



Do No Harm: Mitigating Risk Factors Vent and 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

- Define key fundamental evidence-based nursing care practices for independent and dependent patients that reduce vent and 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



The Why

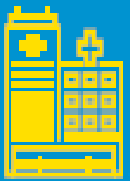


1 in every 10 hospitalized Australians adults will develop an HAI



Australian Pneumonia Data

Pneumonia refers to an infection of the lungs.



Around 17,900 hospital-acquired episodes of pneumonia occur each year in Australian hospitals*

167.4

Highest rate at Principal Referral Hospitals†

46.6

Aggregate rate at Principal Referral Hospitals

Per 10,000 hospitalisations



If all hospitals reduced their rate to less than 46.6 per 10,000 hospitalisations, it would prevent at least 2,830 episodes of pneumonia

The cost associated with Hospital Acquired Pneumonia in Australia

Could cost the hospital an additional \$39,406

Patients with this Pneumonia require 19.0 extra days in the hospital compared to those who don't have a Pneumonia.

2019-2020

Australian Data for HAC's

Complication class	Public hospitals		Private hospitals	
	Separations	Per 100	Separations	Per 100
Pressure injury	2,317	0.0	748	0.0
Falls resulting in fracture or other intracranial injury	2,340	0.0	731	0.0
Healthcare associated infection	62,492	1.2	17,959	0.5
Surgical complications requiring unplanned return to theatre ^(b)	8,041	0.1	3,192	0.1
Unplanned intensive care unit admission ^(c)				
Respiratory complications	15,567	0.3	3,330	0.1
Venous thromboembolism	3,567	0.1	2,251	0.1
Renal failure	701	0.0	174	0.0
Gastrointestinal bleeding	4,349	0.1	1,471	0.0
Medication complications	14,043	0.3	2,364	0.1
Delirium	18,261	0.3	6,420	0.2
Persistent incontinence	573	0.0	317	0.0
Malnutrition	2,082	0.0	703	0.0
Cardiac complications	19,439	0.4	8,644	0.2
Third and fourth degree perineal laceration during delivery	5,017	0.1	461	0.0
Neonatal birth trauma	1,905	0.0	204	0.0
Total	112,998	2.1	37,062	1.0

(a) A separation is counted only once for each hospital-acquired complication category where at least one condition was reported for the separation.

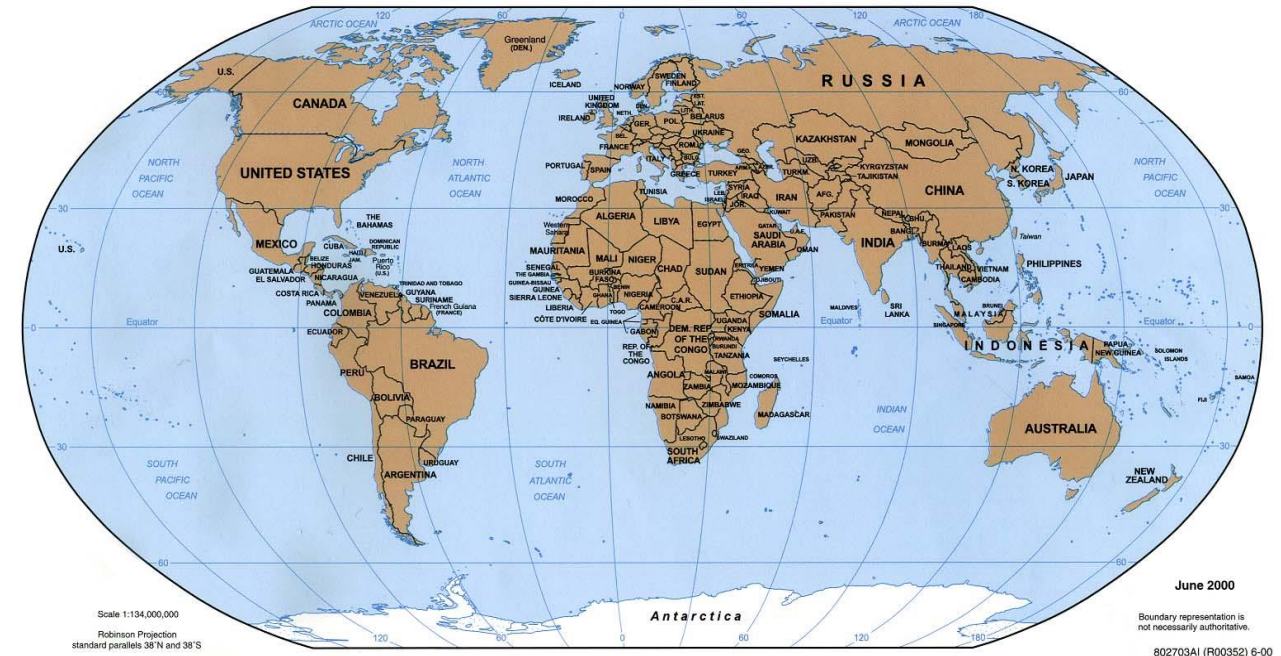
2019-2020

20 Most Common Complication Diagnosis Australian Hospitals

Complication class		Public hospitals	Private hospitals	Total
11.01	Delirium	18,261	6,420	24,681
3.01	Urinary tract infection	17,070	3,222	20,292
3.03	Pneumonia	13,835	6,448	20,283
14.02	Arrhythmias	10,339	5,974	16,313
3.04	Blood stream infection	12,157	2,847	15,004
6.02	Aspiration pneumonia	10,983	2,236	13,219
10.03	Hypoglycaemia	9,011	1,057	10,068
3.07	Infection associated with prosthetic/implantable devices	6,058	1,515	7,573
9.01	Gastrointestinal bleeding	4,349	1,471	5,820
3.02	Surgical site infection	4,005	1,604	5,609
15.01	Third and fourth degree perineal laceration during delivery	5,017	461	5,478
4.01	Post-operative haemorrhage/haematoma requiring transfusion and/or return to theatre	3,507	1,802	5,309
4.02	Surgical wound dehiscence	4,028	885	4,913
3.05	Central line and peripheral line associated bloodstream infection	3,564	1,043	4,607
14.04	Acute coronary syndrome including unstable angina, STEMI and NSTEMI	3,636	888	4,524
3.06	Multi-resistant organism	3,646	837	4,483
6.01	Respiratory failure including acute respiratory distress syndrome requiring ventilation	3,430	836	4,266
14.01	Heart failure and pulmonary oedema	2,828	1,092	3,920
7.02	Deep vein thrombosis	1,901	1,441	3,342
14.03	Cardiac arrest	2,526	720	3,246
Other complications		20,543	6,170	26,713
Total separations		112,998	37,062	150,060
Total complications		160,694	48,969	209,663

VAP/HAP

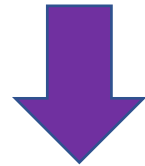
- 🌐 VAP is associated with ↑ MV days and ↑ ICU & hospital LOS¹
 - 🌐 Attributable mortality estimated to be 4.0–13.5%¹
 - 🌐 Financial cost of a VAP episode has been estimated as approximately 15,000 to 40,000 US¹
 - 🌐 Europe and US-# 1 most prevalent HAI²
 - 🌐 Pneumonia was the third most common hospital acquired complication. In 2019 - 20, 9.7% of all hospital acquired complications were pneumonia^{3,4}
- △ 35% VAP, 65% HAP³



1. Torres A, et al. Eur Respir J 2017;50(3):1700582
2. Mitchell BG, et al. Infect Dis Health. 2019;24(4):229-239.
3. Russo PL, et al. Antimicrobial Resistance & Infection Control, 2019;8:114
4. Australian Institute of Health and Welfare. Admitted patient care 2019-20 8: Safety and quality of health systems. 2021. <https://www.aihw.gov.au/reports-data/myhospitals/sectors/admitted-patients#more-data>. Published 2021. Accessed July 13, 2021.

Building Blocks to Best Practice in Caring for Mechanically Ventilated Patients

Ventilator Bundle: HOB 30, Deep Vein Thrombosis (DVT) prophylaxis, Peptic Ulcer Disease (PUD) prophylaxis, Sedation interruption, Spontaneous breathing trial, daily care with chlorhexidine



VAP Bundle: HOB 30, Sedation interruption, Spontaneous breathing trial, oral care 6x per day, CHG rinse 2x per day, subglottic secretions drainage if expected to be ventilated > 72hrs

Risk Factor Categories for Hospital Acquired Pneumonia

- ▲ Factors that increase bacterial burden or colonization
- ▲ Factors that increase risk of aspiration



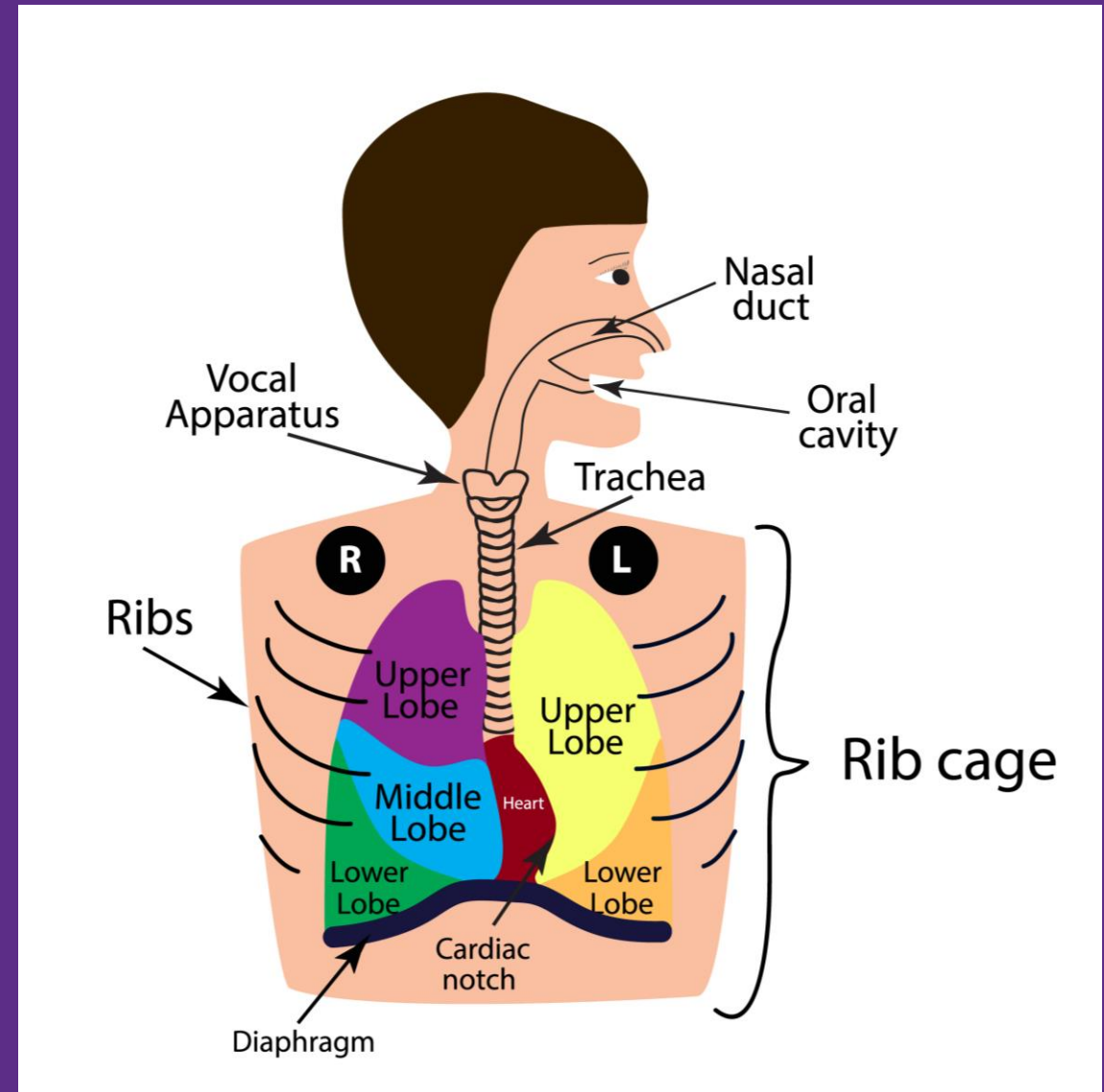
Modifiable Risk Factors

- ▲ Supine positioning
- ▲ Nasogastric tubes and condensate in ventilator tubing
- ▲ Acid-suppressing medications, such as antacids and H2 blockers, that are employed to prevent stress ulcer bleeding in ventilated patients
- ▲ Mechanical ventilation for >48 hours
- ▲ Admission to an ICU
- ▲ Duration of hospital or ICU

Single Ecosystem

- Entire respiratory tract is one ecosystem¹
 - Upper-nasal and oral cavities
 - Lower-alveoli
- Not sterile environment¹
- Oral flora changes in hospitalized patients²
- Relationship between dental plaque and pulmonary lavage fluid³

