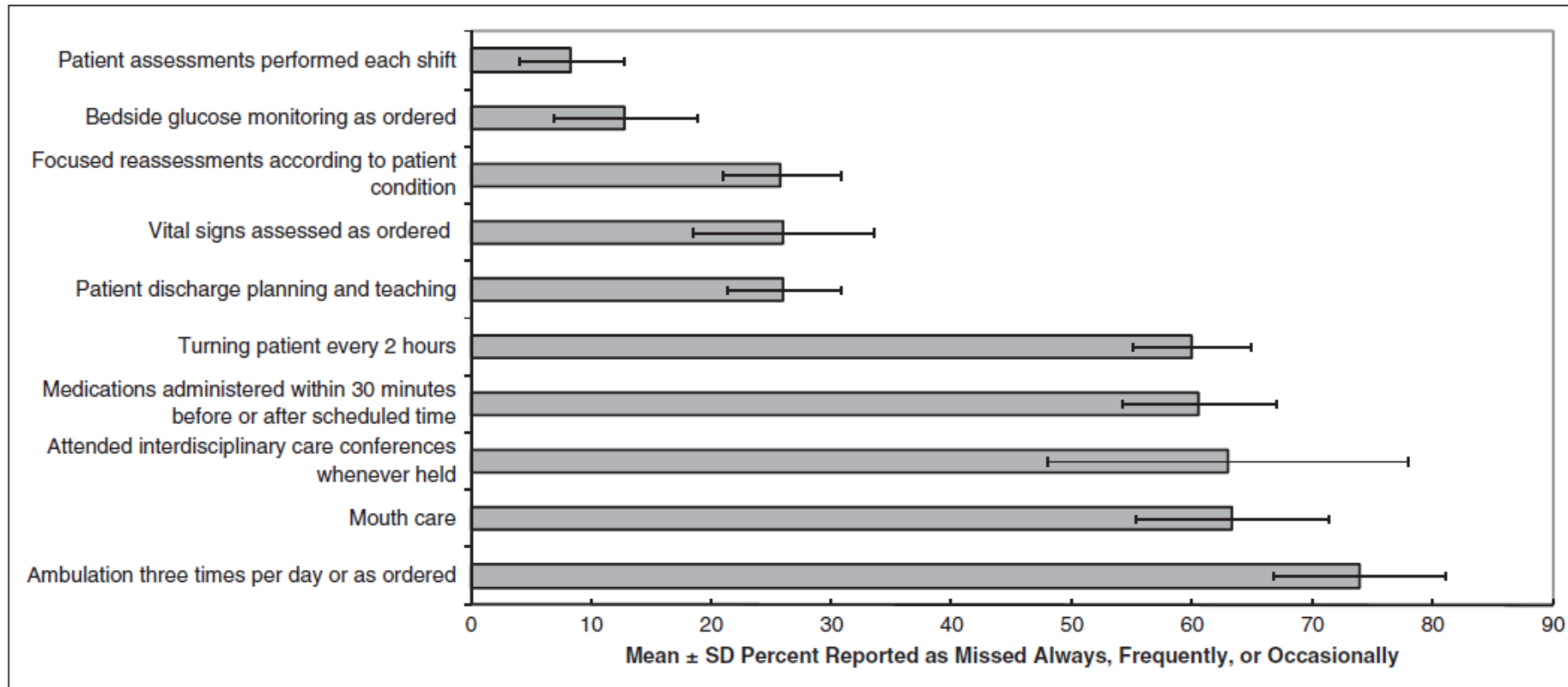# Hospital Variation in Missed Nursing Care

Figure 2. Elements of care most and least frequently missed. The solid bars represent the means across all 10 hospitals, and the range lines indicate the standard deviations.

Patient Perceptions of Missed Nursing Care

Table 2. Elements of Nursing Care by Ability of Patient to Report and Extent Missed*			
	Fully Reportable	**Partially Reportable**	**Not Reportable**
			■ Patient assessment ■ Surveillance ■ IV site care
Frequently Missed	■ Mouth care ■ Listening ■ Being kept informed	■ Ambulation ■ Discharge planning ■ Patient education	
Sometimes Missed	■ Response to call lights ■ Response to alarms ■ Meal assistance ■ Pain medication and follow-up	■ Medication administration ■ Repositioning	
Rarely Missed	■ Bathing	■ Vital signs ■ Hand washing	

* IV, intravenous.

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

- 1 in ever 100 admissions

- 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.
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

Incidence and Outcomes of Non-Ventilator-Associated Hospital-Acquired Pneumonia in 284 US Hospitals Using Electronic Surveillance Criteria

- Cohort study

- Retrospectively applied clinical surveillance criteria for NV-HAP to electronic health record data from 284 US hospitals. The medical records of 250 patients who met the surveillance criteria were reviewed for accuracy.

- NV-HAP, defined as sustained deterioration in oxygenation for 2 or more days in a patient who was not ventilated concurrent with abnormal temperature or white blood cell count, performance of chest imaging, and 3 or more days of new antibiotics.

- 6,022,185 hospitalizations

- 32,797 NV-HAP events (.55 per 100 admissions & .96 per 1000 patient days)

- 74% outside ICU

- Median LOS 16 (11-26)

- Mortality: 22.4%

- Compared with chart review 81%

1 in 200 hospitalizations
1 in 5 died in the hospital.
NV-HAP may account for up to 7% of all hospital deaths.

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

Question

- Does your facility currently measure non-ventilator hospital acquired pneumonia
  - △ Yes
  - △ no

NV-HAP SMCS Research Findings: 2010

24,482 patients and 94,247 pt days

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%)

Cost:
- $4.6 million
- 23 deaths
- Mean Extended LOS 9 days
- 1,035 extra days

Quinn, B. et al. Journal of Nursing Scholarship, 2014. 46(1):11-19

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.

Baker D, Quinn B, Amer J of Infect Control, 2018;46:2-7
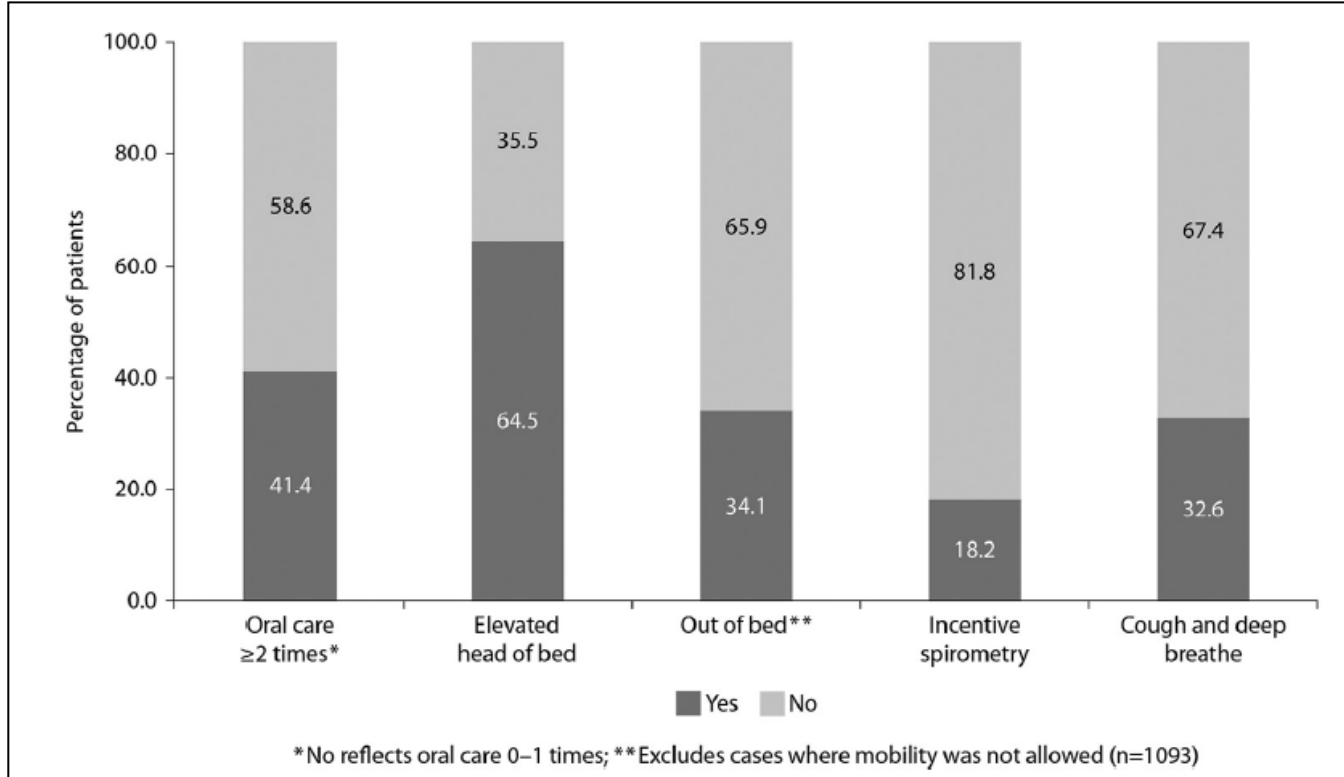
HAPPI-2 Incidence of Non-Vent Hospital-Acquired Pneumonia

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 l group cohorts

Giuliano K, et al. Am J of Infect Control. 2018;46:322-327

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

Giuliano K, et al. Am J of Infect Control. 2018;46:322-327

Is Pneumonia Part of the Sepsis Picture?

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

30-50% of sepsis cases may initiate with pneumonia

Risk of developing sepsis significantly > with NVHAP than with pneumonia on admission

Angus DC, et al. N Engl J Med. 2013 Aug 29;369(9):840-51.
Giuliano KK, Baker D.. *Am J Crit Care*. 2020;29(1):9-14.

Epidemiology & Outcome of nvHABP, vHABP, VABP

- 253 Acute care hospital

- Premier database 2012-2019

- Retrospective cohort

- 17,819 pts met enrollment

Type	Incidence	Morality	Cost
nvHABP	26.5%	11.7%	39,991
vHABP	25.6%	29.2%	$62,464
VABP	47.9%	21.3%	$77,657

Zilberberg MD, et al. *Crit Care Med*. 2022;50(3):460-468. .
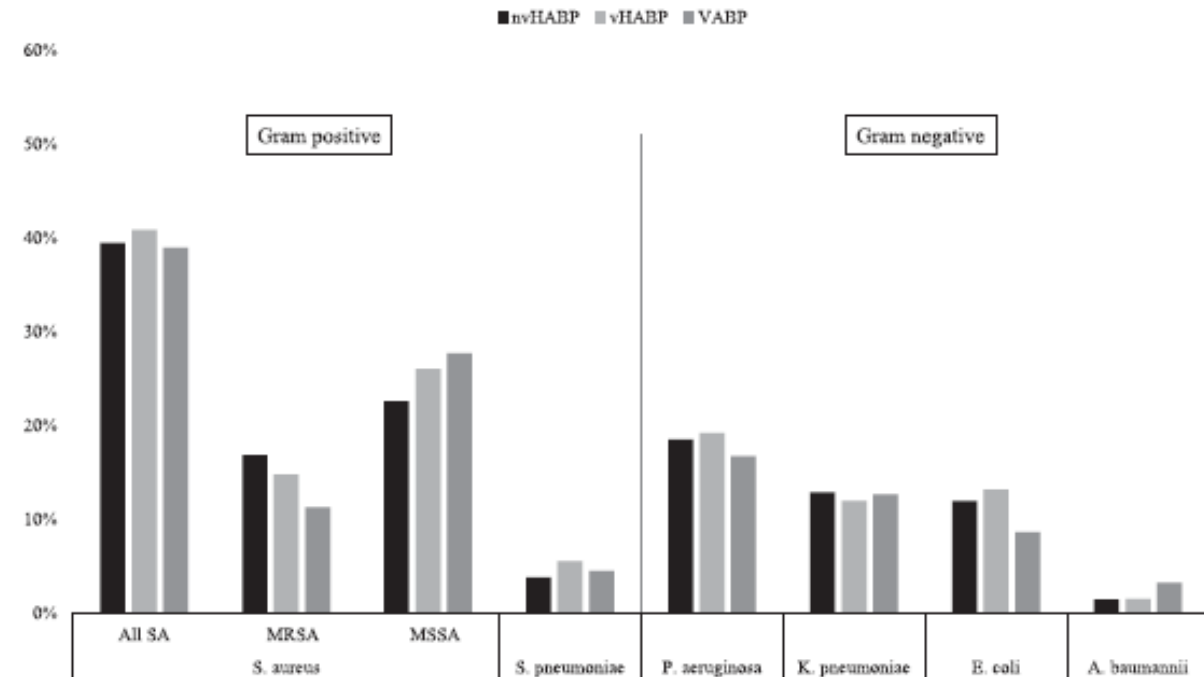
Where is the Highest Risk for NV-HAP?

