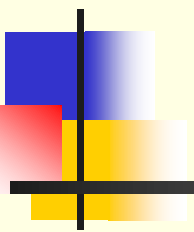


Preventing Ventilator Associated Pneumonia: *A Six Year Experience*



Coretha Weaver, BSN, CIC
Erlanger Health System
Chattanooga, TN



Objectives

The participant will be able to

1. Describe the prevalence, economic and human costs associated with VAP;
2. Discuss best practices implemented during this project to prevent VAPs;
3. Discuss patient outcomes and factors affecting progress;
4. Discuss future work to prevent VAP



- A 533 bed, 5 facility regional teaching health system
- Level 1 Trauma Center
- 68 Adult ICU Beds-
7 Units



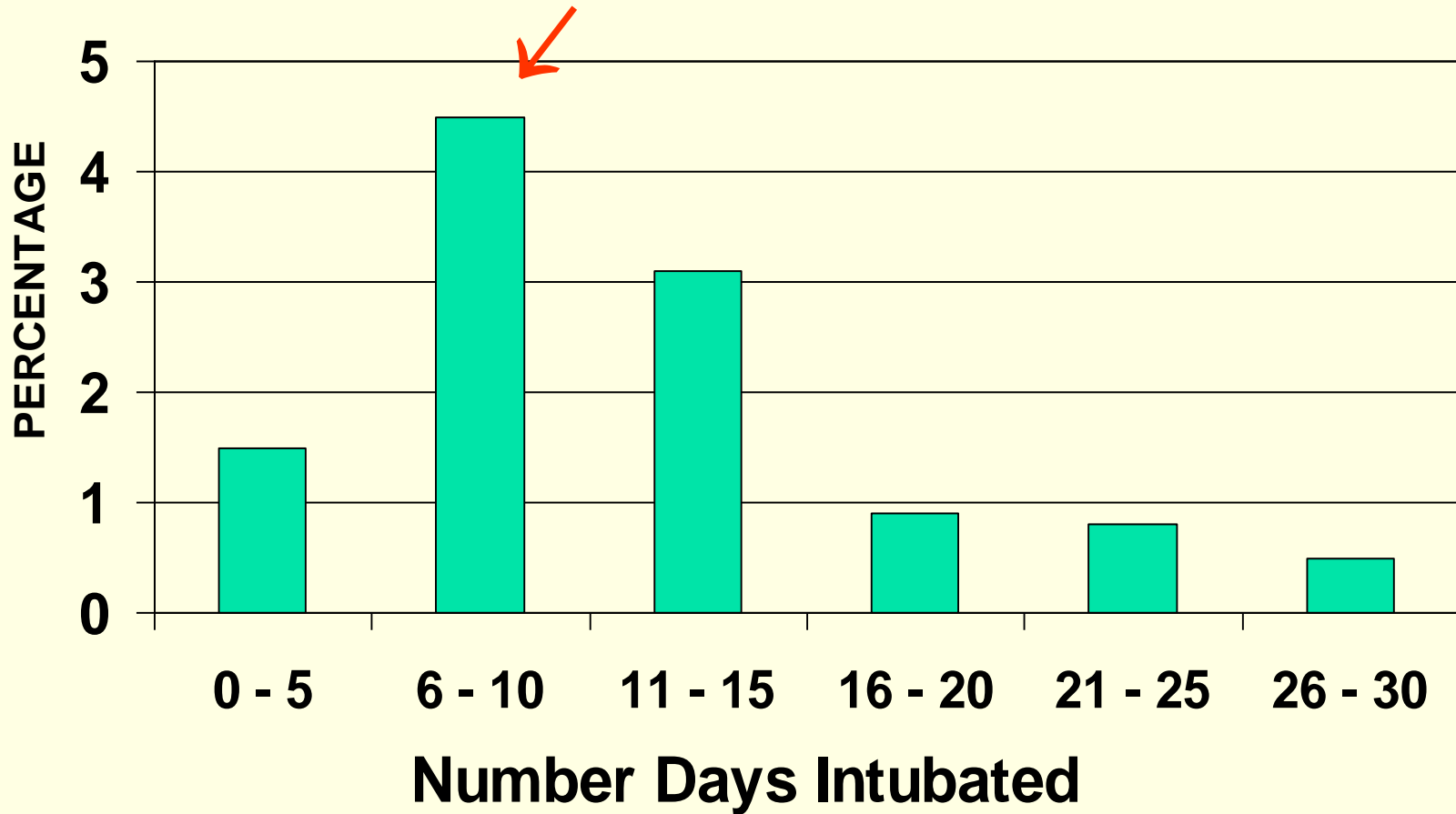


Epidemiology of VAP

- VAP represents >25% of all ICU-acquired infections