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



Where does Pneumonia Start: Oral Bacteria during Hospitalization & Illness

🔬 Oral cavity¹

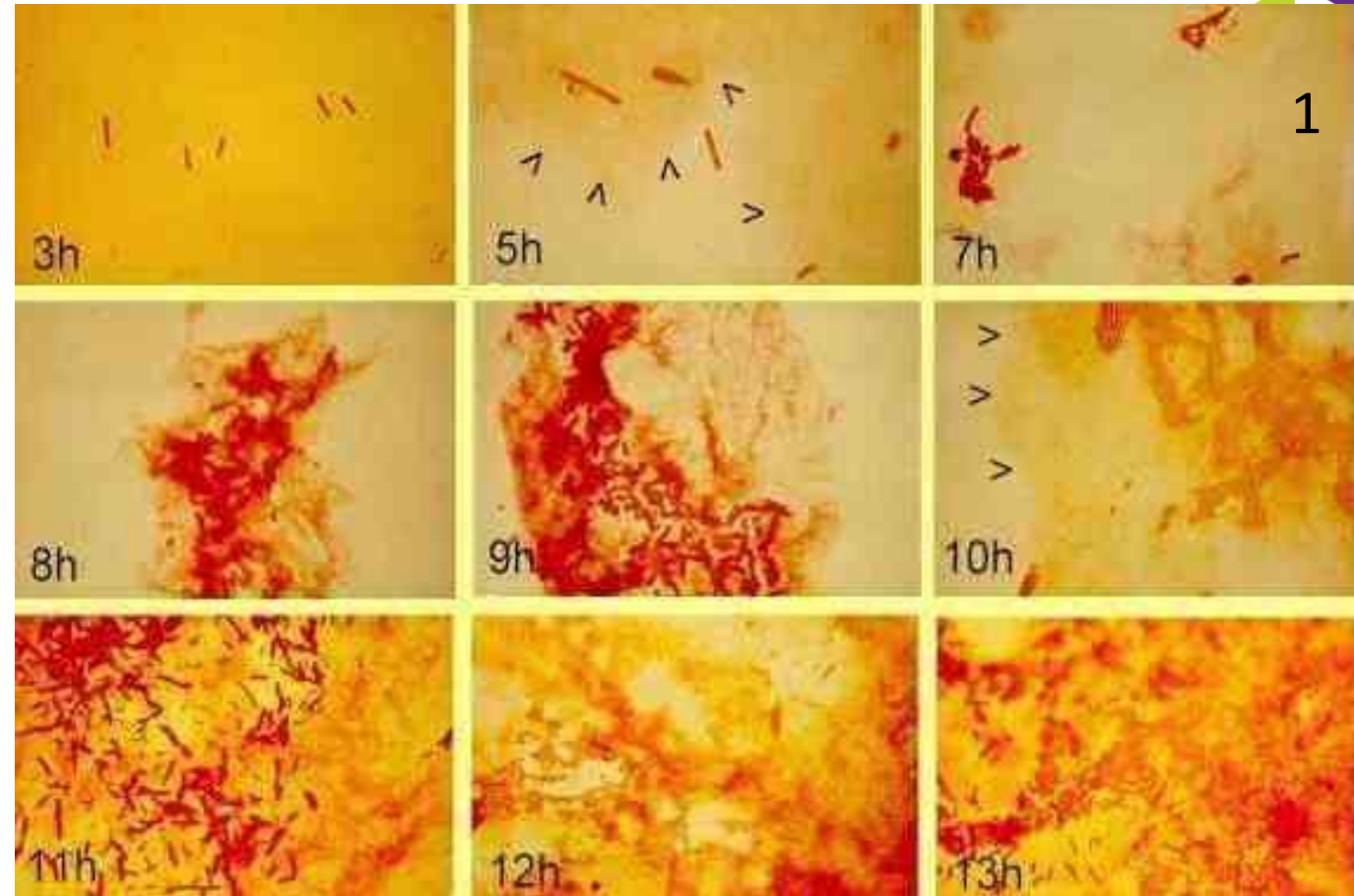
- △ > 1 billion oral microbes
- △ 700-1000 species
- △ Replicate's 5 x in 24hr period

🔬 Disruption of Microbiome²

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

🔬 24-48 hours for HAP pathogens in mouth³

🔬 If aspirated =100,000,000 bacteria/ml saliva into lungs⁴



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

Endotracheal / Nasogastric Tube/ Sinusitis

- 🌀 Carriage of oropharyngeal bacteria during intubation¹
- 🌀 Endotracheal tube acts as a reservoir for infecting microorganisms¹
- 🌀 If cuff pressure < 20 cm 4x ↑ risk VAP³
 - △ Cuff pressure range btwn 25-40cm (JBI-Level A) with maintenance at 25cm-30cm of H₂O pressure.
 - △ No difference between freq & infrequent measurement⁵
 - △ Continuous monitoring resulted in a lower portion of out-of-range cuff pressure (11% vs. 51.7% p< 0.001) and ↓ in VAP⁵
- 🌀 Use oral ET versus nasal^{2,3}
 - △ NGT increases risk of sinusitis/gastric reflux & increases oropharyngeal colonization
 - △ Sinusitis increases the risk of nosocomial pneumonia by 3-fold

1. Diaconu O, et al. *J Crit Care Med (Targu Mures)*. 2018;4(2):50-55.
2. Carstens J. Joanna Briggs Institute, 2010
3. Sole, ML, et al. *AJCC*, 2011;20:109-117
4. Nseir S, et al. *Ann Intensive Care* 2015;5:43
5. Letvin A, et al. *Resp Care* 2018;63(5):495-501

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

Risk Factor Categories for Hospital Acquired Pneumonia

- ▲ Factors that increase bacterial burden or colonization
- ▲ Factors that increase risk of aspiration



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%

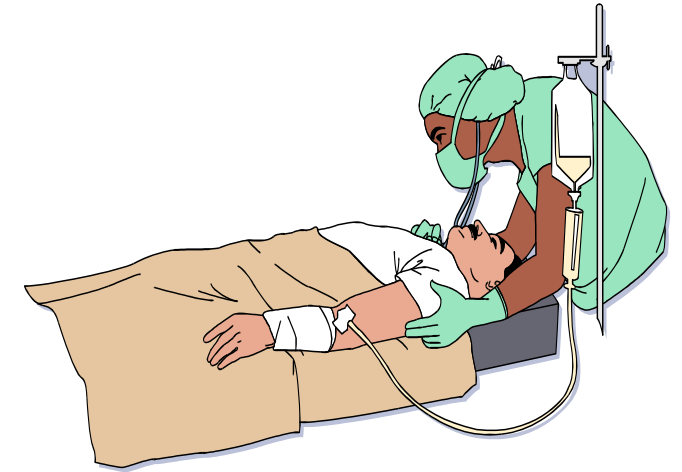
In the lung parenchyma



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:

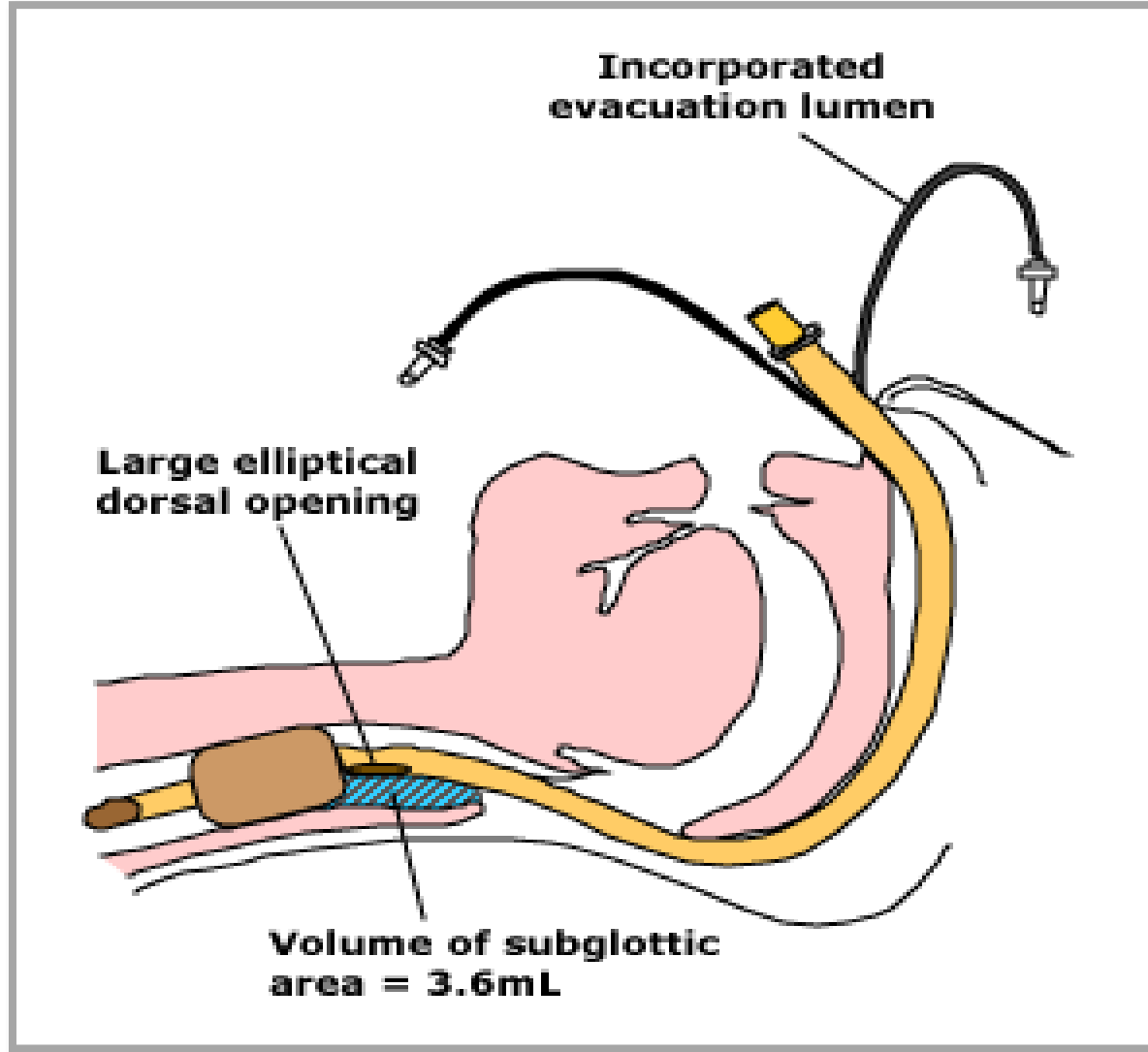
- Supine: 298cpm/30min vs. 2592cpm/300min
- HOB: 103cpm/30min vs. 216cpm/300min