Rate of Nonventilator Hospital-Acquired Pneumonia

NV-HAP per 1000 patient days

Slide courtesy of Barb Quinn
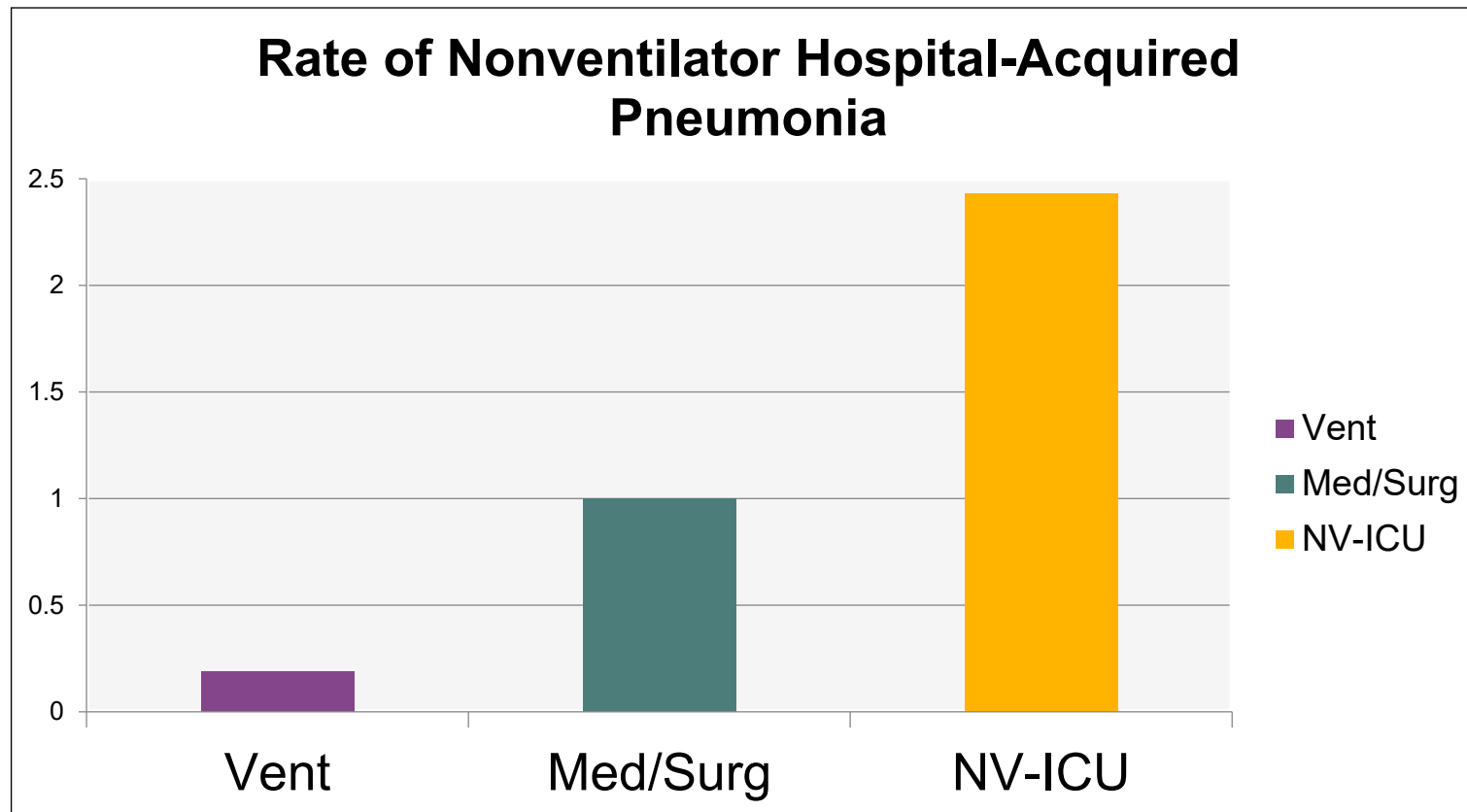
National Initiative (Sponsored by VA)

- National organization to prevent hospital acquired pneumonia
- Develop a Call to Action
  - △ Research focus
    - Economic impact
    - Pathogenesis
    - By NVHAP survey methods
    - Pathways for prevention and implementation science

- APIC Position Paper
  - △ Hospital to design programs to address NVHAP
  - △ Surveillance & reporting requirements

Munro SC, Baker D, Giuliano KK, et al. Nonventilator hospital-acquired pneumonia: A call to action. *Infect Control Hosp Epidemiol*. 2021;42(8):991-996.

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

How Periodontitis Progresses
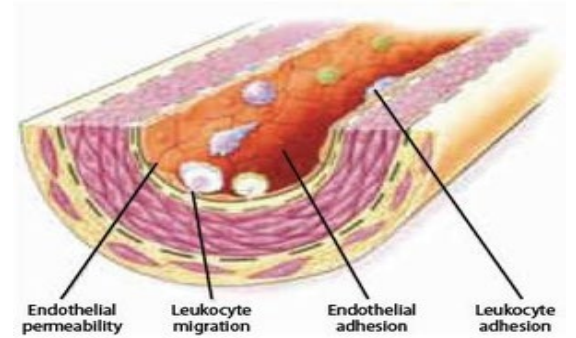
		Endothelial permeability — Leukocyte migration — Endothelial adhesion — Leukocyte adhesion
Gram – bacteria become embedded around the pocket of the tooth	Inflammatory cells are recruited to the site of the infection: CRP IL-6, IL-18 Prostaglandins Thromboxane Fibrinogen	Damage to the endothelium – Formation of the atherosclerotic plaques.

(Akar, H. 2011).

Co-morbidities & Oral Health

Co-morbidities and periodontal disease

- Hypertension
  - △ Increased bacterial burden --> 3-fold increased odds of HTN
- Diabetes
  - △ At risk for periodontitis – increased 3-fold
  - △ Periodontitis is a risk factor for poor glycemic control
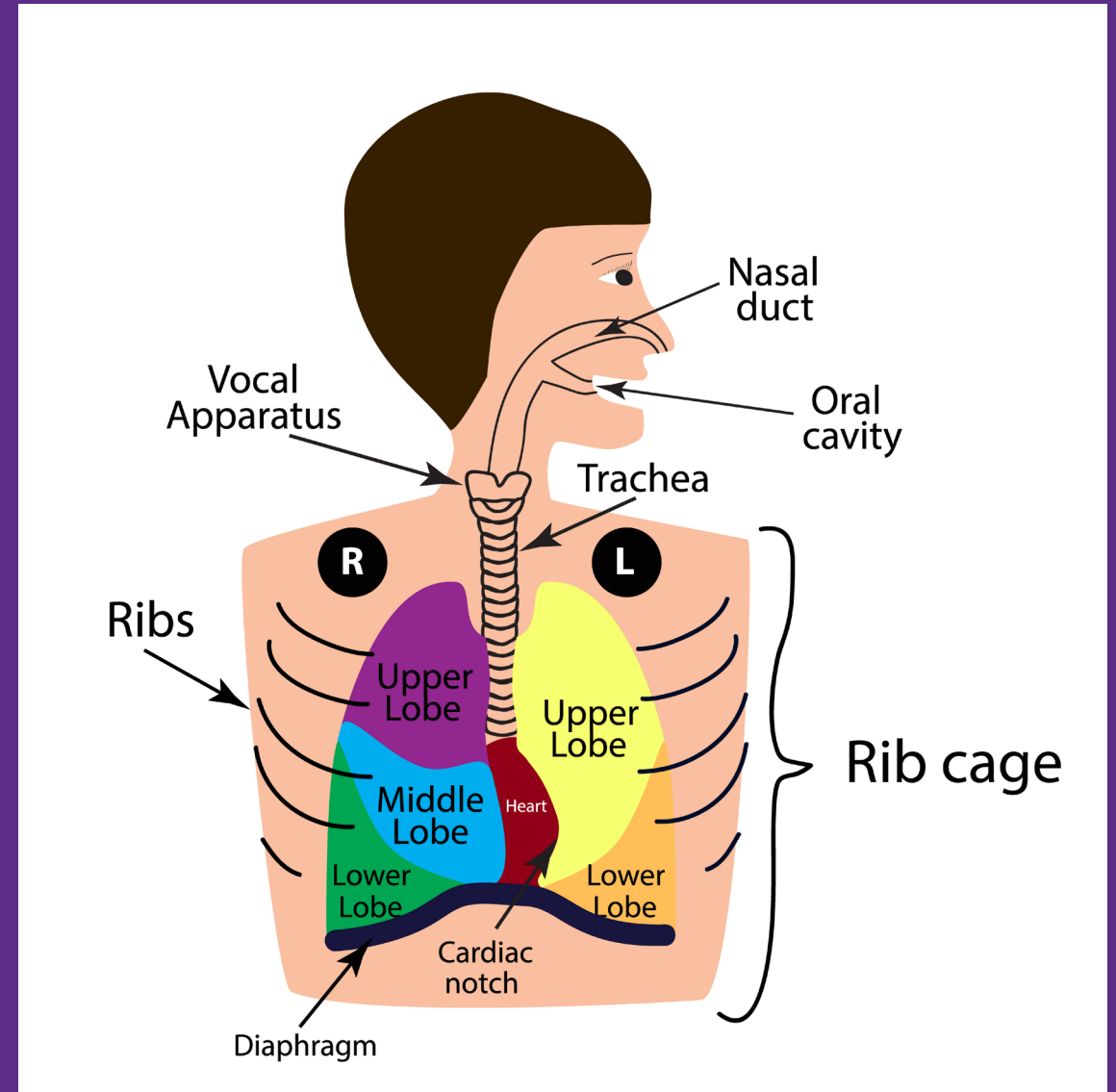- End-Stage Renal Disease: Periodontitis more common in Stage 5D CKD
  - △ Immune function
  - △ Neutrophils
  - △ Cytokines
- Periodontal disease-Impact on Nutrition
  - △ Lack of teeth, dentures, impairs taste

Desvarieux, M. Journal of Hypertension, 2010 23(7), 1413-1421
Simpson TC, et al. Cochrane Database Syst Rev. 2015;2015(11):

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 In Hospital

Pathogens
- Hospital environment
- Healthcare workers
- Disruption of normal oral flora

Aspiration
- Supine position
- CNS depressant medications
- Invasive tubes

Weak Host
- Surgery
- Immobility
- Co-morbid conditions

HAP

Quinn & Baker. (2014). *J Nsg Scholarship, 46*(1), 11-19.