- VAP cases occur at a rate of >100,000 cases of annually in the US
- VAP accounts for more than one-half the antibiotic use in the ICU
- Attributable mortality of VAP can be as high as 50%

VAP: TIME COURSE

Mean Daily Risk Of VAP



Pathophysiology



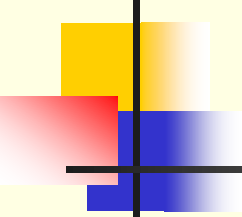
Early VAP

- Timing
 - Within 5 days
- Bacteriology
 - *S. pneumoniae*
 - *H. influenzae*
 - MSSA
 - Susceptible GNB
- Prognosis
 - Less severe, little impact on outcome

Late VAP

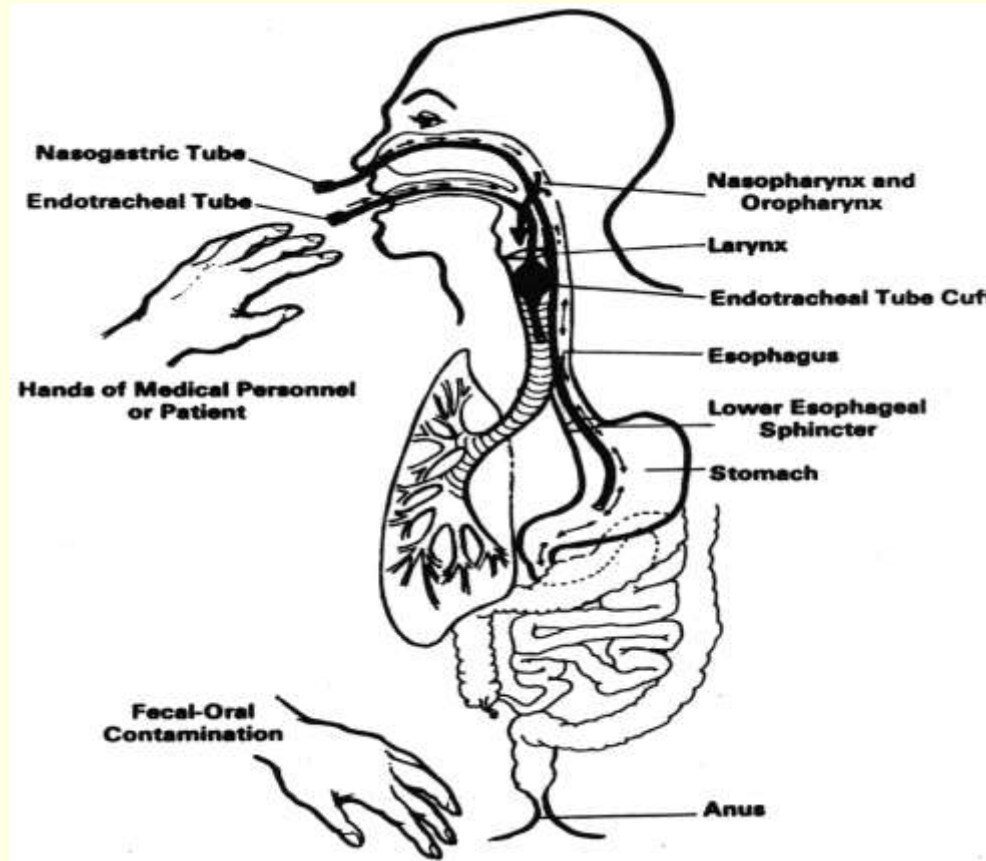
- Timing
 - Beyond 5 days
- Bacteriology
 - *P. aeruginosa*
 - Acinetobacter
 - MRSA
 - Other multiresistant orgs
- Prognosis
 - High attributable mortality and morbidity