Same microbes cultured in all 3 areas

- HOB: 32%
- Supine: 68%

Current Subglottic Suctioning Endotracheal Tubes

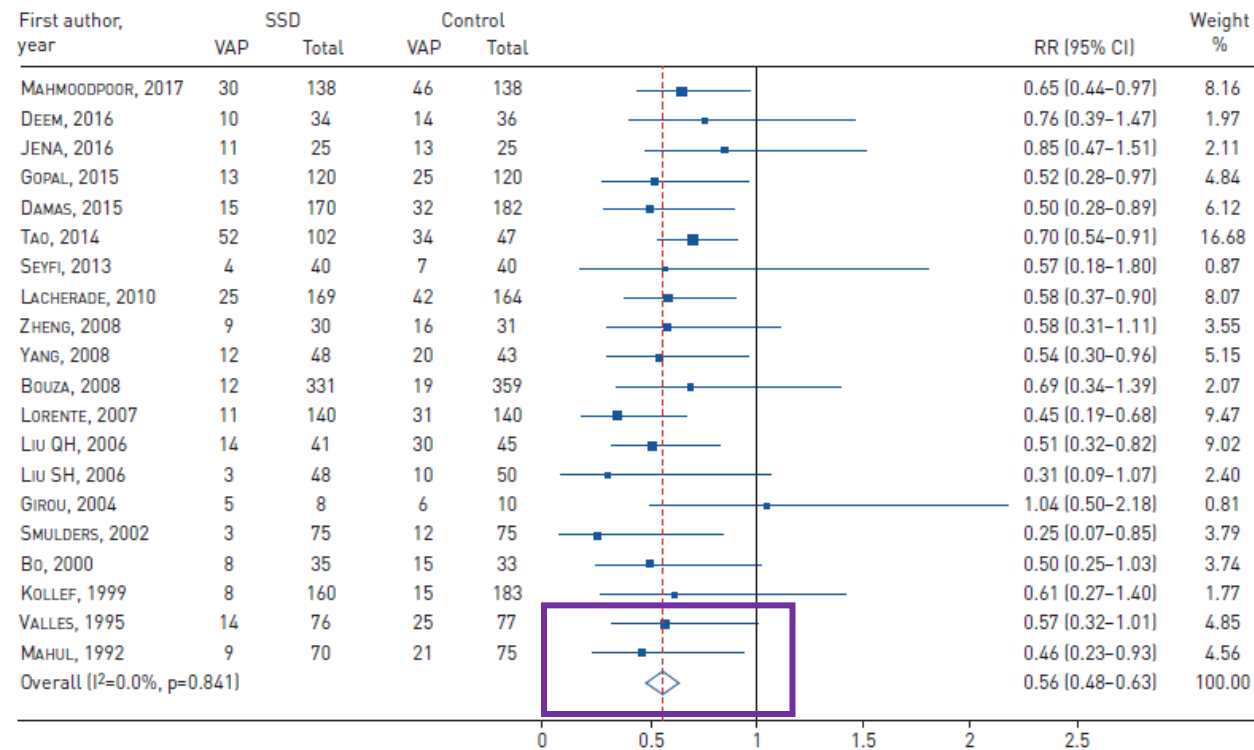


Subglottic suctioning ETTs in patients mechanically ventilated for >72 hours

Update: Subglottic Secretion Drainage Meta-Analysis

20 RCT's, studies from 1992-2017, 3684 Patients

VAP Incidence



Mortality

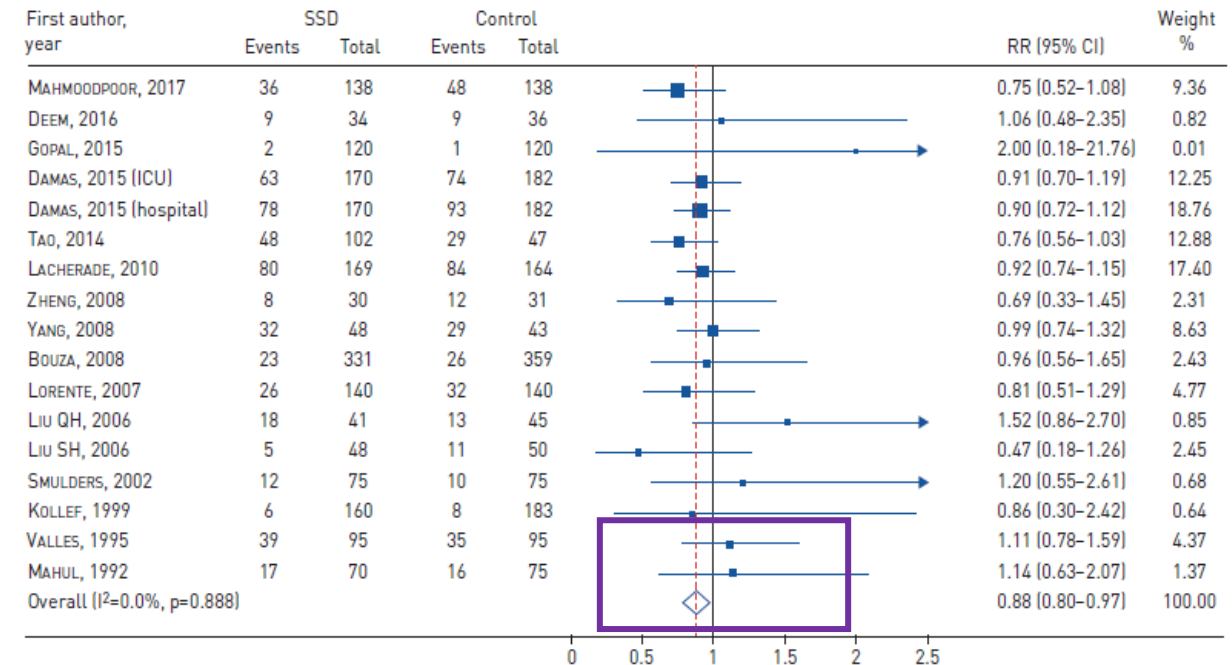


FIGURE 3 Forest plot comparing subglottic secretion drainage (SSD) versus non-SSD on mortality. RR: risk ratio; ICU: intensive care unit.

Oral Hygeine



Polling Question

What is your current oral care regime at your facility?

- △ CHG alone
- △ Toothbrushing
- △ Toothbrushing with CHG
- △ Toothbrushing, CHG, cleansing swabs(Comprehensive kit)
- △ Nothing

What Does the Evidence Tell Us?

Brush
CHG rinse alone
CHG rinse in Combination
Swab/Clean/Moisturize
Suction

All of the above

Comprehensive Oral Care Program



Literature Review: Oral Care

Impact of VAP

Comprehensive Oral Care:

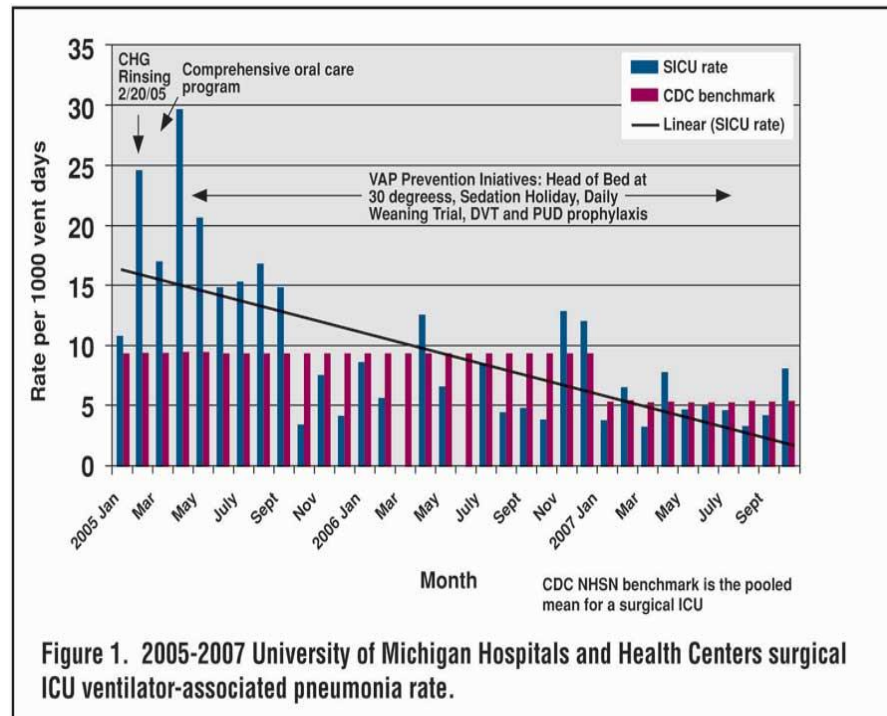
- Reduction in VAP from 5.6 to 2.2¹
- Reduction in VAP from 4.10 (2005) to (2.15) in 2006 with addition of CPC & comprehensive oral care. Vent bundle & rotational therapy already being performed²
- Reduction in VAP from 12.0 to 8.0 (p=.060) with 80% compliance, vent bundle already being performed, 1538 patients randomized to control or study group, Additional outcomes; ↓ vent days (p=.05), ↓ ICU LOS (p=.05) ↓ time to VAP (p= <.001) & reduction in mortality (p=.05)³

1. Schleder B. et al. J Advocate Health 2002;4(1):27-30)
2. Powers J, et al. J Nurs Care Qual. 2007 Oct-Dec;22(4):316-21
3. Garcia R et al AJCC, 2009;18:523-534)

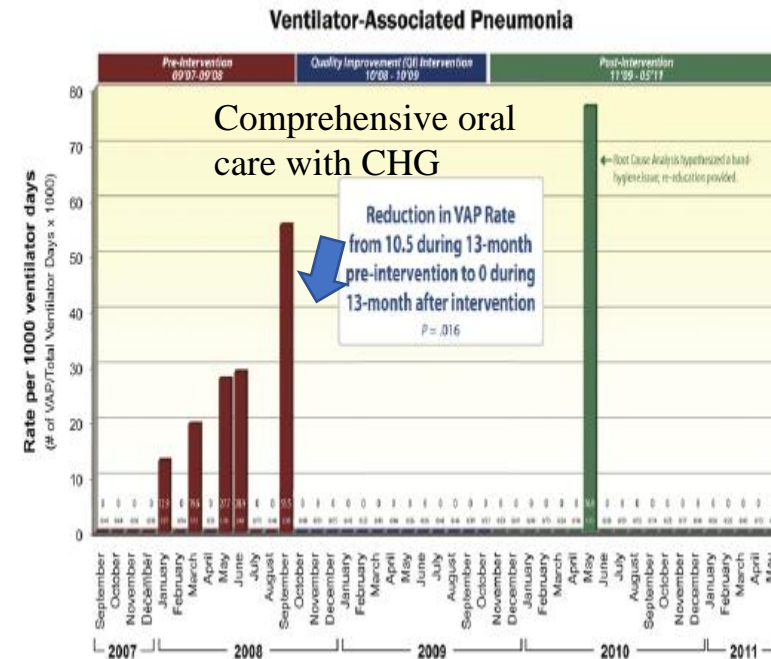
Literature Review: Oral Care Impact of VAP/Dependant

Comprehensive Oral Care & CHG:

- Reduction in VAP to zero for 2 years, vent bundle, mobility, oral care & CHG with comprehensive education preformed (Murray TM et al. AACN Advanced Critical Care. 2007;18(2):190-199)



Dickinson S et al. SCCM Critical Connections, 02/2008






Heck K, et al. American Journal of Infection Control 40 (2012) 877-9

Does CHG Oral Care Impact VAP and Mortality

Klompas Study- Retrospective review

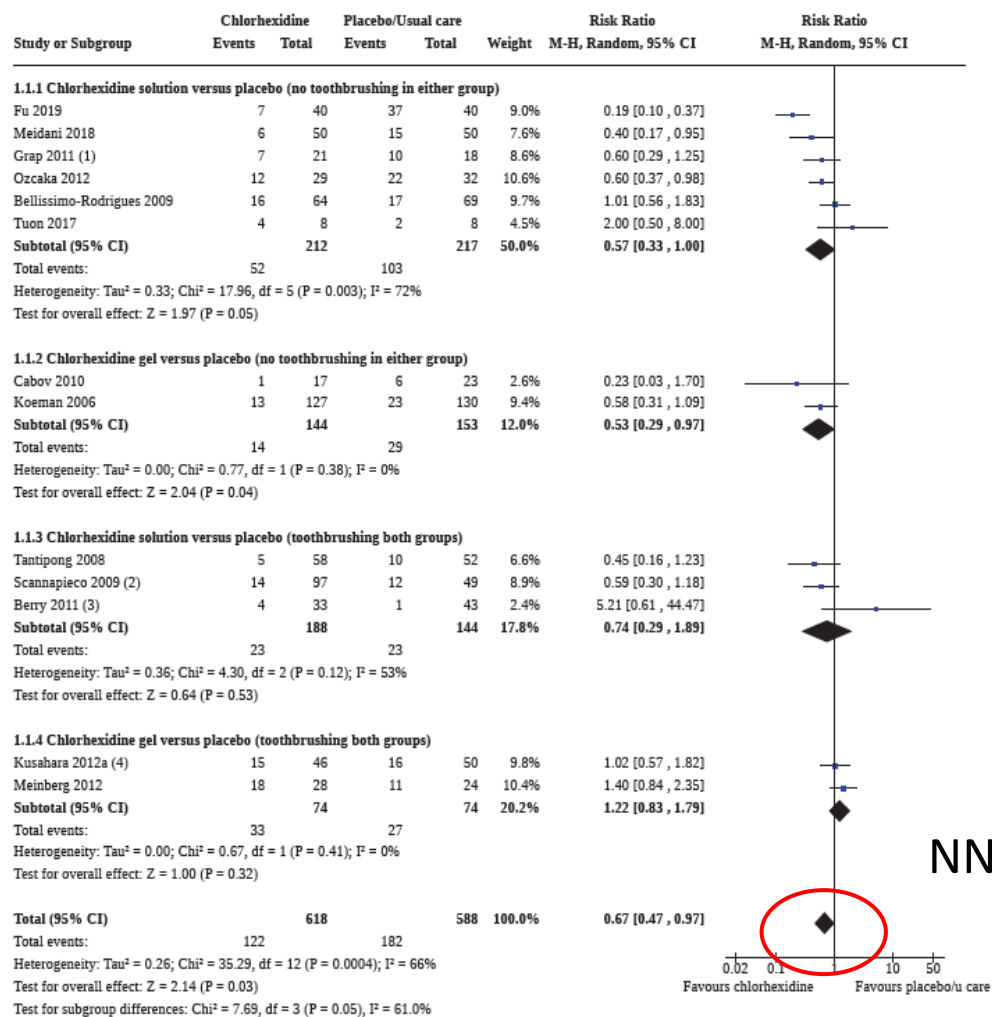
- △ Single center
- △ Impact of vent bundle (5536 patients)
- △ Connection of CHG with increase mortality on patients vented > 3 days

Deschepper study: Retrospective Review

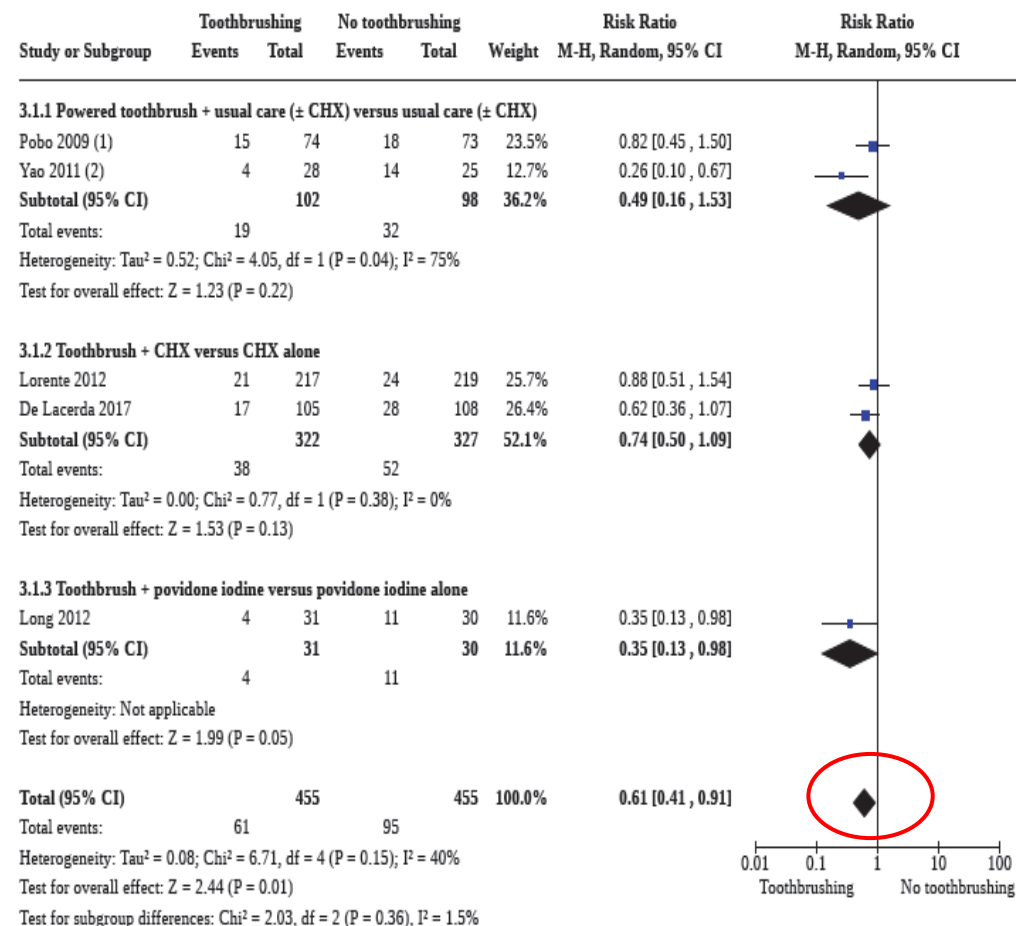
- △ Hospital wide retrospective cohort (82,274 patients)
- △ 11,133 patients received CHG oral care
- △ Divided into low exposure-cumulative dose < 300 mg (8080 pts)
- △ High exposure > 300 mg (3053 pts)
- △ 300 mg CHG is equivalent to 1 bottle of 250ml of oral care soln at .12%-covers 5-6 days at 3 times a day
-  In the sickest group CHG low or high exposure was not a risk for increased mortality
-  Showed improvement on mortality in ICU patients ventilated < 96hrs and not harm if vented > 96 hrs
-  Greatest risk for mortality increase is use in non-ICU patients.