Where does Pneumonia Start: Oral Bacteria during Hospitalization & Illness

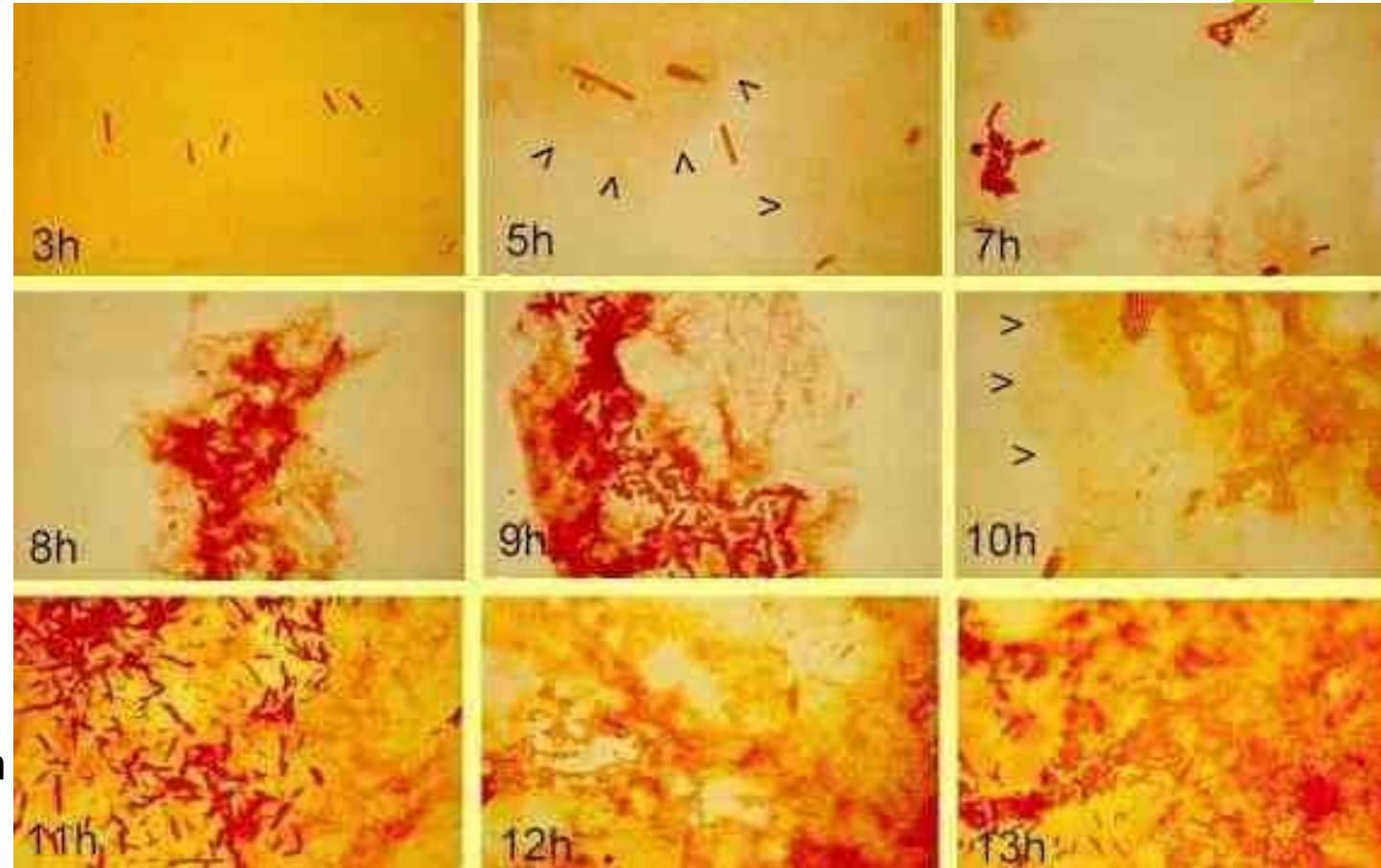- Oral cavity
    - △ > 1 billion oral microbes
    - △ 700-1000 species
    - △ Replicate's 5 x in 24hr period
- Disruption of Microbiome
    - △ Plaque, gingivitis, tooth decay
    - △ Reduced salivary flow/change in pH
- 24-48 hours for HAP pathogens in mouth
- If aspirated =100,000,000 bacteria/ml 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
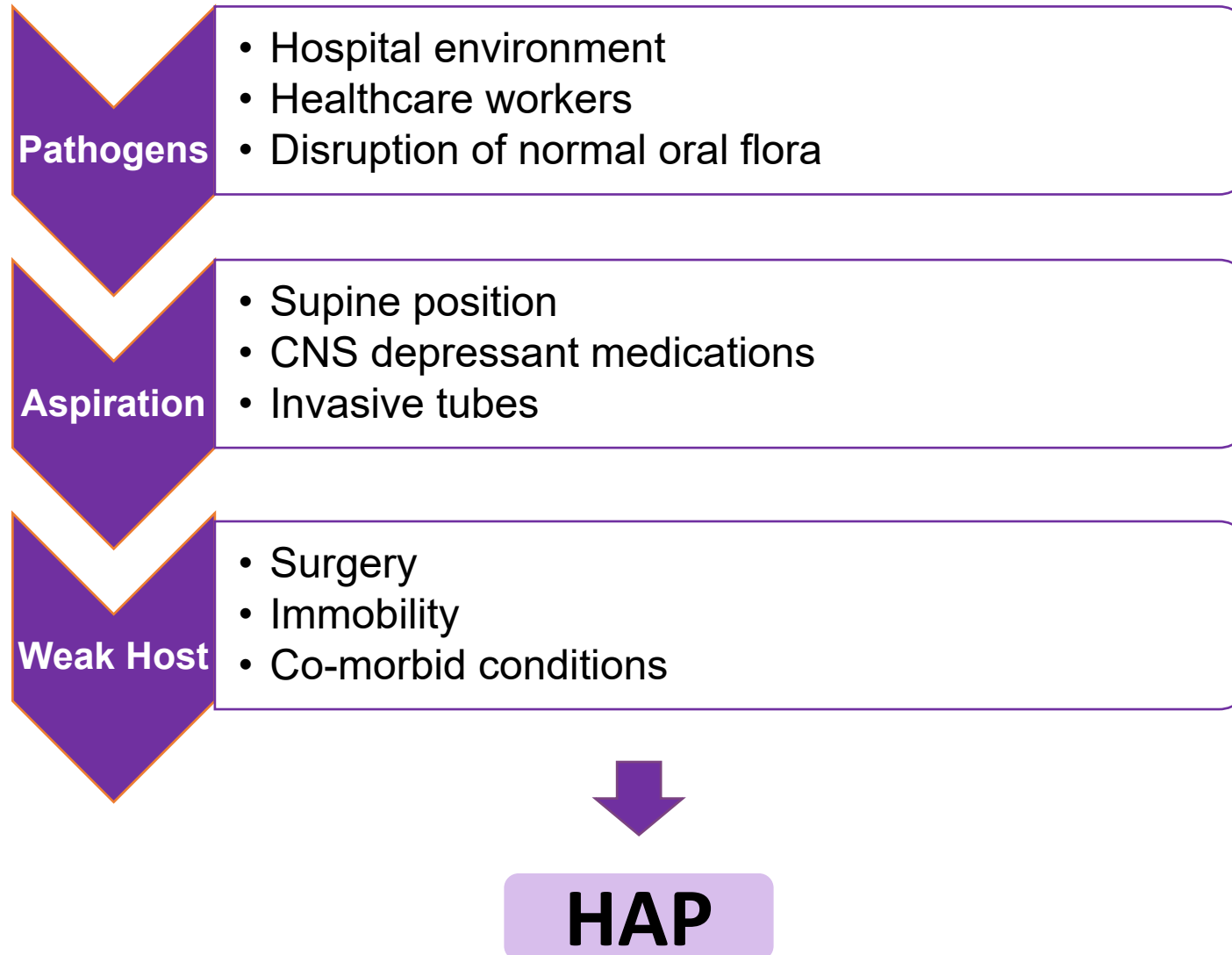 - △ 28 of 31 VAPs the causative organism was identical via DNA analysis

- 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

Garrouste-Orgeas et. al. Am J Respir Crit Care Med. 1997;156:1647-1655
El-Solh AA. Chest. 2004;126:1575-1582

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

Munro CL & Grap MJ. AJCC. 2004;13:25-34

Risk Factors for Pneumonia

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HAP

Quinn & Baker. (2014). *J Nsg Scholarship, 46*(1), 11-19.

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

Gleeson K, et al. Chest. 1997;111:1266-72

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

Torres A et. al Ann Intern Med 1992;116:540-543
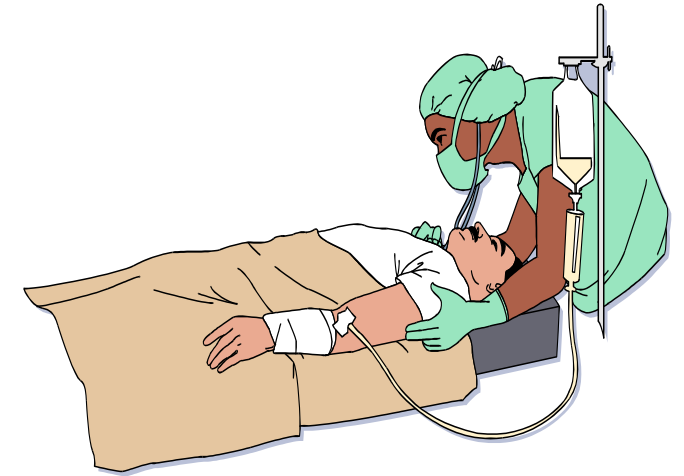
Body Position: Supine versus Semi-recumbent

Results:

- Radioactive contents higher in endobronchial secretions in supine patients
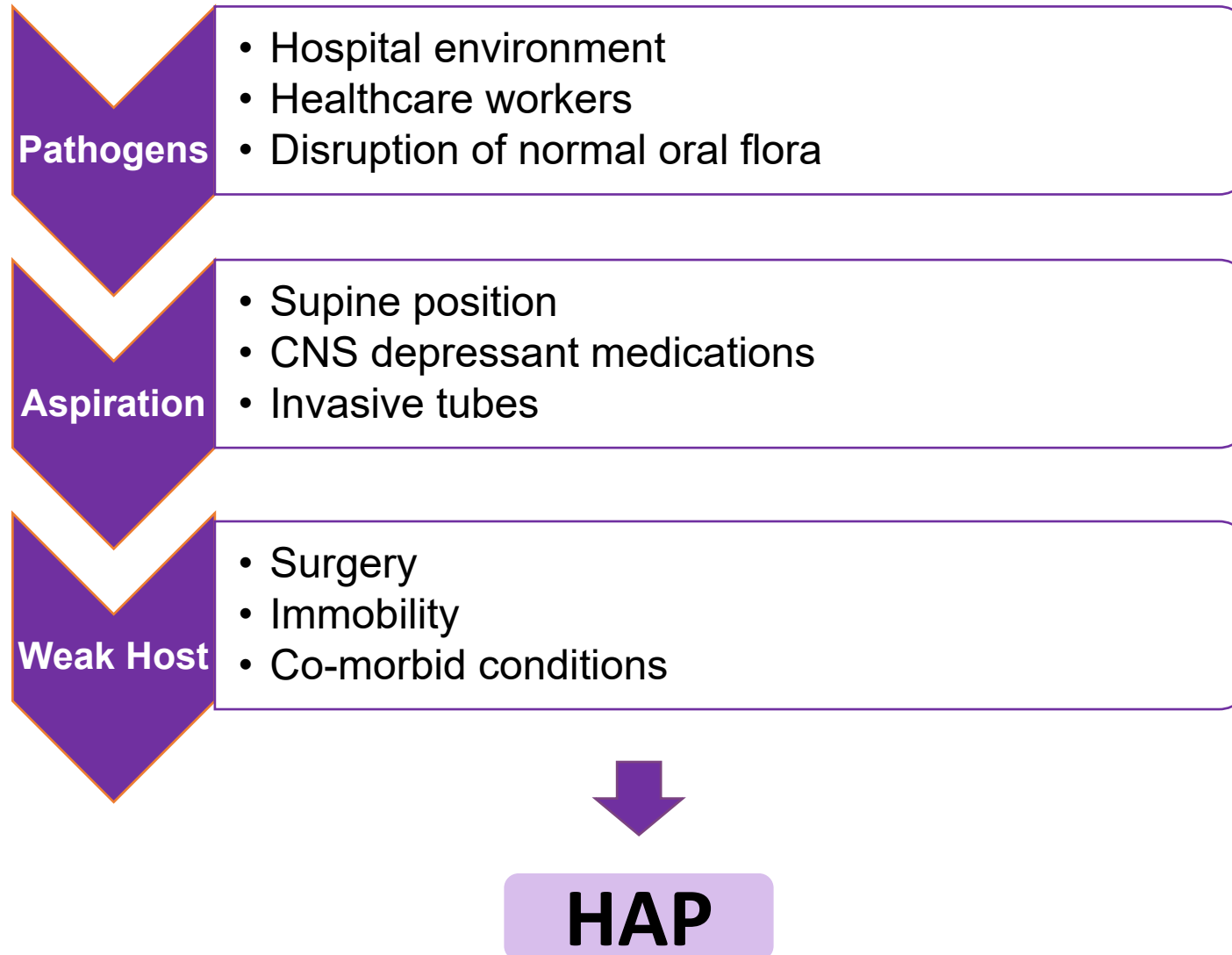
- Time dependent:
  - Supine: 298cpm/30min vs. 2592cpm/300min