Economic Impact



	Non-Infected Ventilator Patients	Patients with VAP
ICU LOS	4 days	26 days
Hospital LOS	13 days	38 days
Hospital Costs	\$21,620	\$70,568
Adjusted Attributable Cost for VAP		\$12,000

Pathogenesis of VAP



Organisms causing VAP arise from endogenous and exogenous sources

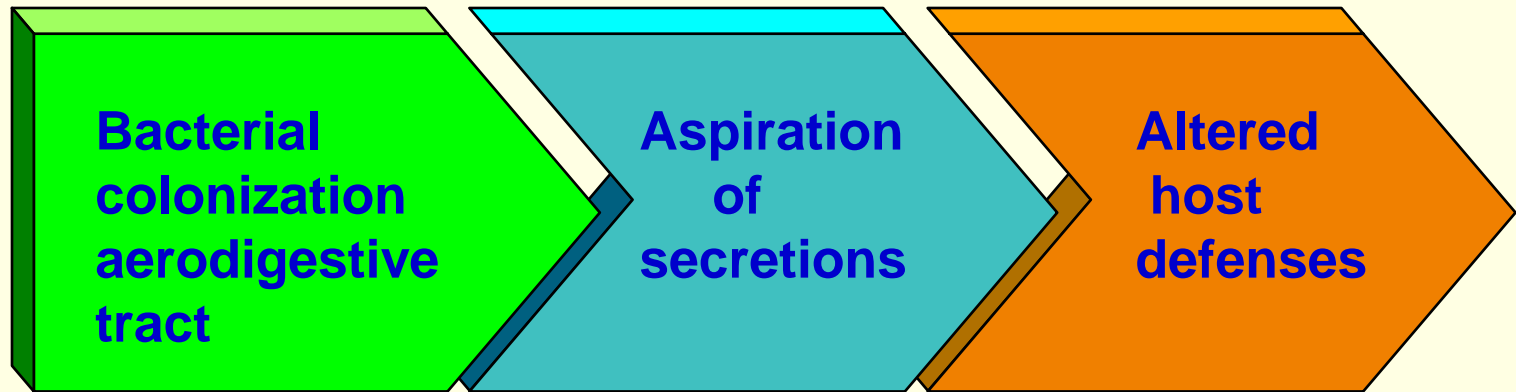
Organisms causing VAP arise from both endogenous and exogenous sources



Risk Factors For VAP

- ❖ Duration of intubation
- ❖ Emergent intubation
- ❖ Re-intubation
- ❖ Insufficient oral hygiene
- ❖ Elevated gastric PH
- ❖ Prior antibiotic therapy
- ❖ Nasogastric tube management
- ❖ Enteral nutrition
- ❖ Supine position
- ❖ Transport out of the ICU
- ❖ Cross contamination of ventilatory equipment
- ❖ Nasal intubation
- ❖ **Lack of healthcare professional training in VAP prevention**

Pathogenesis of VAP



Prevention strategies focus on :