Cochrane Meta-Analysis 2020 of RCT's

Analysis 1.1. Comparison 1: Chlorhexidine versus placebo/usual care, Outcome 1: Incidence of VAP

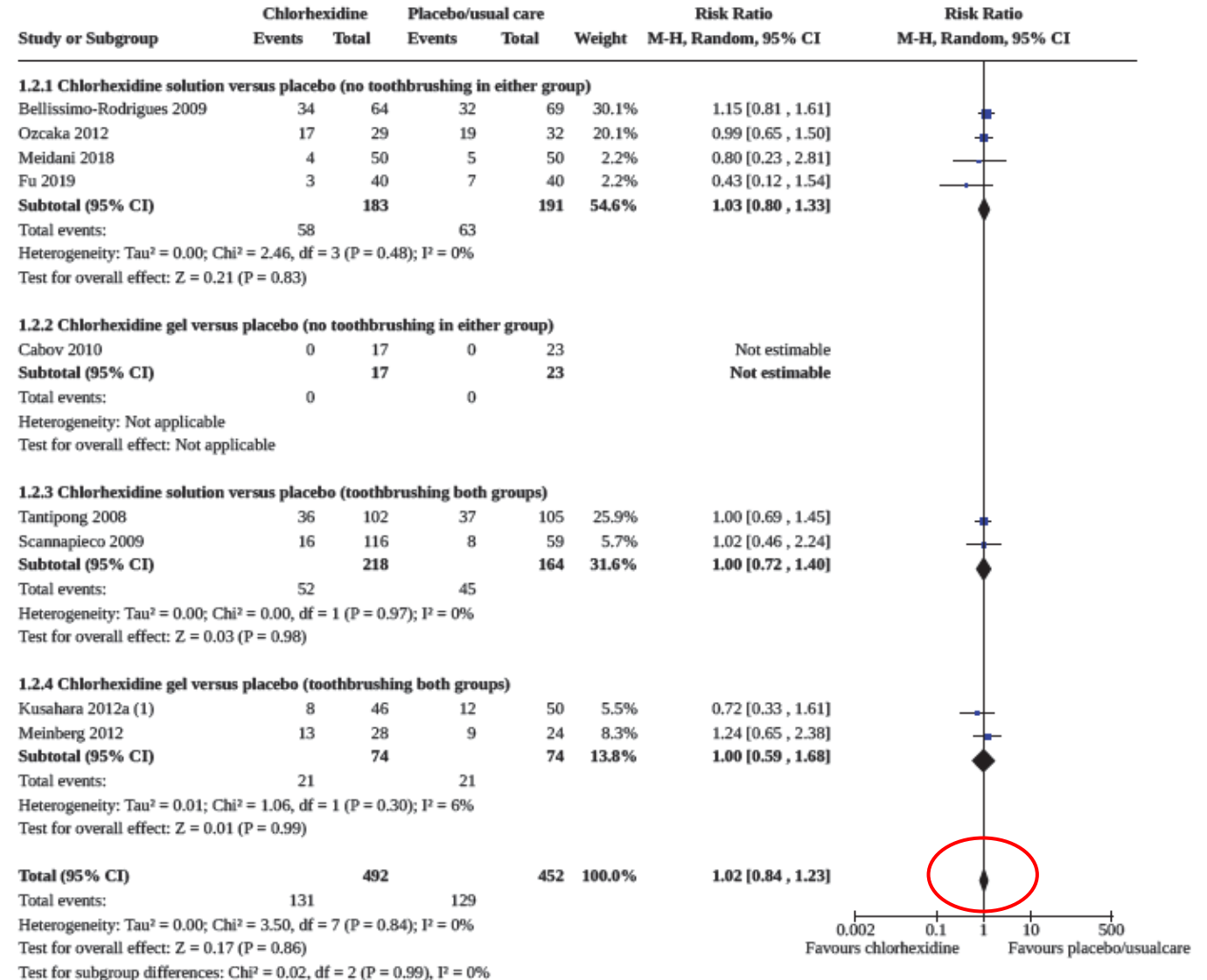


Analysis 3.1. Comparison 3: Toothbrushing versus no toothbrushing, Outcome 1: Incidence of VAP



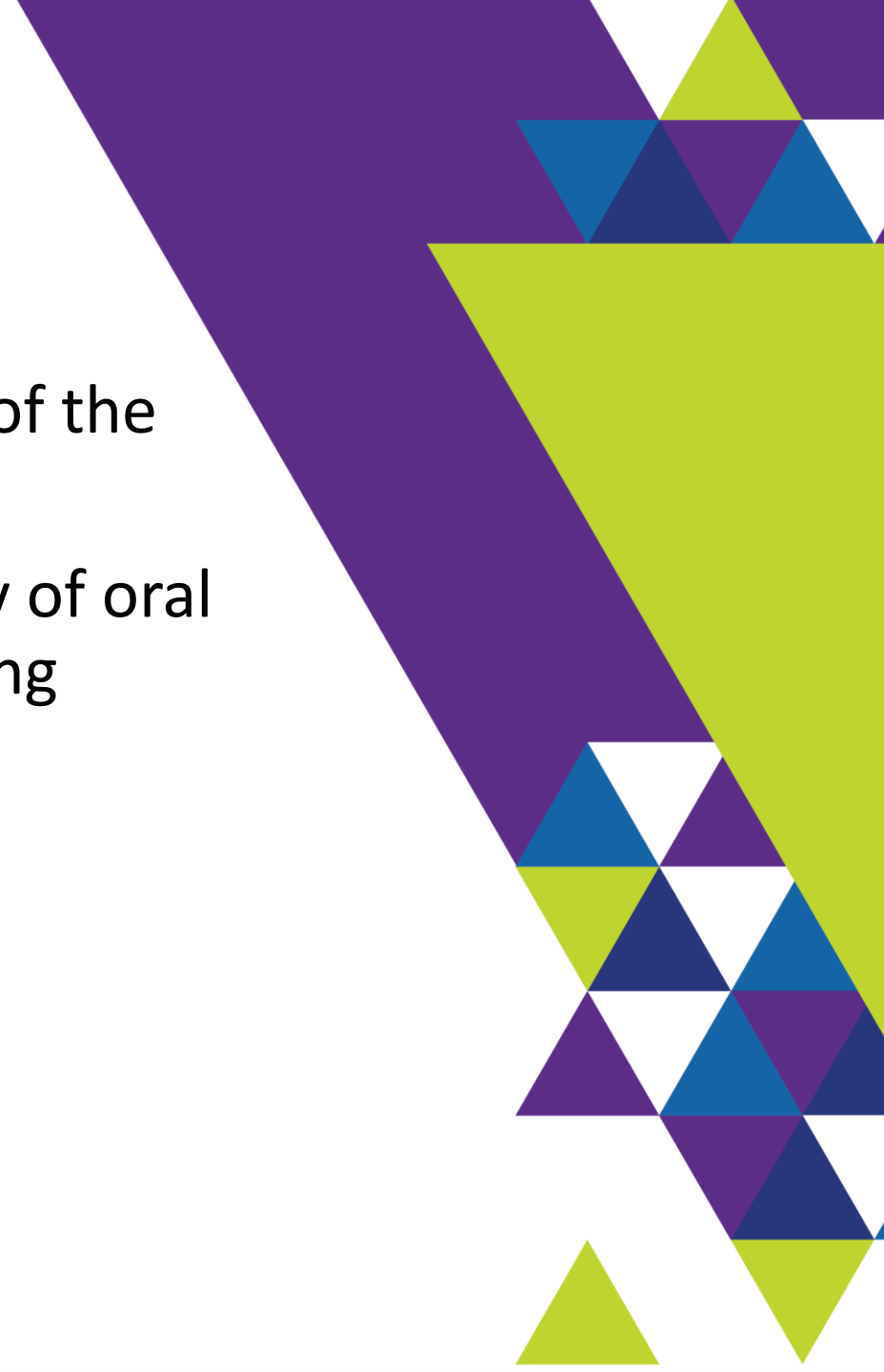
Impact on Mortality

Analysis 1.2. Comparison 1: Chlorhexidine versus placebo/usual care, Outcome 2: Mortality



It is More than CHG

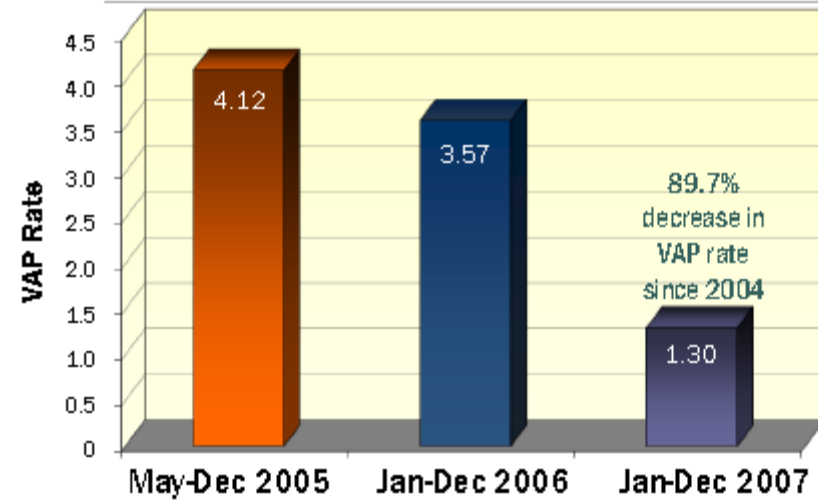
- 🔗 .12% CHG application 2x daily is a small part of the oral care equation
- 🔗 It is the comprehensive and frequent delivery of oral hygiene, including toothbrushing and cleansing



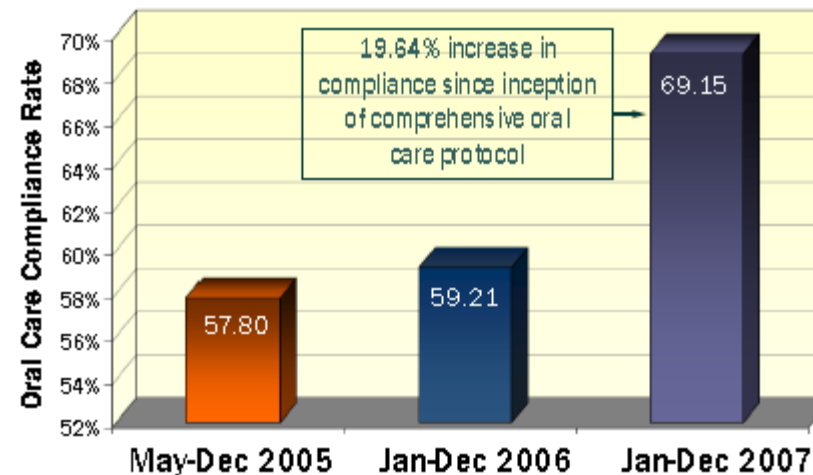
Does Compliance Make A Difference?

