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# Nonventilator Hospital-Acquired Pneumonia Prevention: A 4-Unit Cluster Randomized Study

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## Background & Significance

### CDC (2018)

Nonventilator hospital-acquired pneumonia (NVHAP) is the most prevalent hospital-acquired infection  
Associated 15 to 20% mortality rates – 1 in 5 five patients

### Relationship between oral microflora and hospital-acquired pneumonia

Bacterial pneumonia develops from micro-aspiration of germs in the mouth

During the first 48 hours of hospitalization changes occur in an individual's oral microbiota that are associated with more virulent pneumonia causing organisms

Growing body of evidence of improved oral care as a primary source control for NVHAP

## Study Purpose & Aims

### Purpose

Determine the effectiveness of a universal, standardized oral care protocol on prevention of NVHAP in the acute care setting

### Primary Study Aim

Is the implementation of a universal, standardized oral care protocol vs. usual care associated with a reduction in NVHAP as measured by incidence per 1000 patient days?

### Process Outcome

Frequency of oral care in compliance with the new oral care protocol was used to assess fidelity of the intervention.

### Secondary Outcomes

NVHAP associated morbidity and mortality, readmission rates, mortality, unplanned ICU transfer, and the development of sepsis not present on admission

## Methods

### Four clinical units included

One medical and one surgical unit randomized to an enhanced oral care protocol and matched with one medical and one surgical unit randomized to usual care.

### Intervention

Implementation of a standardized oral care protocol along with staff and patient education.

The oral care intervention aligned with American Dental Association recommendations: use of a high-quality, soft bristle toothbrush, plaque removing toothpaste, a non-alcohol based mouth wash, and lip and mouth moisturizers applied as needed

## Results

- Total sample: 8709
- Demographic data on all patients enrolled (Table 1)
- Demographic and general outcomes data on all NVHAP positive patients (Table 2).



Variable	Medical Control (n=2075)	Medical Intervention (n=2709)	Significance	Surgical Control (n=2048)	Surgical Intervention (n=1877)	Significance
Age (years)	62.0 (17.0)	62.0 (17.7)	p=0.89	62.4 (16.3)	64.0 (18.0)	p=0.001
LOS (days)	5.5 (6.7)	5.4 (6.5)	p=0.43	5.3 (6.5)	7.4 (6.9)	p=0.001
Gender						
Female	883 (47.4%)	1157 (50.1%)	p=0.74	963 (46.7%)	683 (37.3%)	p=0.46
Male	1092 (52.6%)	1352 (49.9%)		1123 (53.8%)	1355 (62.9%)	
Race*						
Caucasian	929 (46.7%)	1237 (45.7%)	p=0.21	1047 (50.1%)	1100 (58.5%)	p=0.001
Asian	668 (32.2%)	854 (31.5%)		963 (46.7%)	224 (12.2%)	
Black or African American	18 (0.9%)	37 (1.4%)		21 (1%)	19 (1%)	
American Indian/Alaskan	0	0		0	0	
Other	393 (19.2%)	542 (20%)		427 (20.2%)	377 (20.5%)	

\*Race includes missing data

Characteristic	NVHAP (n=8709)			
	Medical Control (n=2075)	Medical Intervention (n=2709)	Surgical Control (n=2048)	Surgical Intervention (n=1877)
Age (years)	62.0 (17.0)	62.0 (17.7)	62.4 (16.3)	64.0 (18.0)
LOS (days)	5.5 (6.7)	5.4 (6.5)	5.3 (6.5)	7.4 (6.9)
Female (%)	47.4	50.1	46.7	37.3
Male (%)	52.6	49.9	53.3	62.9
Caucasian (%)	46.7	45.7	50.1	58.5
Asian (%)	32.2	31.5	46.7	12.2
Black or African American (%)	0.9	1.4	1.0	1.0
American Indian/Alaskan (%)	0	0	0	0
Other (%)	19.2	20	20.2	20.5

Table 2

## Study Aims

**Primary Aim.** Is the implementation of a universal, standardized oral care protocol vs. usual care associated with a reduction in NVHAP as measured by incidence per 1000 patient days (Table 3)?

### Process Measure: Oral Care Frequency

Frequency was higher on both intervention units as compared to control units (Table 4).

### Limitations

Cluster matching  
Frequency and quality of oral care  
Single hospital experience  
Hospitals are dynamic environments

Unable to control all circumstances and possible other safety initiatives that could have an indirect impact on the findings

## Conclusion

Overall increase in oral care  
 • But remained lower than target level of 4 times/day  
 Reduced NVHAP on both intervention units  
 • But only medical intervention unit reached statistical significance.  
 However, we did not reach full power to determine a difference between groups.  
 Oral care as primary source control shows promise for NVHAP prevention  
 • Requires further study  
 • Ideal frequency and best practices are unknown  
 These questions would best be addressed with a large, randomized controlled trial

Treatment Group	NVHAP		Total	Rate 1000 patient days
	No.	Yes		
Medical Control	2075 (99.2%)	14 (0.7%)	2089	6.9
Medical Intervention	2709 (99.4%)	11 (0.4%)	2720	4.0
Total	4784	25	4784	8.9*
Surgical Control	2048 (99.4%)	13 (0.6%)	2061	6.3
Surgical Intervention	1839 (99.4%)	7 (0.4%)	1846	3.8
Total	3887	20	3928	5.0*

\* OR control v. intervention medical (OR: 7.1 [CI 2.0, 24.1] p=0.02)  
 \* OR control v. intervention surgical (OR: 1.6 [CI 0.6, 4.1] p=0.29)

	Medical		Surgical	
	Control (mean)	Intervention (mean)	Control (mean)	Intervention (mean)
Frequency	0.86	1.03 (1.9%)	0.9	1.4 (1.3)
% Difference	-1.28 (9.2)	1.19 (1.2)	-1.28 (9.2)	1.22 (0.2)
% Difference	-1.37%*	1.70%*		

  

Unit	Type of oral care			Total assistance and use of suction toothbrush
	Independent Oral Care	Required some assistance to complete oral care	Required assistance to complete oral care	
Medical Intervention	40%	39%	20%	
Medical Control	30%	42%	27%	
Surgical Intervention	55%	37%	7%	
Surgical Control	8%	50%	42%	

Table 4

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