↓ Colonization

↓ Aspiration

↓ Duration of Ventilation

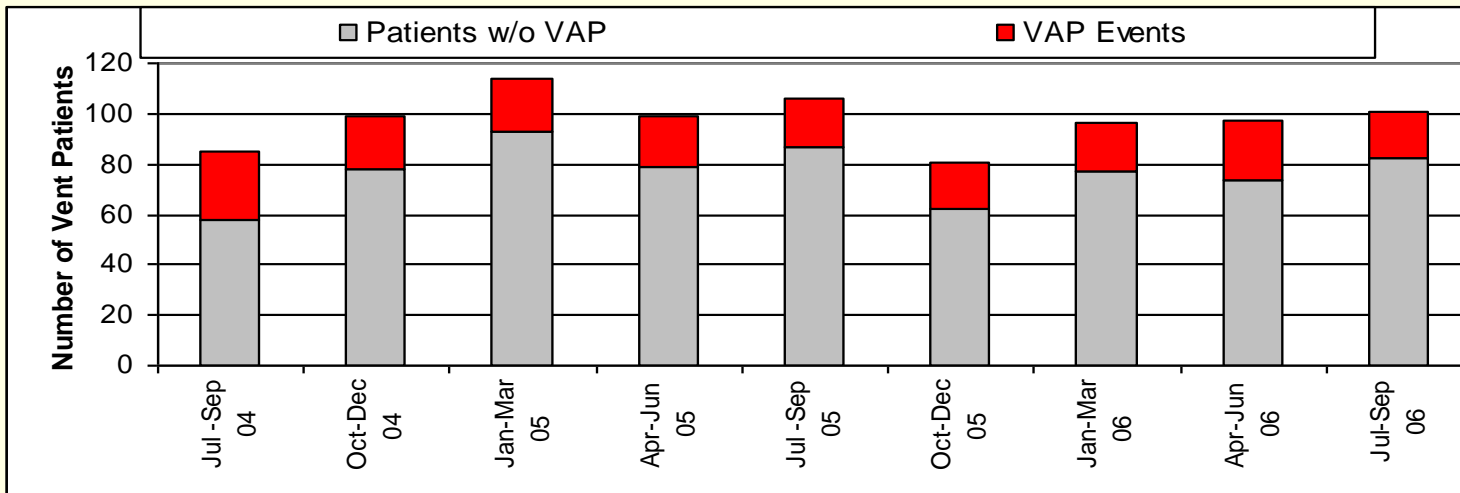
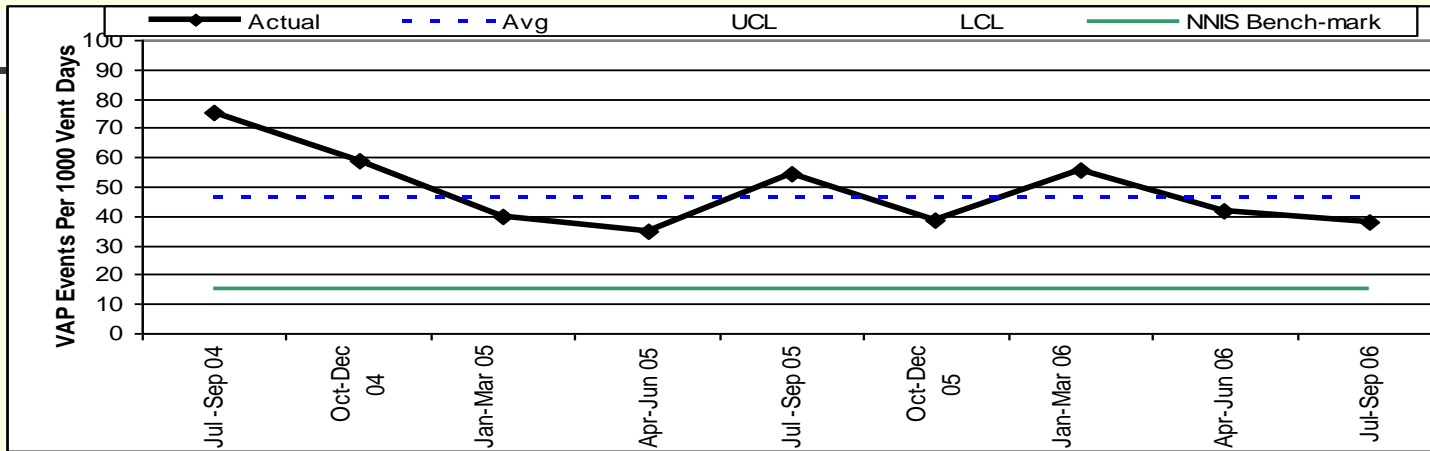
Adapted from AACN VAP Practice Alert Presentation 2005
Adapted from AACN VAP Practice Alert



What are we doing to reduce VAPs?