Oral care compliance
& use of the
ventilator bundle
resulted in a 89.7%
reduction in VAP

VAP rates for the years of the study

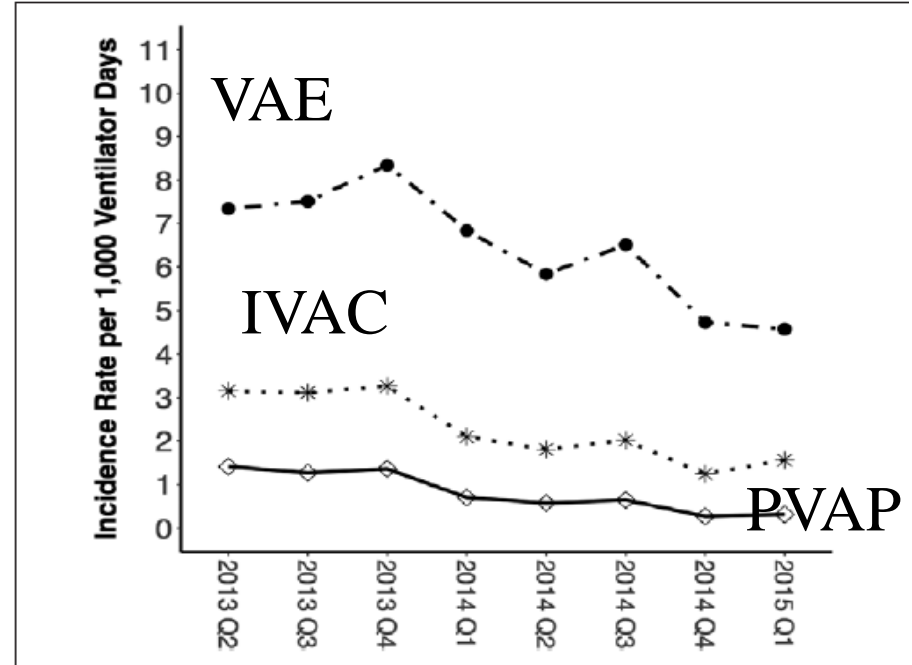


Compliance rates for the years of the study



Impact of a New Bundle/2 State Collaborative

- 38 hospitals, 56 ICU's in 2 states from October 2012 to March 2015
- Evidence based interventions, teamwork & safety culture
- Head-of-bed elevation, use of subglottic secretion drainage endotracheal tubes, oral care, chlorhexidine mouth care, and daily spontaneous awakening and breathing trials.

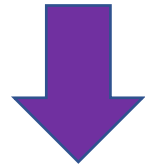


- VAE: 7.34 to 4.58 cases per 1,000 ventilator-days ($p = 0.007$)
- IVAC 3.15 to 1.56 per 1,000 ventilator days ($p = 0.018$)
- PVAP 1.41 to 0.31 cases per 1,000 ventilator-days ($p = 0.012$)

Building Blocks to Best Practice in Caring for Mechanically Ventilated Patients



Ventilator Bundle: HOB 30, Deep Vein Thrombosis (DVT) prophylaxis, Peptic Ulcer Disease (PUD) prophylaxis, Sedation interruption, Spontaneous breathing trial, daily care with chlorhexidine¹



VAP Bundle: HOB 30, Sedation interruption, Spontaneous breathing trial, oral care 6x per day, CHG rinse 2x per day, subglottic secretions drainage if expected to be ventilated > 72hrs²

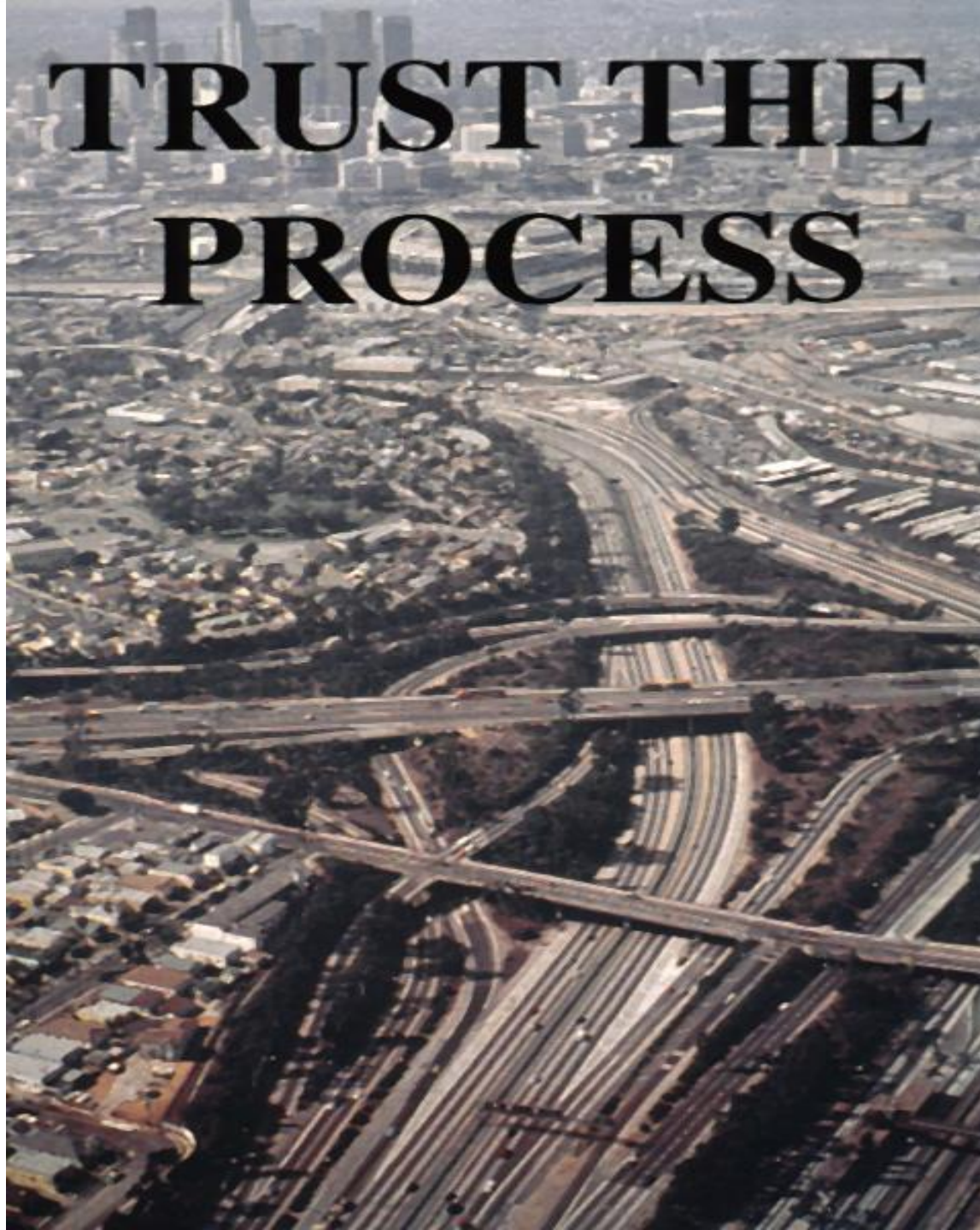


ABCDE Bundle: Assess & manage pain, Both Spontaneous awakening trial (SAT) & spontaneous Breathing trial(SBT), Choice of Sedation, Delirium Assessment and management, Early Mobility, Family and Patient Engagement³

1. <http://www.ihl.org/resources/Pages/Tools/HowtoGuidePreventVAP.aspx>
2. Rawat N, et al. Crit Care Med, 2017;45:1208-1215
3. www.ICUliberation.org



TRUST THE PROCESS



Non-Vent Pneumonia: Addressing Risk Factors



Build the Will: NV-HAP Causes Harm

- 🔗 HAP 1st most common HAI in U.S.^{1,2}
- 🔗 1 in every 4 hospital infections are pneumonia¹
 - △ 60% non-ventilator
- 🔗 Increased mortality → 15.5%-30.9%³
 - △ 8 ½ x more likely to die than equally sick patients who did not get non-vent HAP⁴
- 🔗 Increased morbidity → 50% are not discharged home^{5,6,7}
 - △ Extended LOS → 7-9 days^{5,6,7}
 - △ Increased Cost → \$36K to \$54K per case⁶
 - △ 2x likely for readmission <30 day^{5,6}
 - △ 46% ↑ ICU utilization^{5,6}
 - △ Increase antibiotic utilization⁸

1. Magill SS, et al. NEJM 2018;379:1732-1744
2. Strassle PD, et al. Infect Control Hosp Epidemiol. 2020 Jan;41(1):73-79.
3. Giuliano K, et al. Am J of Infect Control. 2018;46:322-327
4. Micek ST, et al. Chest. 2016 Nov;150(5):1008-1014.
5. Baker D, Quinn B et al. J Nurs Care Qual, 2019 1-7
6. Giuliano K, et al. Am J of Infect Control. 2018;46:322-327
7. Davis J et al. Pa Patient Safety Advisory, 2018;15(3)
8. Lacerna CC, et al. Infec control & Hosp Epidemiology 2020;41, 547-552

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

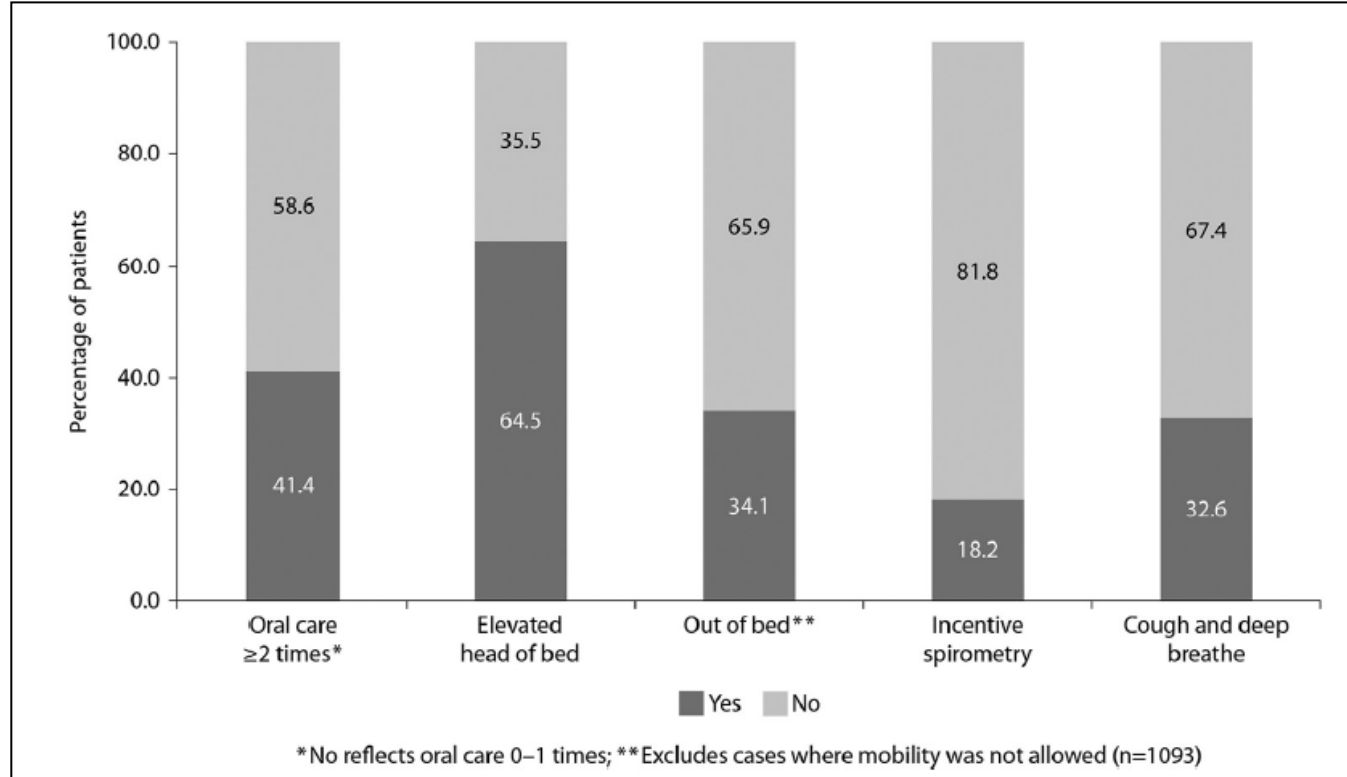


- ▲ Multicenter retrospective chart review
- ▲ Extracted NV-HAP cases per the 2014 ICD-9-CM codes for pneumonia not POA and the 2013 CDC case definition
- ▲ 21 hospitals completed data collection
- ▲ Measured nursing care missed 24hrs before diagnosis
- ▲ Non-vent HAP occurred on every unit



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)

Is Pneumonia Part of the Sepsis Picture?