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

Same microbes cultured in all 3 areas
- HOB: 32%
- Supine: 68%

Torres A et. al. Ann Intern Med 1992;116:540- 543

Risk Factors for Pneumonia

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HAP

Quinn & Baker. (2014). *J Nsg Scholarship, 46*(1), 11-19.

Weak Host: Who is at Highest Risk?

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

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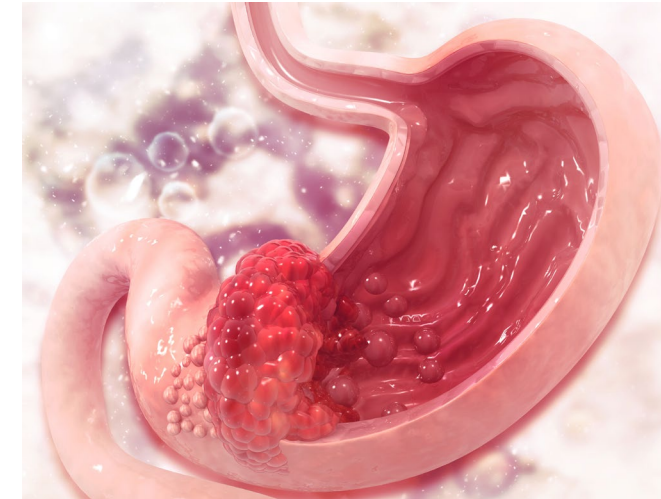- More than 6 medications
- Low albumin
- On antibiotics
- Dependent for ADLs
- Smokers

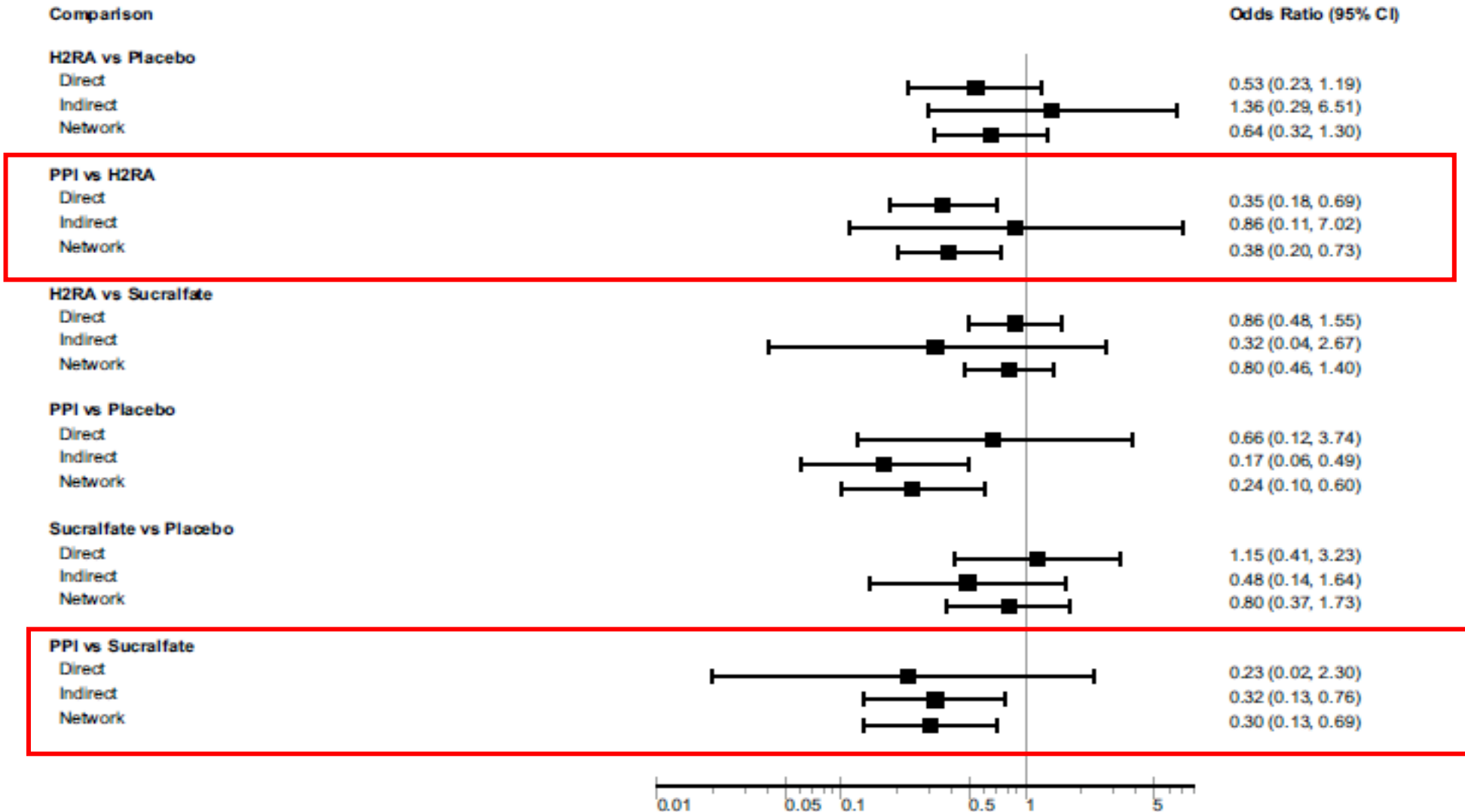Strassle PD, et al. Infect Control Hosp Epidemiol. 2020 Jan;41(1):73-79.
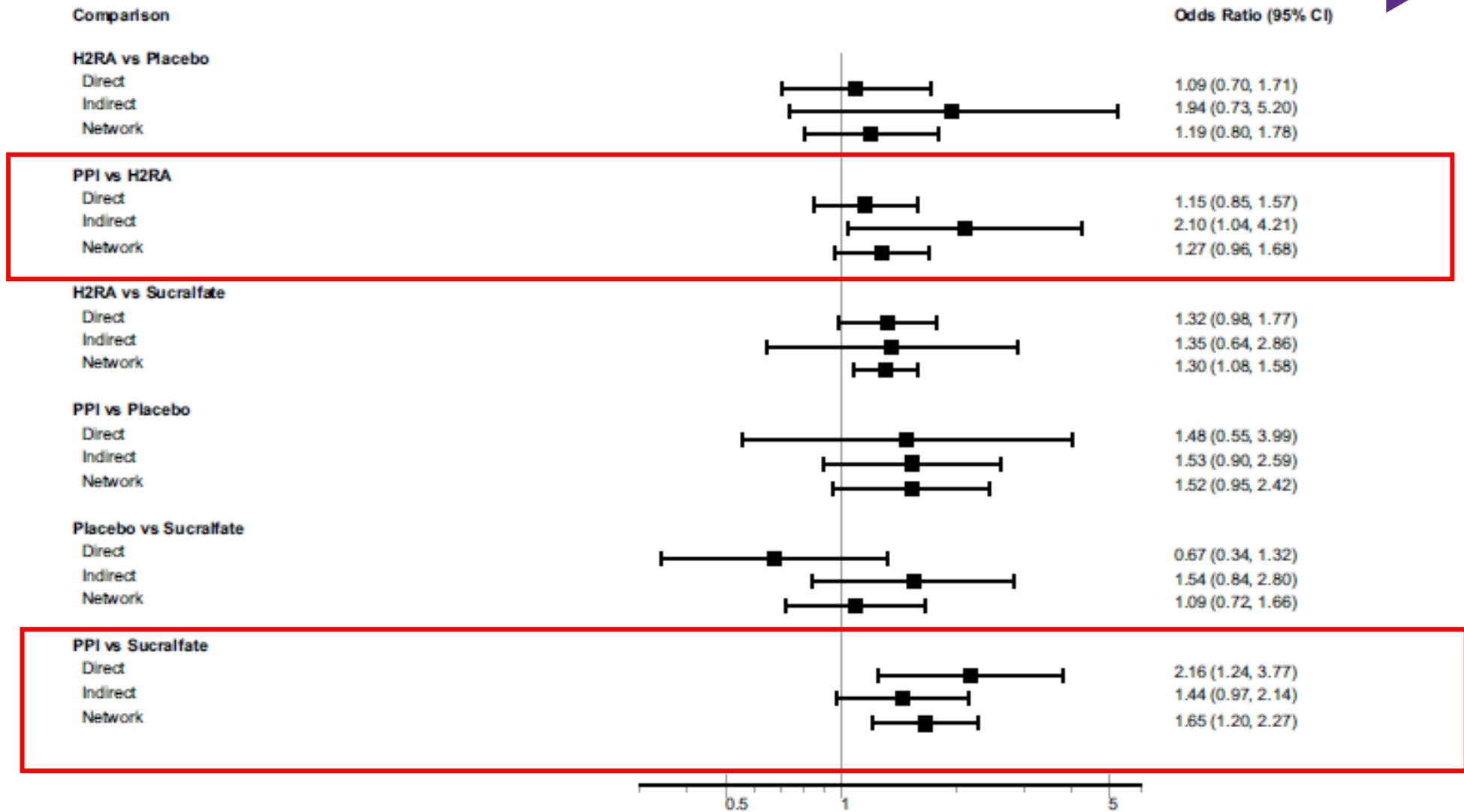
Stewardship of Stress Ulcer Prophylaxis (SUP)

- 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

Huang et. al (2018). Critical Care 22(20), 1-9.
Herzig et. Al (2014) Ann Neurol. 76(5): 712-178.
Marchina et al (2019). J of the Neurological Sciences, 400;122-128.