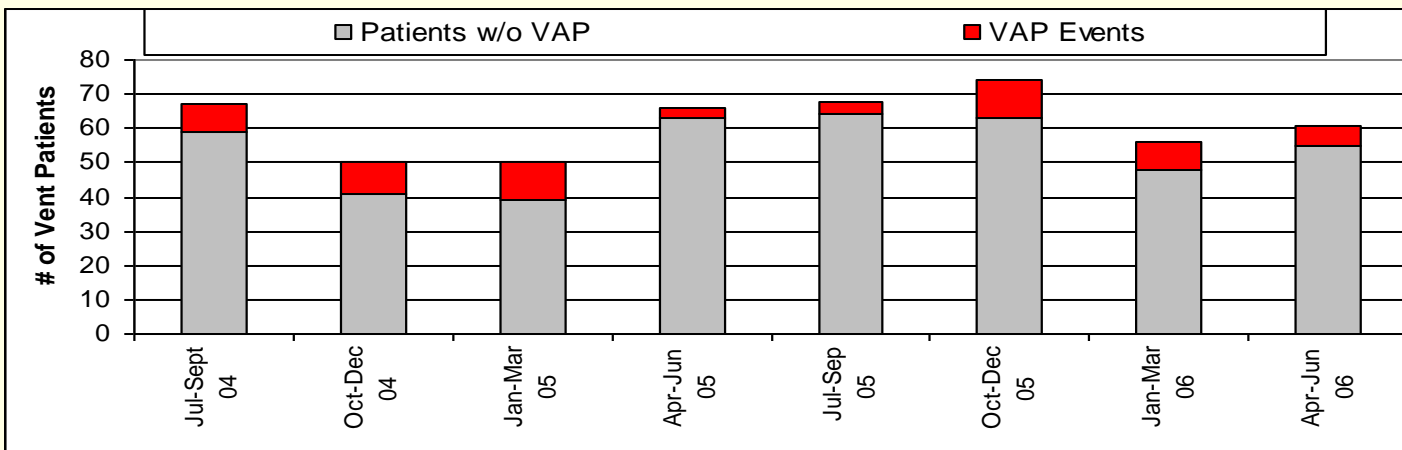
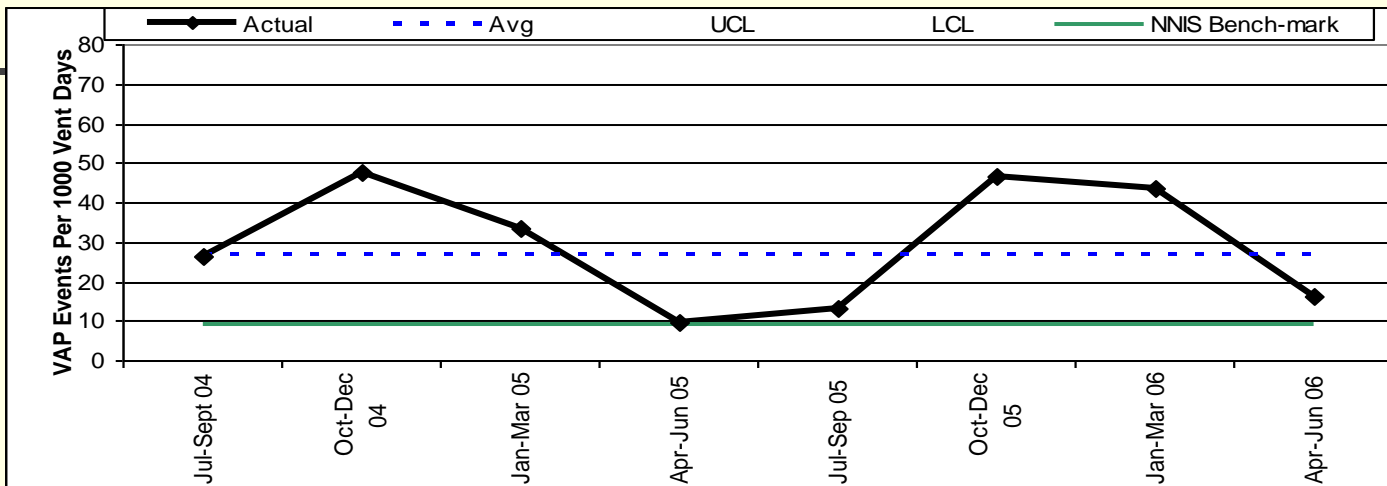
How are we doing?