30-50% of sepsis cases may initiate with pneumonia¹

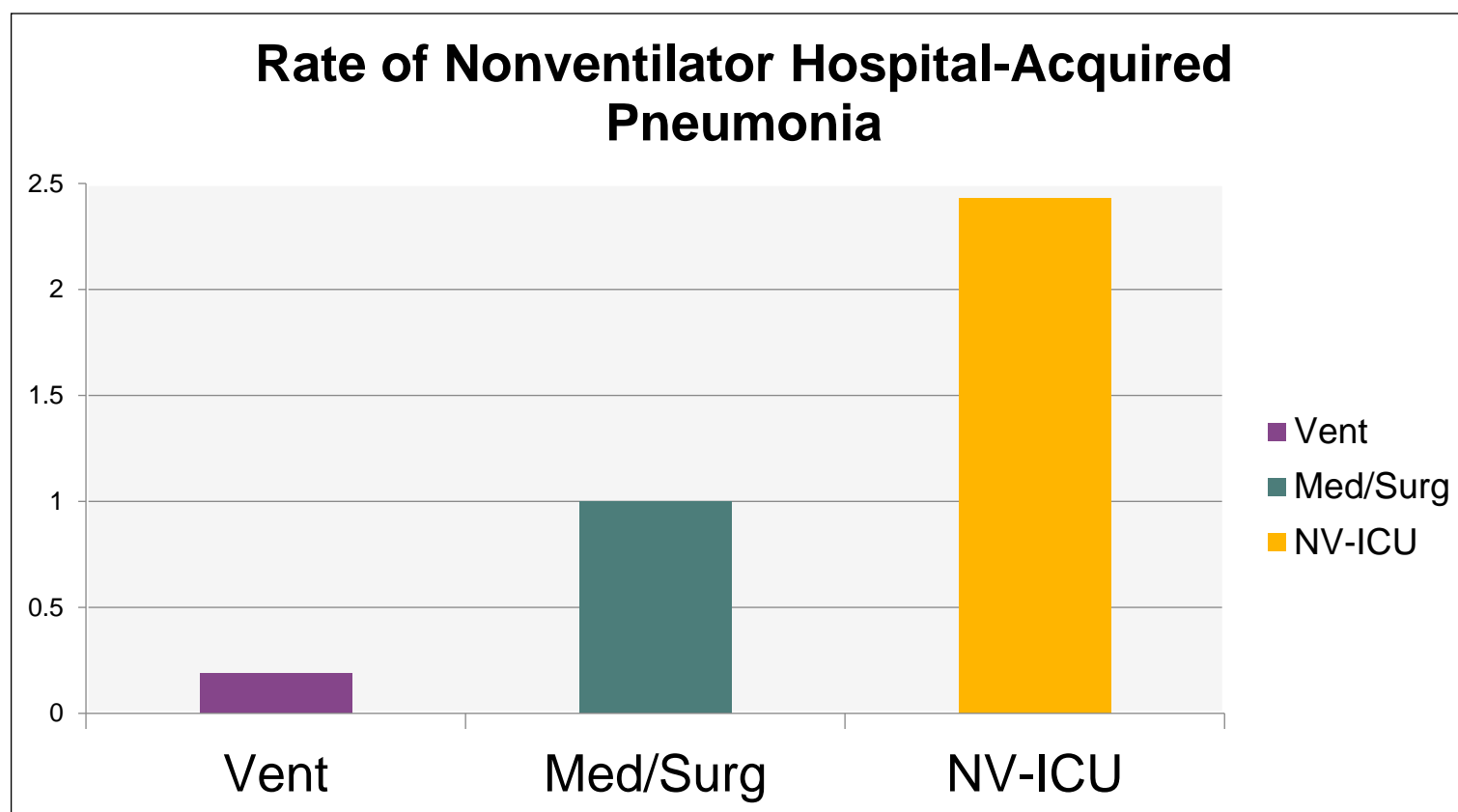
Site of infection	Frequency %		Mortality %	
	Male	Female	Male	Female
Respiratory	41.8	35.8	22.0	22.0
Bacteremia	21.0	20.0	33.5	34.9
Genitourinary	10.3	18.0	8.6	7.8
Abdominal	8.6	8.1	9.8	10.6
Device related	1.2	1.0	9.5	9.5
Wound/ soft tissue	9.0	7.5	9.4	11.7
Central nervous system	0.7	0.5	17.3	17.5
Endocarditis	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 admission²

1. Angus DC, et al. N Engl J Med. 2013 Aug 29;369(9):840-51.
2. Giuliano K, et al. Am J of Infect Control. 2018;46:322-327



Where is the Highest Risk for NV-HAP?



NV-HAP per 1000 patient days

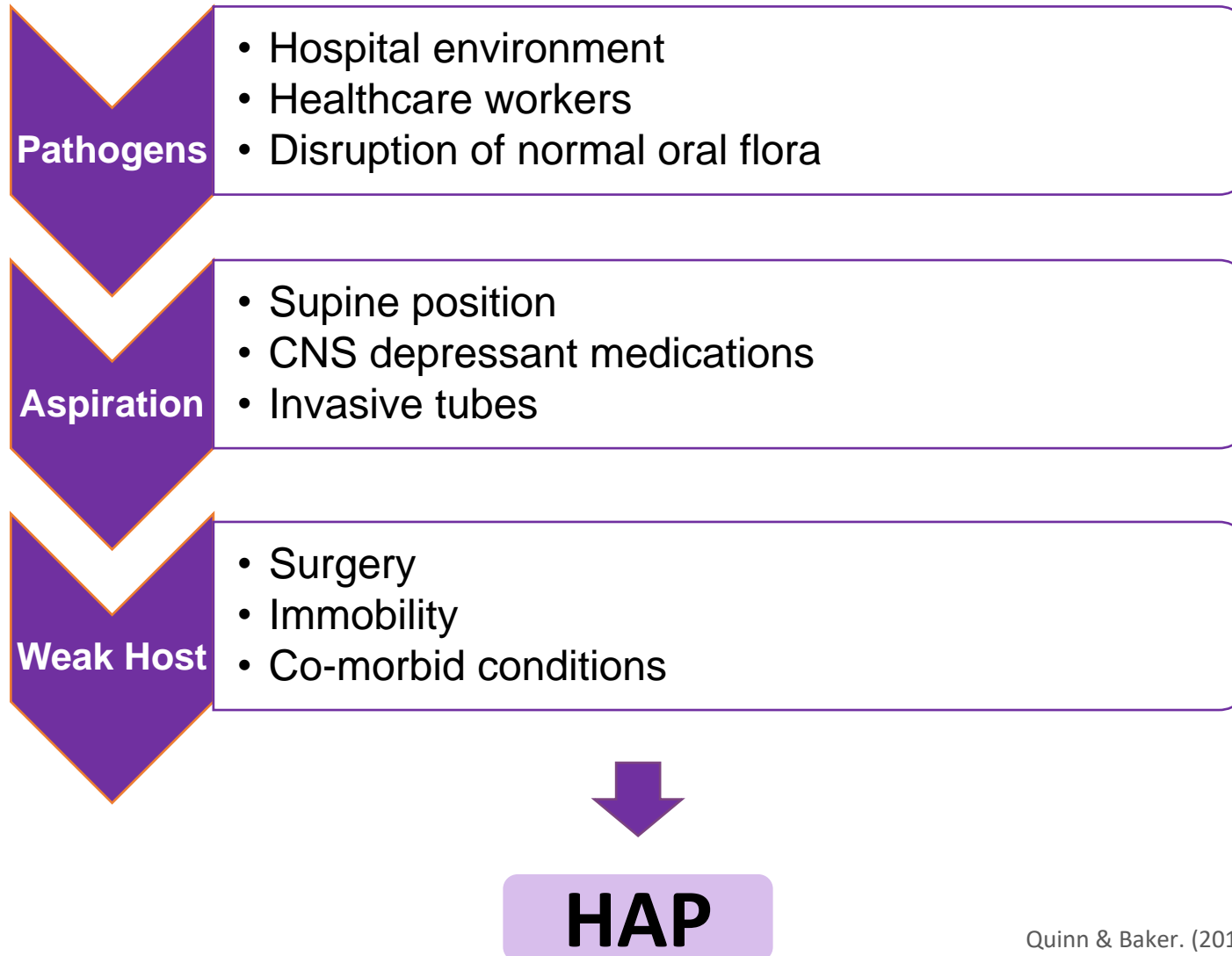
NV-HAP Prevention Strategies: Systematic Review

- ▴ Improving oral hygiene
- ▴ Increasing mobility/patient movement
- ▴ Dysphagia management

Addressing the risk-factors
associated with NV-HAP/
through evidence based
fundamental nursing care
strategies for dependent
and independent patients



Risk Factors for Pneumonia



Weak Host: Who is at Highest Risk?

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

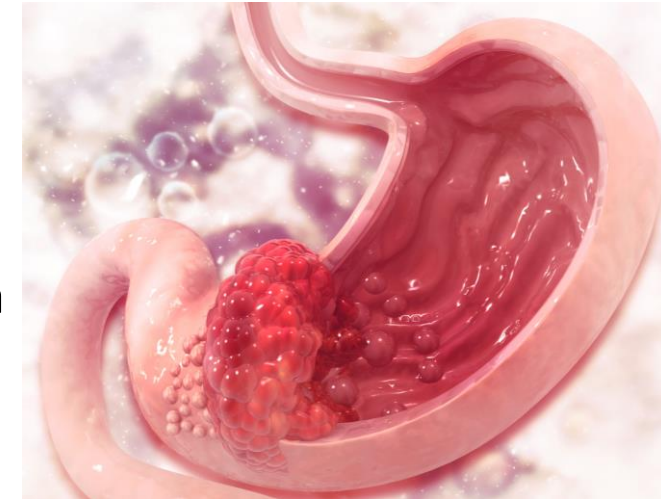
- Immunocompromised
- More than 6 medications
- Low albumin
- On antibiotics
- Dependent for ADLs
- Smokers



Stewardship of Stress Ulcer Prophylaxis (SUP)



- ▲ The most common complication of SUP is pneumonia¹
- ▲ ICU enteral fed patients¹
 - △ no benefit & may increase risk for pneumonia Avoid unnecessary use
- ▲ Acute Stroke patients (Systematic Review & Meta-Analysis)^{2,3}
 - △ Acid suppressive medications are an important contributor to pneumonia development, especially PPIs
- ▲ May lead to loss of protective bacteriostatic effect of gastric acid^{1,3}
- ▲ Higher risk of Clostridium difficile infection when combined with antibiotics¹



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



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



Dysphagia Management

- 🔗 Dysphagia screening/acute stroke or high-risk^{2,3} populations
- 🔗 Swallow exam^{2,3}
- 🔗 Initiated appropriate type of nutrition & liquids³

Top tips for prevention and management of aspiration pneumonia¹

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.

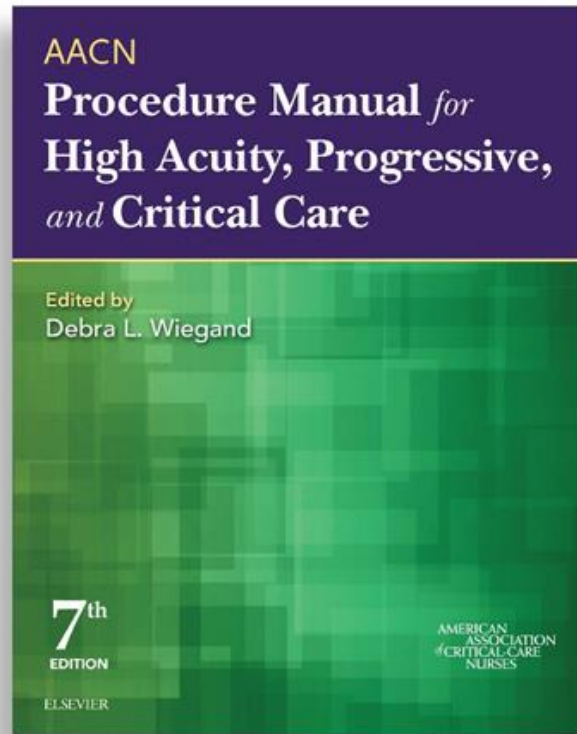
Monitor

- 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.



AACN Procedural Manual-7th Ed



Procedure 4: Endotracheal Tube Care and Oral Care

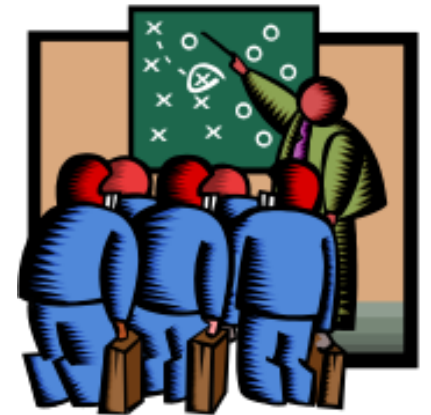
Authors:

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

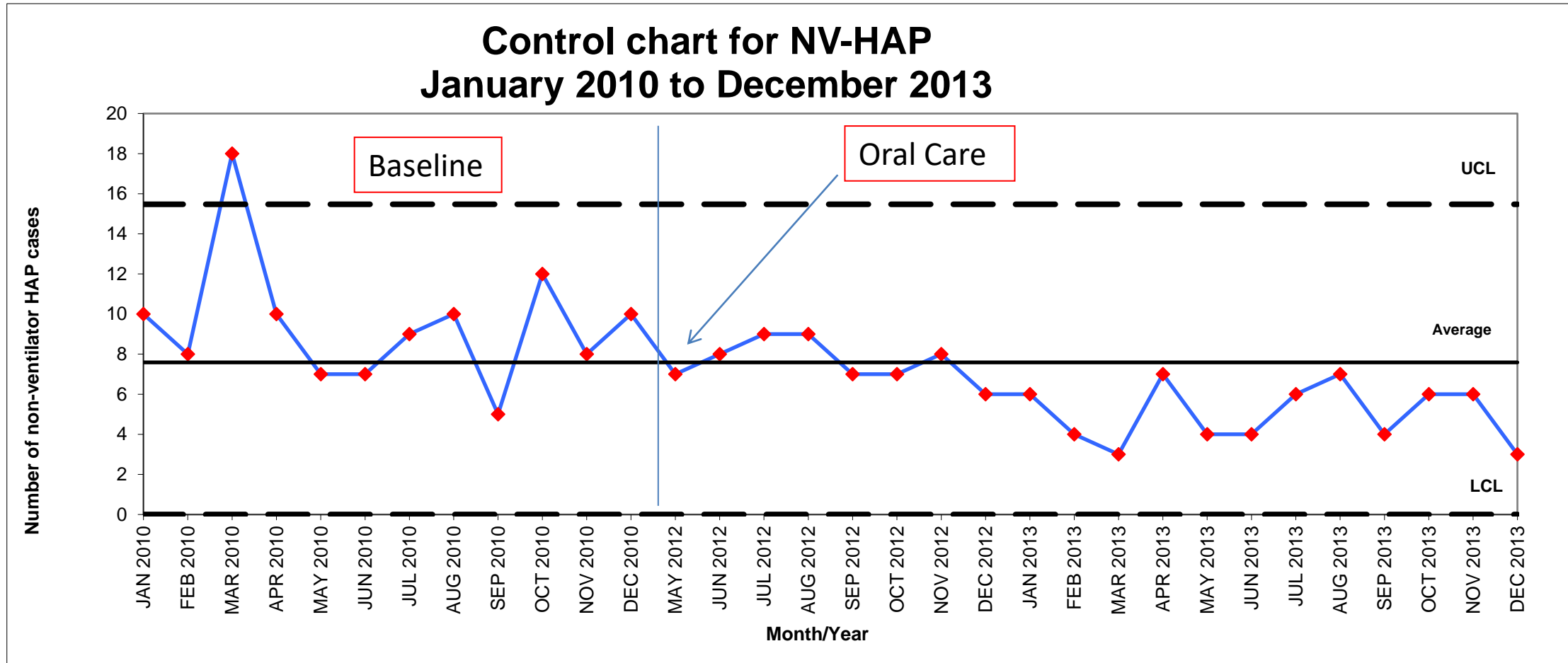


Protocol – Plain & Simple

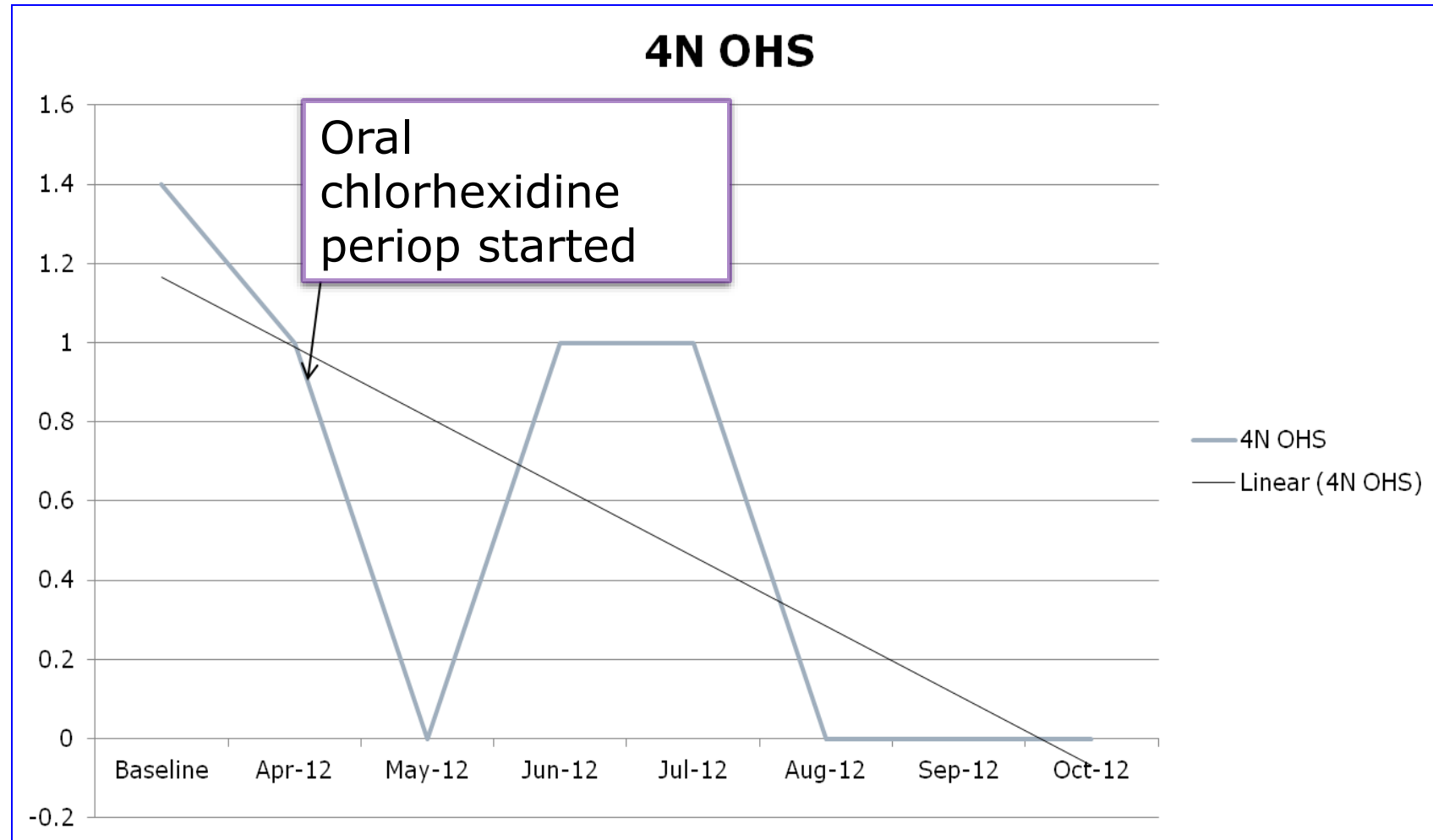
Patient Type	Tools	Procedure	Frequency
Self Care / Assist	Brush, paste, rinse, moisturizer <ul style="list-style-type: none">• Soft-bristled toothbrush• Toothpaste with dentifrice• Antiseptic mouth rinse (alcohol-free)• Moisturizer (Petroleum-free)	Provide tools Brush 1-2 minutes Rinse	4X / day
Dependent / Aspiration Risk	Suction toothbrush kit (4)	Package instructions	4X / day
Dependent / Vent	ICU Suction toothbrush kit (6) <ul style="list-style-type: none">• 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

NV-HAP Incidence

50 % Decrease from Baseline



Open Heart Surgery Patients: NV-HAP Reduced 75%



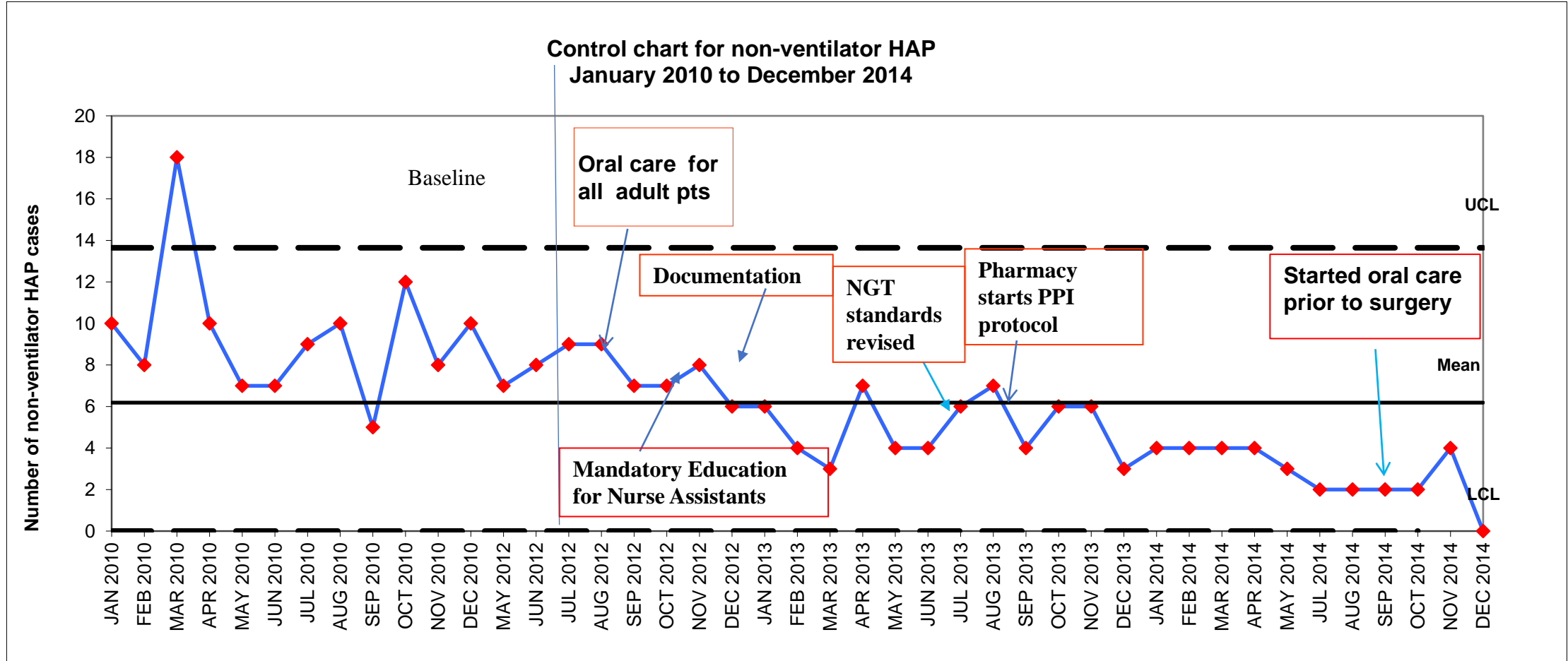
Return on Investment

- ▲ 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

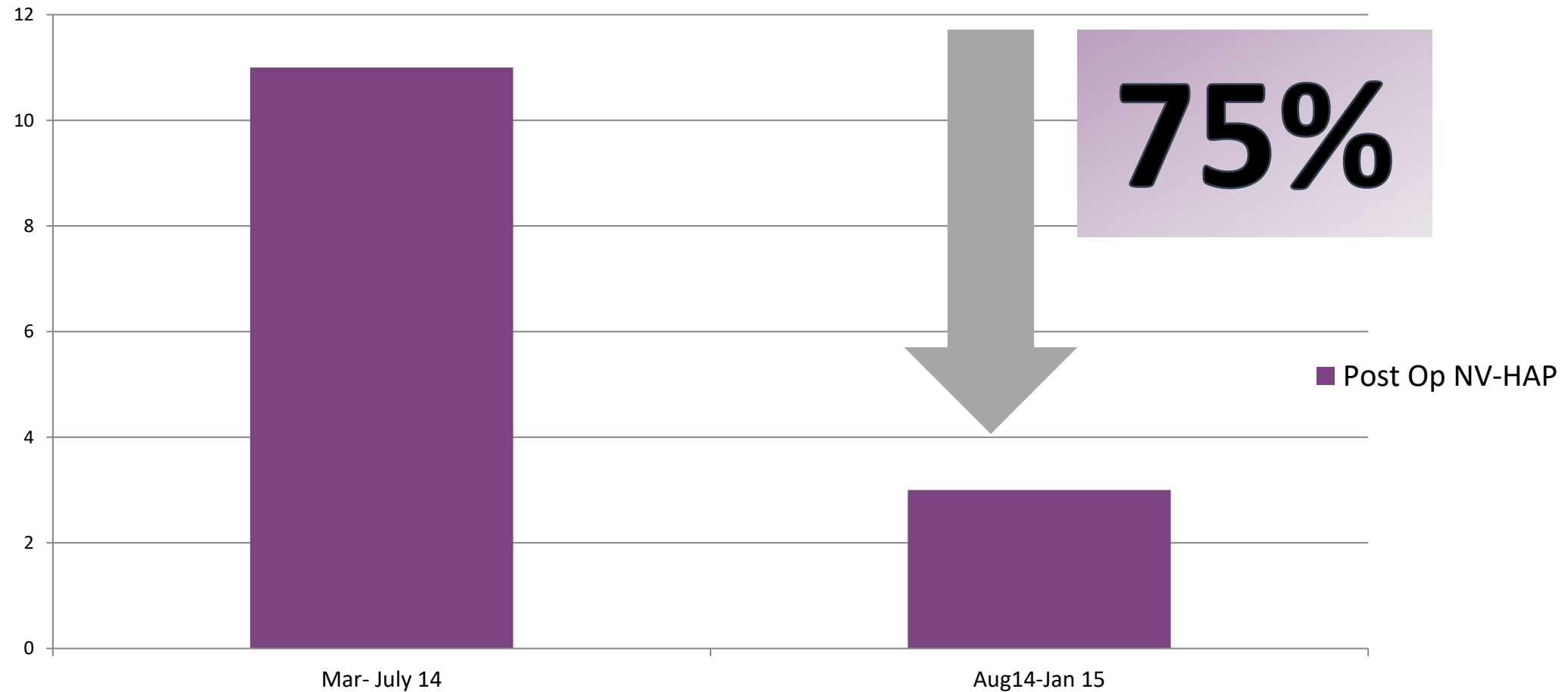
8 lives saved

PRICELESS

NV-HAP ↓ 70% from baseline!