SUP: Impact on Bleeding Risk

Comparison	Odds Ratio (95% CI)
H2RA vs Placebo	
Direct	0.53 (0.23, 1.19)
Indirect	1.36 (0.29, 6.51)
Network	0.64 (0.32, 1.30)
PPI vs H2RA	
Direct	0.35 (0.18, 0.69)
Indirect	0.86 (0.11, 7.02)
Network	0.38 (0.20, 0.73)
H2RA vs Sucralfate	
Direct	0.86 (0.48, 1.55)
Indirect	0.32 (0.04, 2.67)
Network	0.80 (0.46, 1.40)
PPI vs Placebo	
Direct	0.66 (0.12, 3.74)
Indirect	0.17 (0.06, 0.49)
Network	0.24 (0.10, 0.60)
Sucralfate vs Placebo	
Direct	1.15 (0.41, 3.23)
Indirect	0.48 (0.14, 1.64)
Network	0.80 (0.37, 1.73)
PPI vs Sucralfate	
Direct	0.23 (0.02, 2.30)
Indirect	0.32 (0.13, 0.76)
Network	0.30 (0.13, 0.69)

Alhazzani W, et al. Intensive Care Med (2018) 44:1–11

SUP: Impact on Risk of Pneumonia

Alhazzani W, et al. Intensive Care Med (2018) 44:1–11

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

Kalish BJ, et al. Journal of Clinical Nursing, 2013;23:1486-1501

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, SaO_2 level, or postop pulmonary complications (JAMA Surg 2017)

Freitas et al (2012) IS for prev pulm compl after CABG. Cochrane Database Syst Rev (9) do Nascimento Jr et al (2014) IS for prev of postop pulm compl in upper abd surg. Cochrane Review. Issue (2) Pantel et al (2017) Effect of IS on postop hypoxemia & pulm compl. after bariatric surg: A RCT

Dysphagia Management

- Dysphagia screening/acute stroke or high-risk[2,3] populations

- Swallow exam[2,3]

- Initiated appropriate type of nutrition & liquids[3]

Top tips for prevention and management of aspiration pneumonia[1]

The following provides key points for clinicians to consider to avoid this hospital-acquired complication

Conduct risk assessment

Conduct a comprehensive risk assessment

Identify risk factors such as:
- Impaired swallow and/or cough reflex
- Strokes or other neuromuscular conditions
- Cancers affecting cranial nerves or the recurrent laryngeal nerve
- Poorly controlled nausea and vomiting
- Excessive alcohol consumption.

▼

For a patient at risk, develop a prevention plan as part of a comprehensive care plan

▼

Develop prevention plan

Clinicians, patients and carers develop an individualised, comprehensive prevention plan to prevent aspiration pneumonia:
- Goals of treatment consistent with the patient's values
- Any specific nursing requirements, including equipment needs
- Any allied health interventions required, including equipment needs
- Observations or physical signs to monitor and determine frequency of monitoring, including temperature, respiratory rate and chest auscultation – and document findings in the clinical record
- Laboratory results to monitor and determine frequency of monitoring
- If specialist assistance is required.

▼

Deliver prevention plan

Where clinically indicated, deliver aspiration pneumonia prevention strategies, such as:
- Speech pathology review
- Drinking thickened fluids
- Sitting upright when eating
- Safe swallowing strategies.

▼

Monitor

- Monitor the effectiveness of the aspiration pneumonia prevention strategies, and reassess the patient if aspiration pneumonia occurs
- Review and update the care plan if it is not effective or is causing side effects
- Engage in reviewing clinical outcomes, identifying gaps and opportunities for improvement.

1. Australian Commission on safety and quality in healthcare hospital acquired complications information kit , Sydney: ACSQHC
2. Mitchell BG, et al. Infect Dis Health. 2019;24(4):229-239
3. Quinn B, et al. Am J Infect Control. 2020;48(5S):A23-A27.

National Survey on NVHAP

- 48% response rate

- Mostly academic centers (84%)

- 24% do not monitor for NVHAP

- 57.6% have a universal oral care policy
  - △ 48% lack suction toothbrush on med-surg
  - △ 27% lack basic oral care supplies

- 54% have a pre-surgical oral care

- 72% to 84% have early mobility, manage SUP, & do HOB elevation

Baker DL, Giuliano KK. *Infect Control Hosp Epidemiol*. 2022;43(3):379-380.

Polling Question

- What is your current oral care regime for patients at risk for NVHAP?
  - △ Toothbrushing 2x daily
  - △ Toothbrushing, antiseptic mouth rinse and mouth moisturizer 4x daily
  - △ antiseptic mouth rinse 2x daily
  - △ Nothing
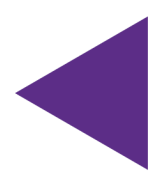
AACN Procedural Manual-7th Ed
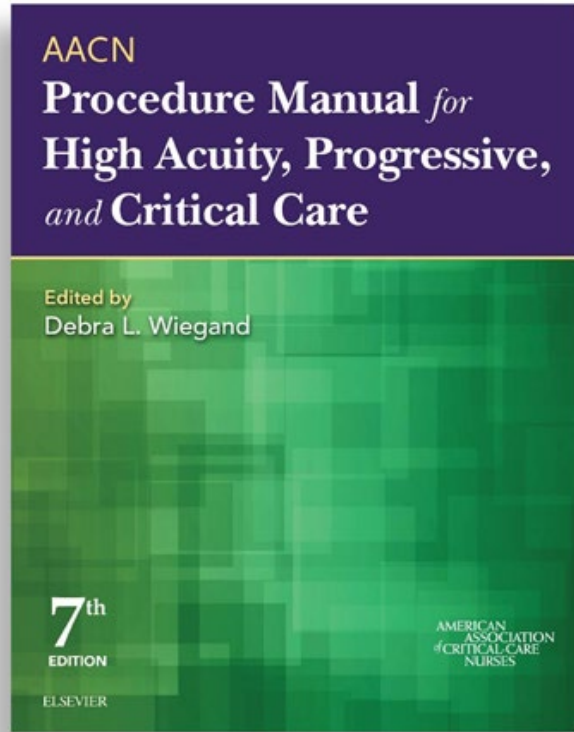
**Procedure 4: Endotracheal Tube Care and Oral Care**

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

- Ongoing monitoring and measurement
  - △ Monthly audits

Quinn B, et al. J of Nursing Scholarship, 2014, 46(1):11-19
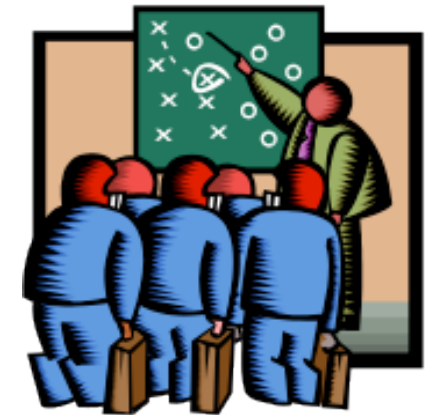
Use of the Influencer Model

Influencer Model www.Vitalsmarts.com	Motivation	Ability
Personal	Patient stories	Education
Social	Compare units	Mentor peers
Structural	Measure Recognize	Tools

Quinn B, et al. J of Nursing Scholarship, 2014, 46(1):11-19

Gap Analysis

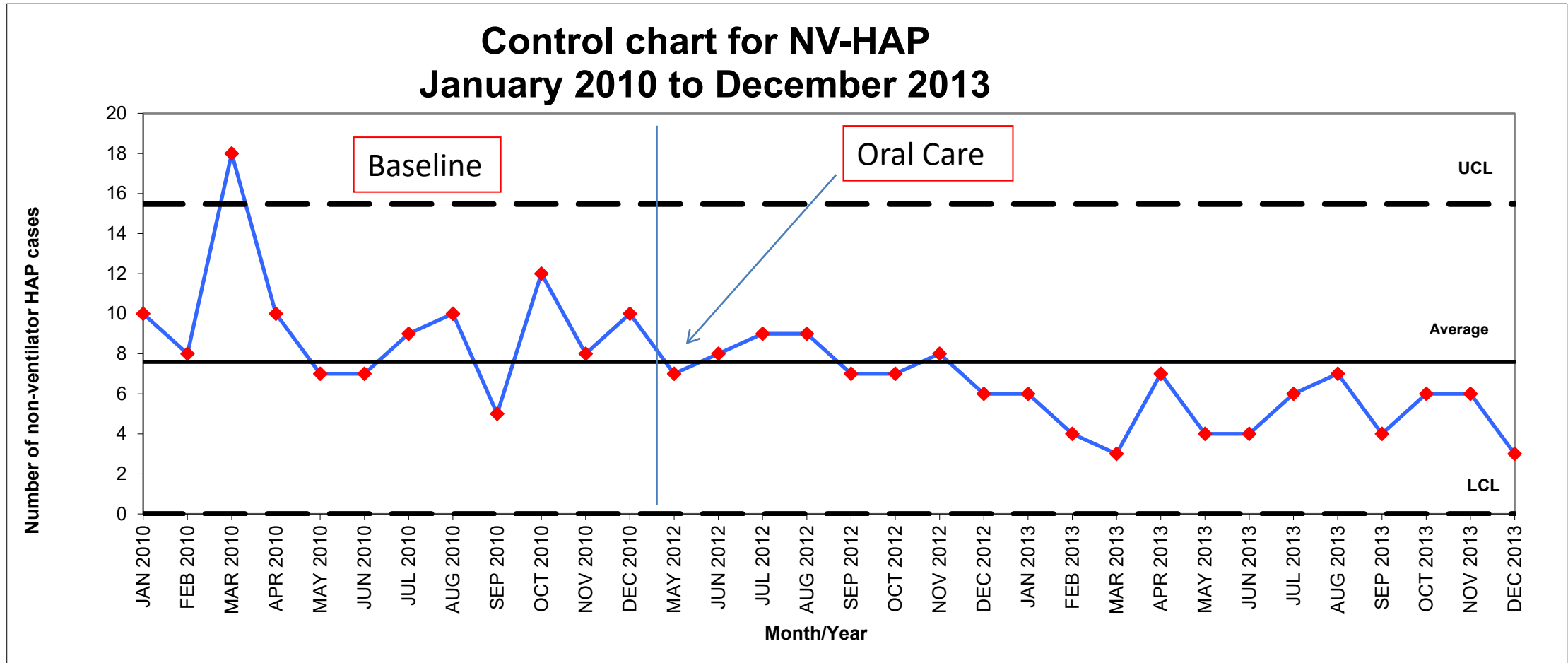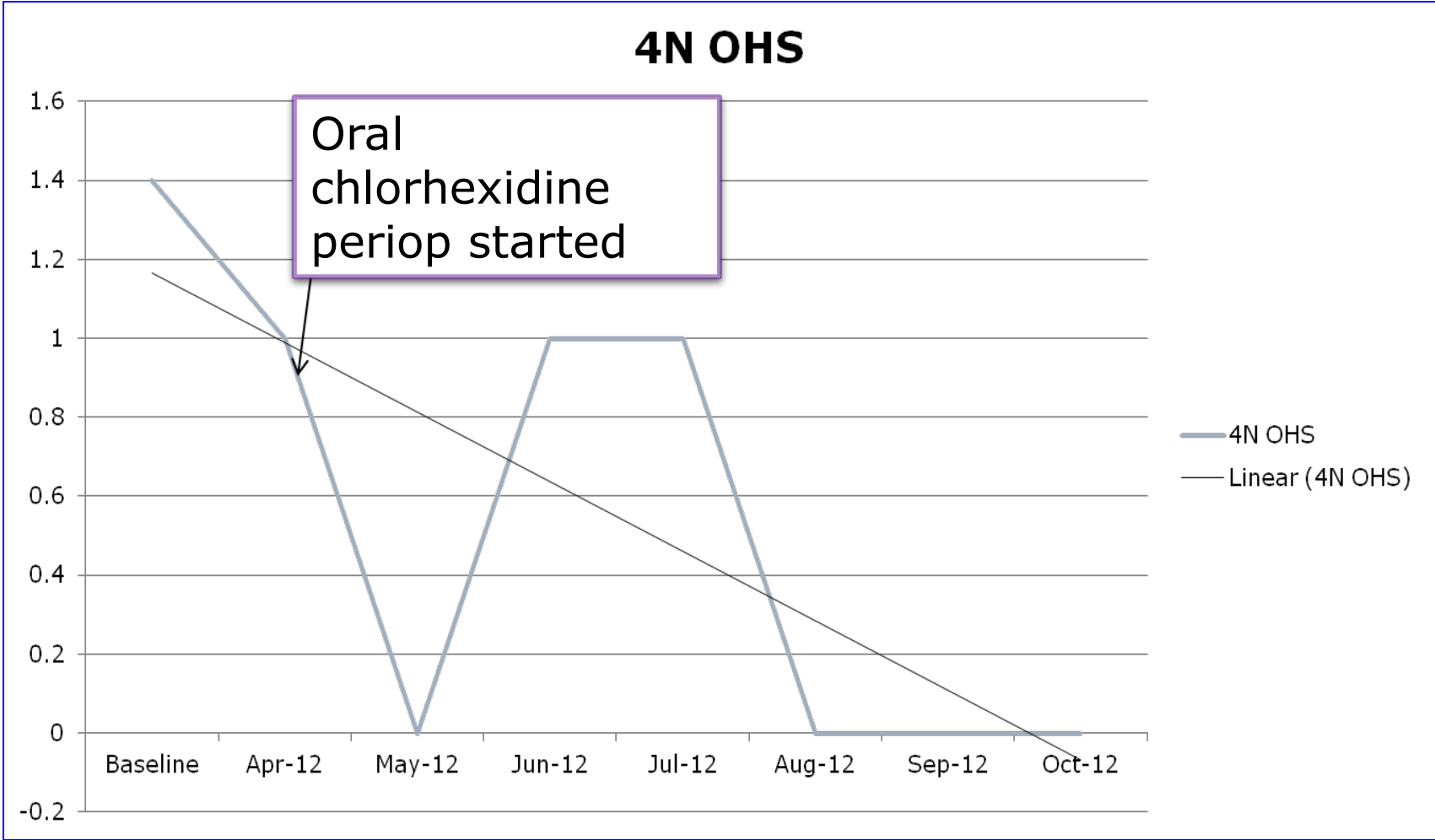| Best Practice	Our Gaps	Action To Take
Comprehensive oral care for all (CDC, SHEA)	ICU vent patients only	Develop inclusive oral care protocol
Oral CHG (0.12%) periop adult CV surgery and vent pts. (CDC, ATS, IHI)	Not using CHG on these patients	Added to preprinted orders, and to protocol
Therapeutic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