Trauma ICU VAP Event Data Jul 04-Sep 06



Extracted from Project Impact Data

Surgical ICU VAP Event Data Jul 04-Jun 06



Extracted from Project Impact Data

Historical VAP Data

Unit	Erlanger 1999 Infection Rate/1000 vent days	NHSN Rate/1000 vent days Pooled Mean
TICU	15.0	15.2
NNICU	20.0	11.2
MICU	16.5	4.9
SICU	NA	9.3



VAP Prevention Strategy

- **Formed a multidisciplinary team-2005**
 - Intensivist/Pulmonologist
 - Infection Preventionists (IP)
 - Director Critical Nursing
 - Trauma Surgeon/Critical Care
 - Critical Care Nurses - Multiple
 - Critical Care Nurse Manager
 - Respiratory Director
 - Respiratory Educator
- **Monthly team meetings**



Search for Best Practices- 2005

- Reviewed the literature and practice guidelines
- Developed standards of practice elements endorsed by medical staff leadership
- Agreed on a surveillance plan



Surveillance for VAP

- Utilize NNIS/NHSN definitions for surveillance for VAP
- Utilize NNIS/NHSN system to enter and analyze data
- Collect compliance data on process indicator **priorities** and report by unit



Creative Resourcing -2006

- Initial VAP surveillance done in TICU, SICU, & MICU by Project Impact Nurses with IP support .
- VAP triggers identified by Respiratory therapy to IP from Neuro-ICU,CCU, and Burns for review .
- Education on identifying VAPs done by IPs
- VAP final reviews and process indicators done by IP
- Attempted to set up radiology trigger for case identification



Interventions for Prevention of VAP

1. Education for all staff who manage ventilated patients
2. Daily Sedation Vacation(IHI)
3. Daily assessment for weaning(IHI)
4. Standardize mouth care and teeth brushed daily
5. HOB ↑30 degrees or greater (IHI)
6. Endotracheal tubes with subglottic suction port for all patients (except day surgery)



Interventions for Prevention of VAP

7. Patients receive orotracheal intubation
8. Check NG residuals Q4 hours
9. Use non-invasive ventilation and avoid re-intubation where possible
10. Protocol for Peptic ulcer Disease (IHI)
11. Protocol for DVT prevention (IHI)



Prioritizing Interventions

- Education – **Top priority**
 - Developed VAP video with test
 - Curriculum covered all elements of best practices
 - Required for all staff caring for ventilated patients including residents
 - Policy development: sedation vacation, revision of RT weaning protocol, standard of care for NG management.

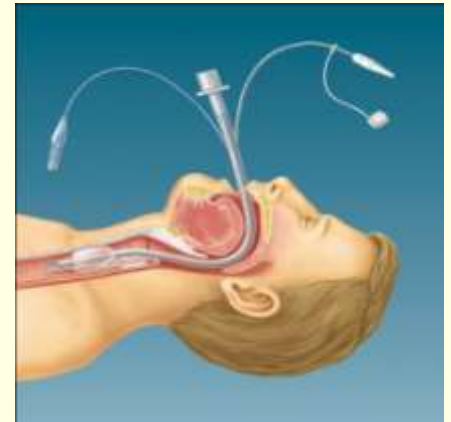
Prioritizing Interventions

- Implementing the IHI Bundle
 - ↑ HOB ≥ 30 degrees
 - Weaning protocol
 - Sedation vacation
 - Implementation of PUD & DVT protocols



Beyond the IHI Bundle

- Hi-low Evac endotracheal tube
 - 2006 (Upgraded to TaperGuard 2009)
 - Anesthesia
 - Lifeforce – Air support
 - Emergency Medicine
- Assessing NG residual Q4hrs
- Orotracheal intubation



Failure of Initial Surveillance Plan 2006



■ Reasons for failure:

- Impact nurses deferred to trauma physician's designation of VAP (VAP rate of 20 -40 per 1000 vent days in TICU)
- Respiratory care unable to sustain staffing for surveillance
- IP unable to sustain efforts due to staffing (2.5 IP FTEs)
- Radiology chest film reads inconsistent & reports never initiated



Patient Safety Leadership Provides Resources - 2007

- Dedicated IP nurse to collect VAP data
- Dedicated nurse to collect process data, send VAP triggers to IP, and coach staff
- Management engineer and data analyst from Process Improvement to support VAP project

Sometimes timing is everything!