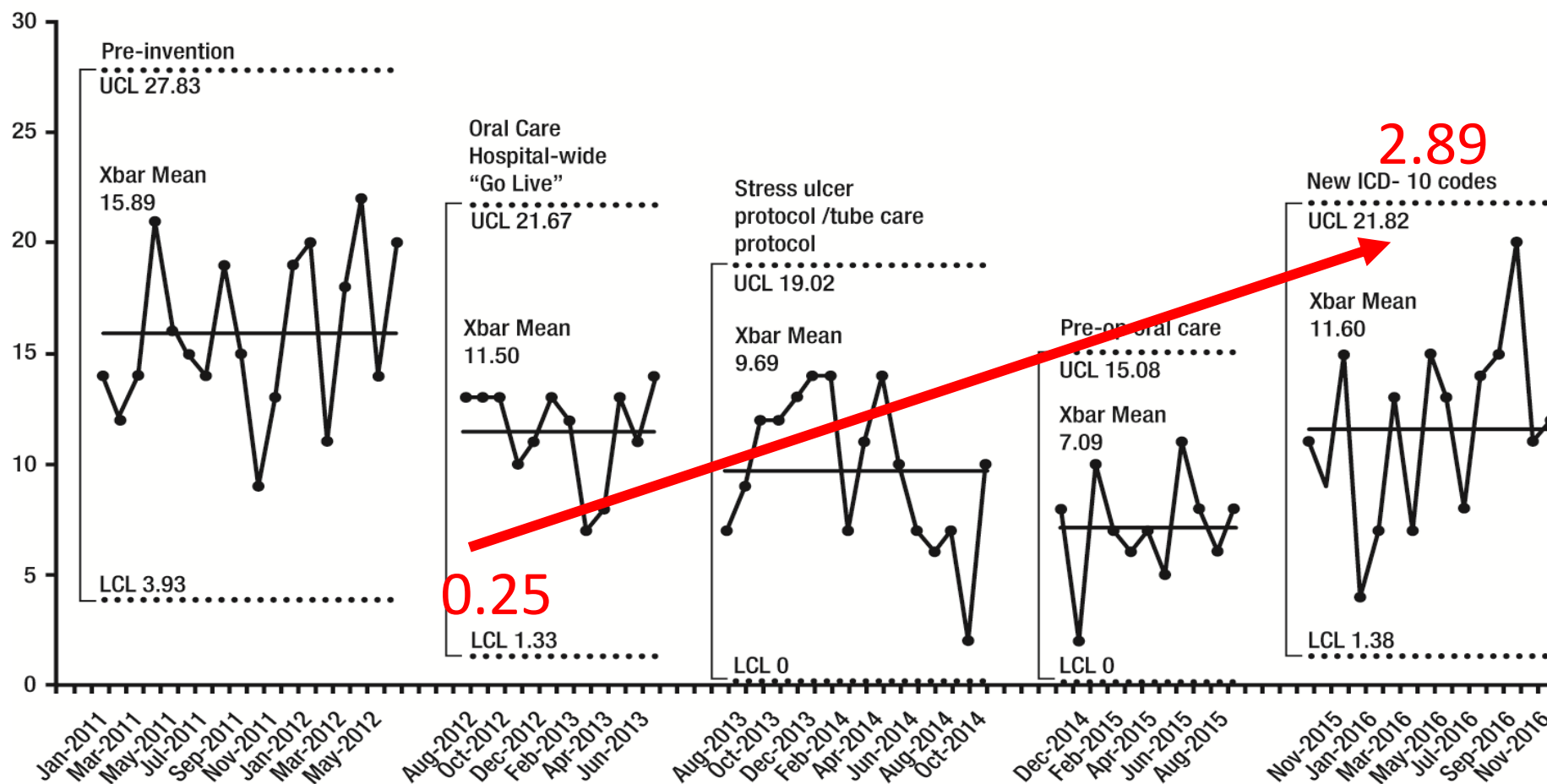


Post-Operative NV-HAP (all adult inpatient surgery) Incidence 6 months Pre-Oral Care vs. 6 Months After



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)



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 anti-septic; 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

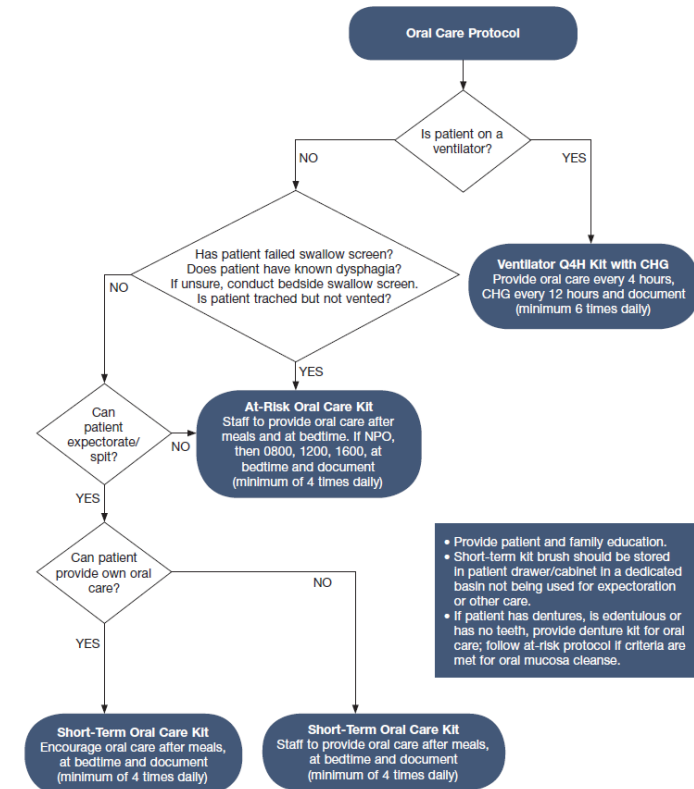
Outcomes:

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:

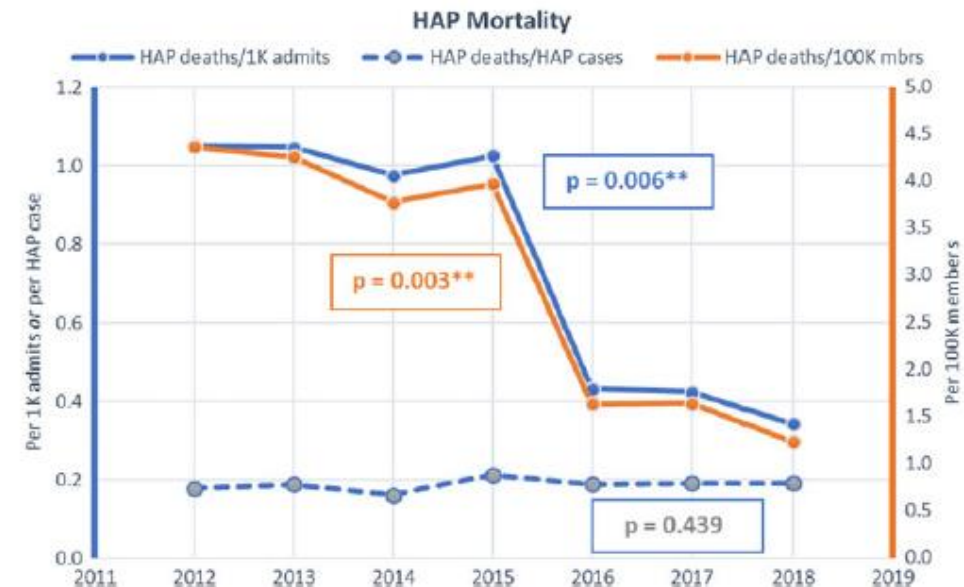
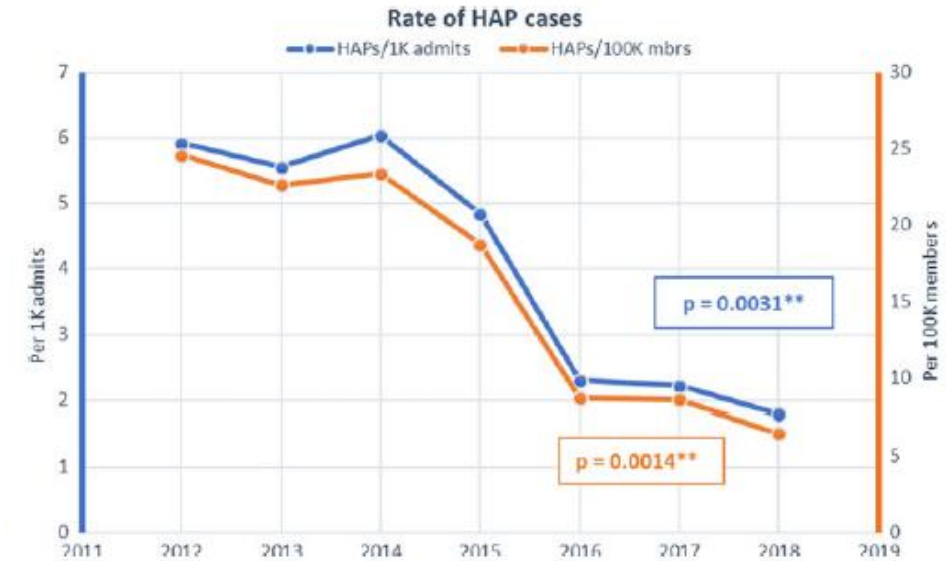
Short-term Oral Care Kit	At-risk Oral Care Kit
Use this kit if you can: <ul style="list-style-type: none">• Swallow without difficulty• Spit without difficulty <i>Recommended for use at least four times per day, including after meals and at bedtime.</i>	Use this kit if you can: <ul style="list-style-type: none">• Trouble swallowing• Difficulty spitting• Recent stroke• Tracheostomy without a ventilator <i>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.</i>
Ventilator Oral Care Kit Use this kit if you are on a ventilator, have a breathing tube (endotracheal tube) or a tracheostomy in place. <i>The hospital staff will provide oral care every four hours and use a special chlorhexidine (CHG) mouth rinse every 12 hours.</i>	<i>If you or your family are unable to provide your oral care, a staff member will assist you.</i>

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



Metrics for NVHAP/Independent Pneumonia



- ▶ 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

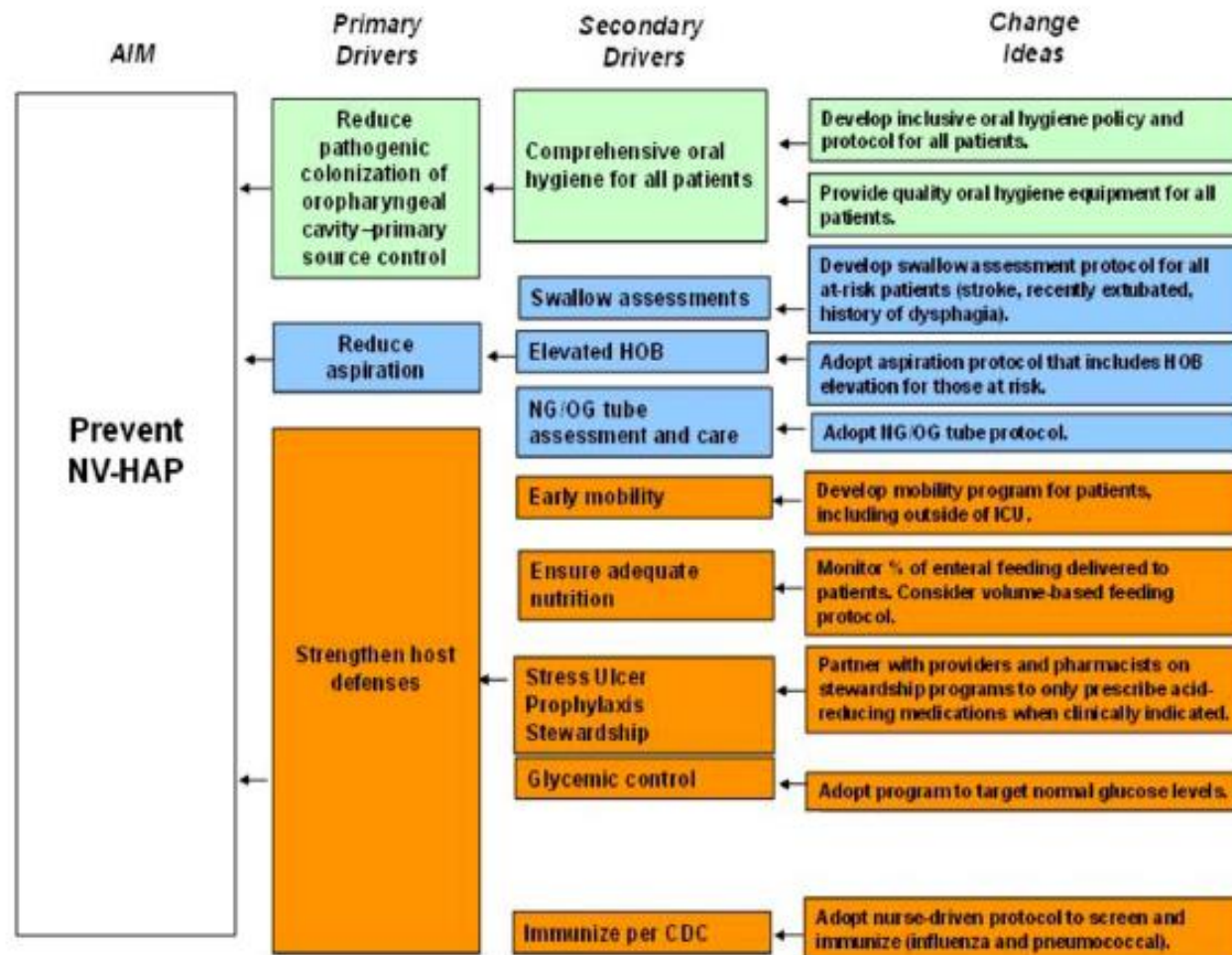


Future State--Objective Surveillance Definitions for NV-HAP: Clinical Indicators in the EHR

	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

Comprehensive NV-HAP Prevention



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*

**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.**