Quinn, B. et al. Journal of Nursing Scholarship, 2014. 46(1):11-19

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

Quinn B, et al. J of Nursing Scholarship, 2014, 46(1):11-19

NV-HAP Incidence
50 % Decrease from Baseline

Control chart for NV-HAP
January 2010 to December 2013

Quinn, B. et al. Journal of Nursing Scholarship, 2014. 46(1):11-19

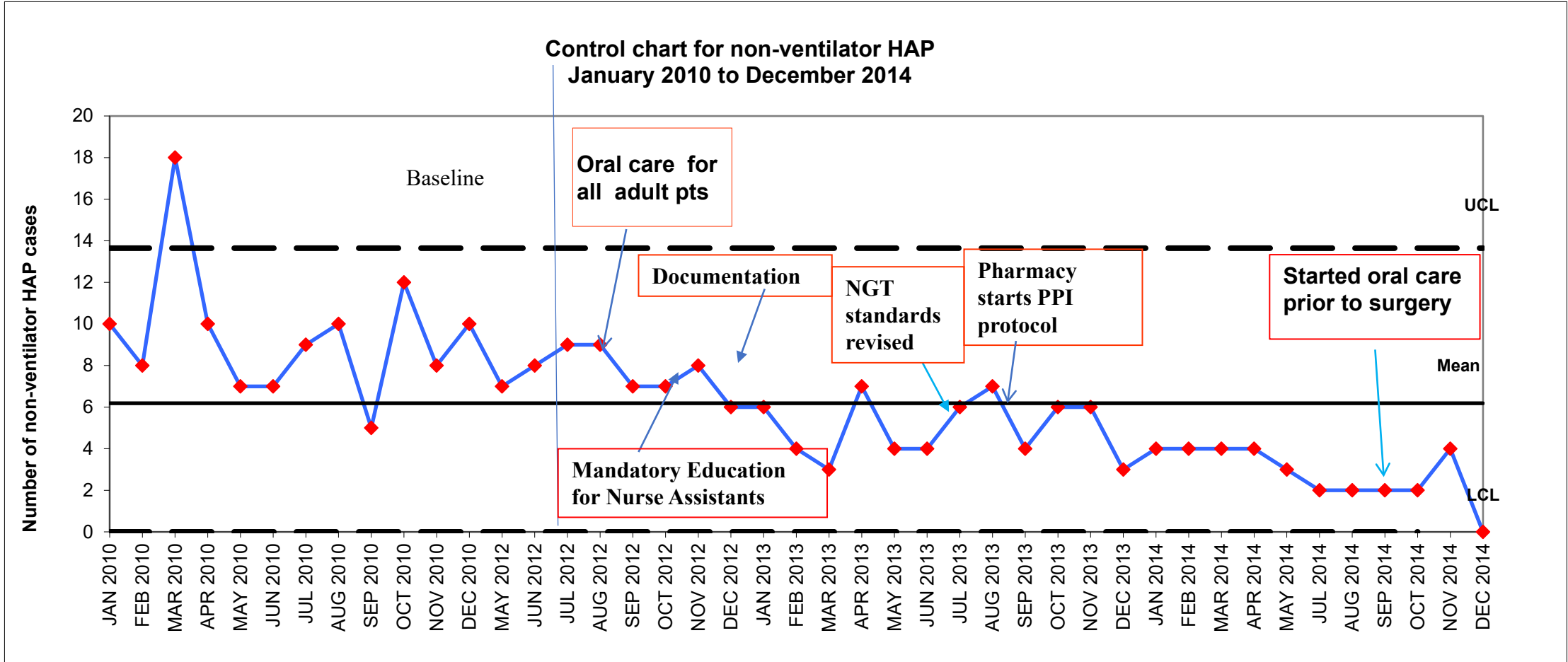# Open Heart Surgery Patients: NV-HAP Reduced 75%

Return on Investment

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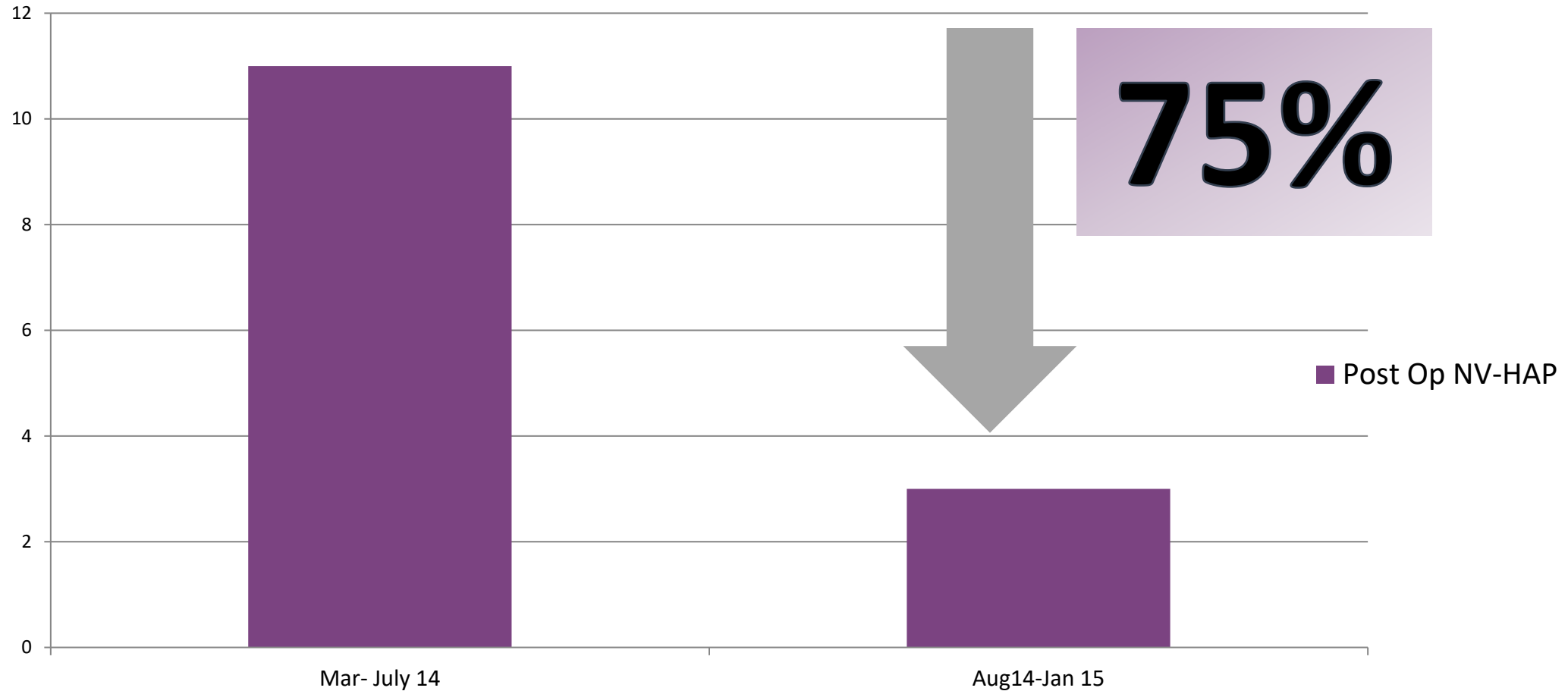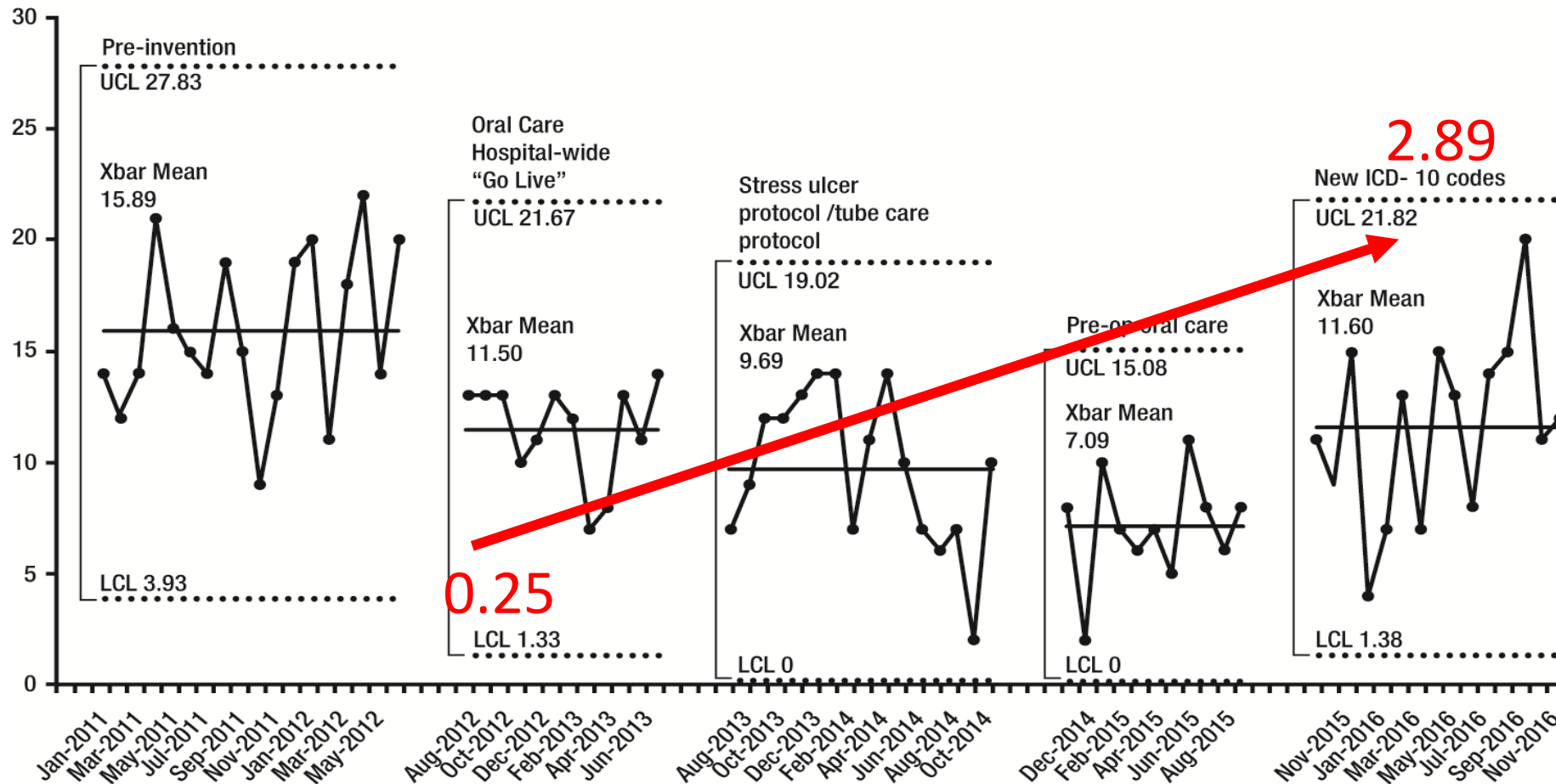- $2,282,400 return on investment

8 lives saved

PRICELESS

Quinn, B. et al. Journal of Nursing Scholarship, 2014. 46(1):11-19

NV-HAP ↓ 70% from baseline!

Control chart for non-ventilator HAP
January 2010 to December 2014

Baseline

Oral care for all adult pts

Documentation

NGT standards revised

Pharmacy starts PPI protocol

Started oral care prior to surgery

Mandatory Education for Nurse Assistants

UCL

Mean

LCL

Number of non-ventilator HAP cases

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

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

75%

Legend: Post Op NV-HAP

X-axis: Mar- July 14, Aug14-Jan 15

Y-axis: 0 to 12

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)

Baker, Quinn, Ewan, Giuliano (2018) Sustaining quality improvement: LT reduction of NVHAP. J Nurs Care Qual, 1-7.

American Dental Association Approved Oral Care for Acute Care Setting

Oral care type	Tools	Procedure	Frequency
Self/assist (may require setup)	Soft-bristled toothbrush, toothpaste with fluoride, sodium bicarbonate (optional), alcohol-free antiseptic mouth rinse, mouth and lip moisturizer (nonpetroleum-based)	Brush for 1-2 min with toothpaste, rinse with antiseptic; moisturize as needed.	2-4 times/d
Dependent/aspiration risk/nonventilated	Soft-bristled suction toothbrush, cleansing and alcohol-free antiseptic solution, mouth and lip moisturizer (nonpetroleum-based)	Brush with suction for 1-2 minutes using liquid cleansing/antiseptic solution; moisturize as needed.	2-4 times/d
Dependent/ventilated	Soft-bristled or swab suction toothbrush, cleansing and alcohol-free antiseptic solution, mouth and lip moisturizer (nonpetroleum-based)	Brush/swab with suction for 1-2 min using liquid cleansing/antiseptic solution; moisturize as needed. Optional: Brush/swab with suction 1 min with chlorhexidine 0.12%	About every 4 h or 6 times/d Optional: Chlorhexidine 0.12% every 12 h
Dentures or edentulate (not caps)	Denture storage cup, denture brush, denture cleanser adhesive (optional)	Remove and brush/rinse dentures; brush gums and mouth; may soak dentures at night with commercial cleanser.	2 times/d Remove dentures while patient is sleeping

Quinn B, et al. *Am J Infect Control*. 2020;48(5S):A23-A27.

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**

Slide courtesy of Barb Quinn

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

Warren C et al. AJN 2019;119(2):44-51
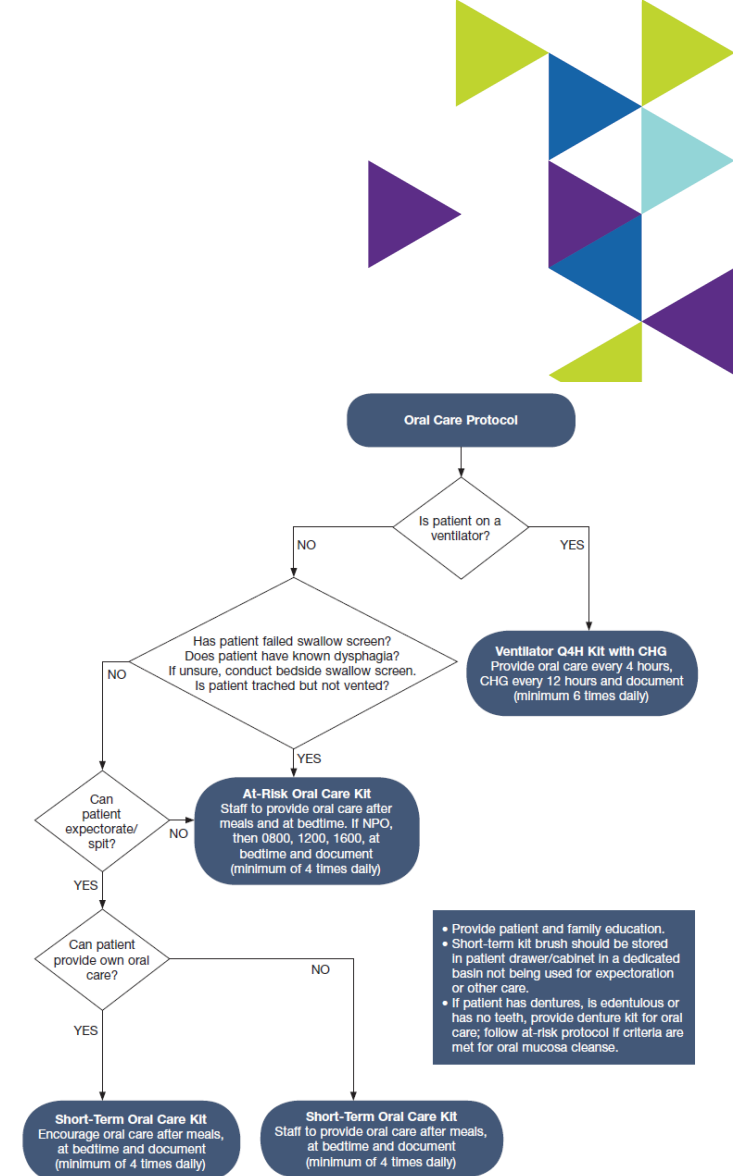
Results

- 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 partnerd 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
Use this kit if you can:
• Swallow without difficulty
• Spit without difficulty
Recommended for use at least four times per day, including after meals and at bedtime.

At-risk Oral Care Kit
Use this kit if you can:
• Trouble swallowing
• Difficulty spitting
• Recent stroke
• Tracheostomy without a ventilator
Recommended for use at least four times per day, 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.

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.

If you or your family are unable to provide your oral care, a staff member will assist you.

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

6300 v1   PA 8/15

Warren C et al. AJN 2019;119(2):44-51

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

Lacerna CC, et al. *Infection Control & Hospital Epidemiology*. 2020;41(5):547-552.
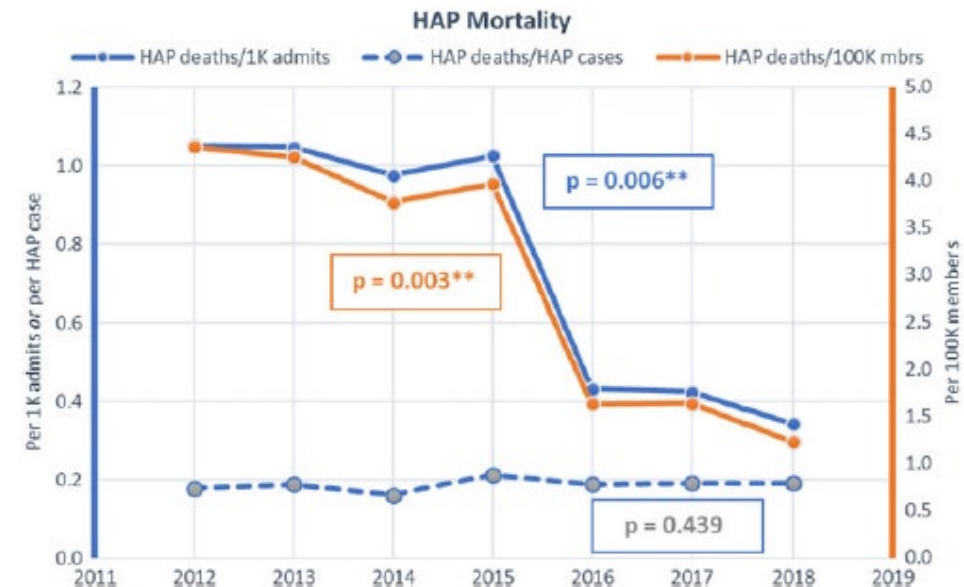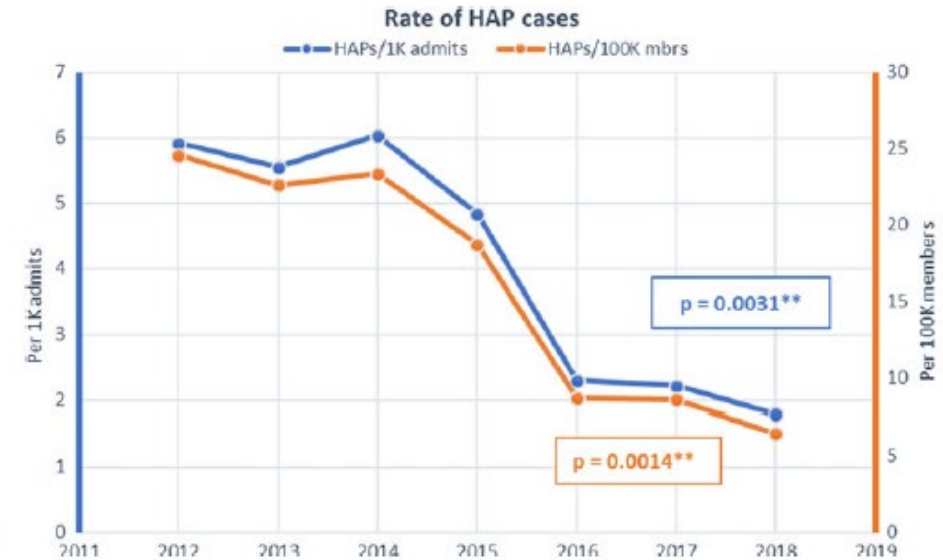
Oral Care-Prevention of NVHAP

- 800 bed facility

- Randomize 4 units -2 experimental/2 control

- Experimental received enhanced oral care & targeted education

- Freq of oral care 4x daily

- Control units received edu on usual oral care

Giuliano KK, et, al. *Am J Nurs*. 2021;121(6):24-33.

Self-care and staff-assist. Able to expectorate (spit)

EQUIPMENT
- Soft toothbrush, ADA approved
- Toothpaste and mouth rinse, ADA approved
- Mouth moisturizer prn or mouthwash
- Dental floss or interdental cleansers (optional)
- Lip balm (optional)

FREQUENCY
- After each meal and before bedtime.
- If patient is NPO, oral care should be done 2-4 times daily.

PROCEDURE
1. Set patient up at sink or in bed with all equipment.
2. Instruct patient to brush teeth for 1-2 minutes.
3. Use mouth rinse twice a day, swish for 20 to 30 seconds.
4. If patient is able and supply is available, use floss or interdental cleansers.
5. May moisturize interior of mouth and lips using an oral swab prn.
6. Discard disposable equipment/swab in appropriate receptacle.

Dependent for oral care. Not able to expectorate (spit). At risk for aspiration.

EQUIPMENT
- Suction toothbrush with oral cleaning solution packet (as appropriate and available)
- Soft toothbrush moistened with clean tap water or alcohol-free mouthwash
- Mouth moisturizer prn
- Dental floss or interdental cleansers (optional)
- Lip balm (optional)

FREQUENCY
- After each meal and before bedtime.
- If patient is NPO, oral care should be done 2-4 times daily.

PROCEDURE
1. Moisten suction or regular toothbrush as noted.
2. Assist the patient to brush all surfaces of the teeth until clean (1-2 minutes).
3. Suction debris from mouth.
4. Apply mouth moisturizer using an oral swab, to the interior of the oral cavity and apply lip balm.
5. Discard disposable equipment in appropriate receptacle.

Dependent on oral care. Patient on a ventilator.

EQUIPMENT
- Suction toothbrush/ oral swab
- Oral cleansing solution
- Mouth moisturizer
- May consider chlorhexidine oral rinse per hospital policy — current studies are unclear as to benefit and harm

FREQUENCY
- Every four hours and prn to remove oral debris.

PROCEDURE
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/oral swab and moisten with oral cleansing solution.
3. Connection suction toothbrush to continuous suctions.
4. If chlorhexidine is used, remove the debris and cleanse the gums, tongue, and inside of cheeks with the solution-saturated oral swab.
5. Suction debris from mouth
6. Apply moisturizer using oral swab to the interior of the oral cavity and lips.
7. Discard disposable equipment/swab in appropriate receptacle.

Denture care or patients with no teeth. Before the patient goes to sleep, remove and clean dentures and place them in a denture cleansing solution once daily.

EQUIPMENT
- Denture cup, labeled
- Denture brush is preferred when available, otherwise soft toothbrush
- ADA approved denture cleanser (for soaking)
- 2 oral swabs
- Denture adhesive (optional)
- Mouth rinse
- Mouth moisturizer prn or mouthwash

FREQUENCY
- Dentures are removed for cleaning at bedtime. Remove dentures when sleeping

PROCEDURE
1. After removing dentures, place in a labeled denture cup.
2. Brush the palate, buccal surfaces, gums, and tongue with the toothbrush or swab.
3. Patient can swish and spit mouthwash, or use oral swab to apply moisturizer.
4. Line the sink with paper towel and add water to cushion the dentures in case you drop them. Carefully brush dentures with warm tap 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. If patient needs denture adhesive to hold firmly in place, follow manufacture directions.
8. Soak dentures in a denture cleanser in the denture cup at bedtime.

Oral Care-Prevention of NVHAP

- 8709 patients
  - △ Control: 4163
  - △ Experimental: 4546
- Medical control-7x more likely to develop NVHAP
- Surgical units' difference did not reach statistical difference
- Freq of oral care;
  - △ Intervention: 2.02-2.25
  - △ Control: .95-1.18

Treatment Group	NV-HAP			
	No	Yes	Total	Incidence Rate per 1,000 Patient-Days
Medical Control, No. (%)	2,059 (99.2)	16 (0.8)	2,075	1.40
Medical Intervention, No. (%)	2,706 (99.9)	3 (0.1)[a]	2,709	0.21
Total	4,765	19	4,784	−85 (% difference)
Surgical Control, No. (%)	2,075 (99.4)	13 (0.6)	2,088	1.17
Surgical Intervention, No. (%)	1,830 (99.6)	7 (0.4)[b]	1,837	0.51
Total	3,905	20	3,925	−56 (% difference)

CI = confidence interval; NV-HAP = nonventilator hospital-acquired pneumonia; OR = odds ratio.

[a] OR for medical control vs. medical intervention units (OR: 7.1; 95% CI, 2.01-24.1, P = 0.002).

[b] OR for surgical control vs. surgical intervention units (OR: 1.6; 95% CI, 0.65-4.1, P = 0.29).

Giuliano KK, et, al. *Am J Nurs*. 2021;121(6):24-33.

VA Initiative-2018-Nationwide Action Planning for Deployment

Prepare foundation (Organizational Champion & stakeholders), baseline data & organize supplies

Customize nursing documentation templates, data collection tools, & pt education materials

Customize and conduct nursing training

Implementation

Monitor, iterate & scale
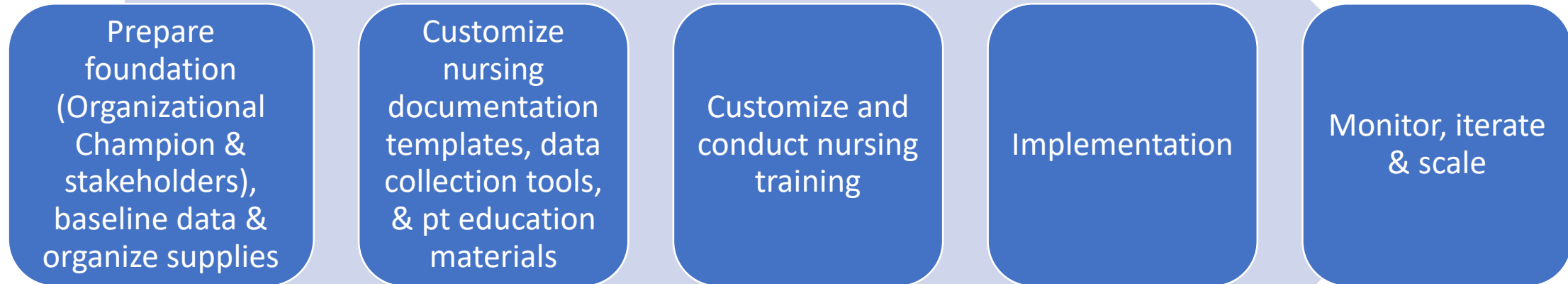
Single Center-Oct 2016-April 2018

- 1 VA center-↓NV-HAP from 105 cases to 8.3 cases per 1000 patient days
- 2.84 million cost savings
- 13 lives

Munro S, *Nurs Adm Q.* 2018;42(4):363-372.

Comprehensive NV-HAP Prevention

AIM	Primary Drivers	Secondary Drivers	Change Ideas
Prevent NV-HAP	Reduce pathogenic colonization of oropharyngeal cavity –primary source control	Comprehensive oral hygiene for all patients	Develop inclusive oral hygiene policy and protocol for all patients.
			Provide quality oral hygiene equipment for all patients.
	Reduce aspiration	Swallow assessments	Develop swallow assessment protocol for all at-risk patients (stroke, recently extubated, history of dysphagia).
		Elevated HOB	Adopt aspiration protocol that includes HOB elevation for those at risk.
		NG/OG tube assessment and care	Adopt NG/OG tube protocol.
	Strengthen host defenses	Early mobility	Develop mobility program for patients, including outside of ICU.
		Ensure adequate nutrition	Monitor % of enteral feeding delivered to patients. Consider volume-based feeding protocol.
		Stress Ulcer Prophylaxis Stewardship	Partner with providers and pharmacists on stewardship programs to only prescribe acid-reducing medications when clinically indicated.
		Glycemic control	Adopt program to target normal glucose levels.
		Immunize per CDC	Adopt nurse-driven protocol to screen and immunize (influenza and pneumococcal).

Quinn B, et al. *Am J Infect Control*. 2020;48(5S):A23-A27.

Healthcare-Associated Pneumonia

(Tablan et al., 2003; Davis, 2012)

1. Staff education and involvement in infection prevention.

2. Infection and microbiologic surveillance with data on local drug resistant pathogens.

3. Appropriate cleaning, sterilization or disinfection and maintenance of equipment, dev and environment.

4. Vaccinate staff and high risk patients (i.e. Flu shots).

5. Deep breathing exercises and ambulation.

6. Isolate infected patients as indicated.

7. Rapid screening with isolation as indicated.

8. Limit symptomatic staff and visitors.

9. Maintain intact, moist, and healthy oral lining and mucosa.

10. [†]Monitoring and early removal of invasive devices.

11. [†]Anti-microbial stewardship program.

12. [1‡]Swallow screens.

13. [‡]Lung expansion/mobilize.

14. [‡]Adequate nutrition.

15. [‡]Serum glucose in target range.

16. See prevention strategies for Aspiration Pneumonia.

3 Steps YOU can Take to Address NV-HAP

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

Slide courtesy of Barb Quinn

Metrics for NVHAP

- Percent NVHAP (#NVHAP / #patients X 100)

- NVHAP/1000 pt days (#NVHAP / # pt days X 1000)

- NVHAP Count

- No national benchmark so set internal goal

- Current literature: 1.22 – 5.9 / 1000 pt days

Slide courtesy of Barb Quinn

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

	Worsening oxygenation	≥3 days of new antibiotics	Temp > 38ºC	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

Klompas, et. al (2018). ID Week Poster
Wenjing JI. Et al. JAMA Network Open, 2019;2(10)

Incidence and Outcomes of Non-Ventilator-Associated Hospital-Acquired Pneumonia in 284 US Hospitals Using Electronic Surveillance Criteria

- Cohort study

- Retrospectively applied clinical surveillance criteria for NV-HAP to electronic health record data from 284 US hospitals. The medical records of 250 patients who met the surveillance criteria were reviewed for accuracy.

- NV-HAP, defined as sustained deterioration in oxygenation for 2 or more days in a patient who was not ventilated concurrent with abnormal temperature or white blood cell count, performance of chest imaging, and 3 or more days of new antibiotics.

- 6,022,185 hospitalizations

- 32,797 NV-HAP events (.55 per 100 admissions & .96 per 1000 patient days)

- 74% outside ICU

- Median LOS 16 (11-26)

- Mortality: 22.4%

- Compared with chart review 81%

1 in 200 hospitalizations
1 in 5 died in the hospital.
NV-HAP may account for up to 7% of all hospital deaths.

Jones BE,. *JAMA Netw Open*. 2023;6(5):e2314185.

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

Slide courtesy of Barb Quinn

2. GAP Analysis

Best Practice	Gaps	Action to Take
Comprehensive oral care protocol for all patients (CDC, SHEA)	Oral care protocol for ICU patients only. Units did not have sufficient high-quality oral care supplies. Documentation insufficient	Develop a new oral care standard operating procedure for medical surgical and long-term care patients; improve oral care provision and documentation, supplies readily available
Limit use of acid-reducing medications unless clinically warranted (SHEA)	Proton pump inhibitor and histamine 2 receptor blocker prescribing continues in half of patients	Prescribers: Careful consideration of the needs of each patient. Education, pharmacy audits
Aspiration precautions include elevating HOB 30°-45° unless contraindicated (CDC, SHEA, ATS)	Health care providers worried that this positioning will increase pressure ulcers	Use consistent charting template that includes elevation of HOB in addition to oral care details
Monitoring for development of all types of hospital-acquired infections	Encounter data pulls in community-acquired pneumonia	Educate clinicians who enter encounter data to record present on admission status for coders, track cases

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.

Kathleen Vollman
ADVANCING NURSING THROUGH KNOWLEDGE & INNOVATION

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MEDBRIDGE