New Team Support - 2007

- New CNO – Executive Sponsor
- New Intensivist/Pulmonologist & project physician champion
- Addition of Hospitalist to team



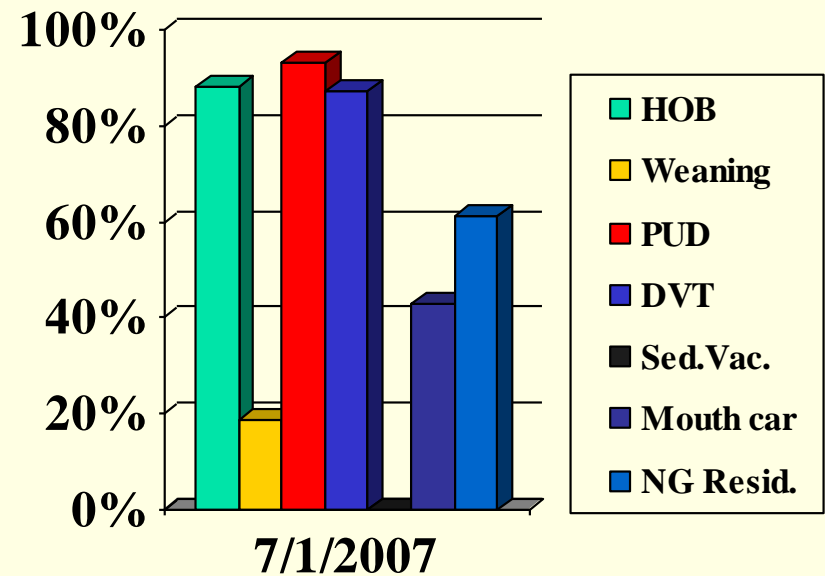
VAP PI Team Work

- Meetings every other month – Excellent attendance!
- Focus on process data and strategies to improve compliance
- Continuous review of literature
- Ongoing review of new technology

Initial Process Data Collection

July 2007 Data

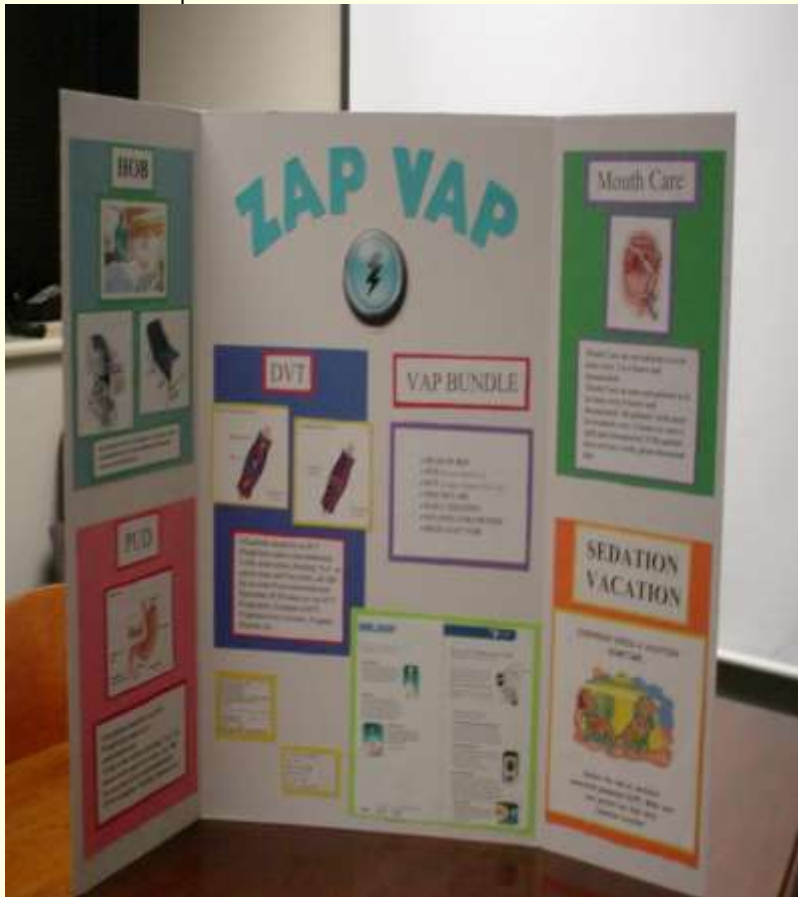
Total bundle
compliance = 17%



Educating, Coaching, Counseling



**Critical Care
Output**



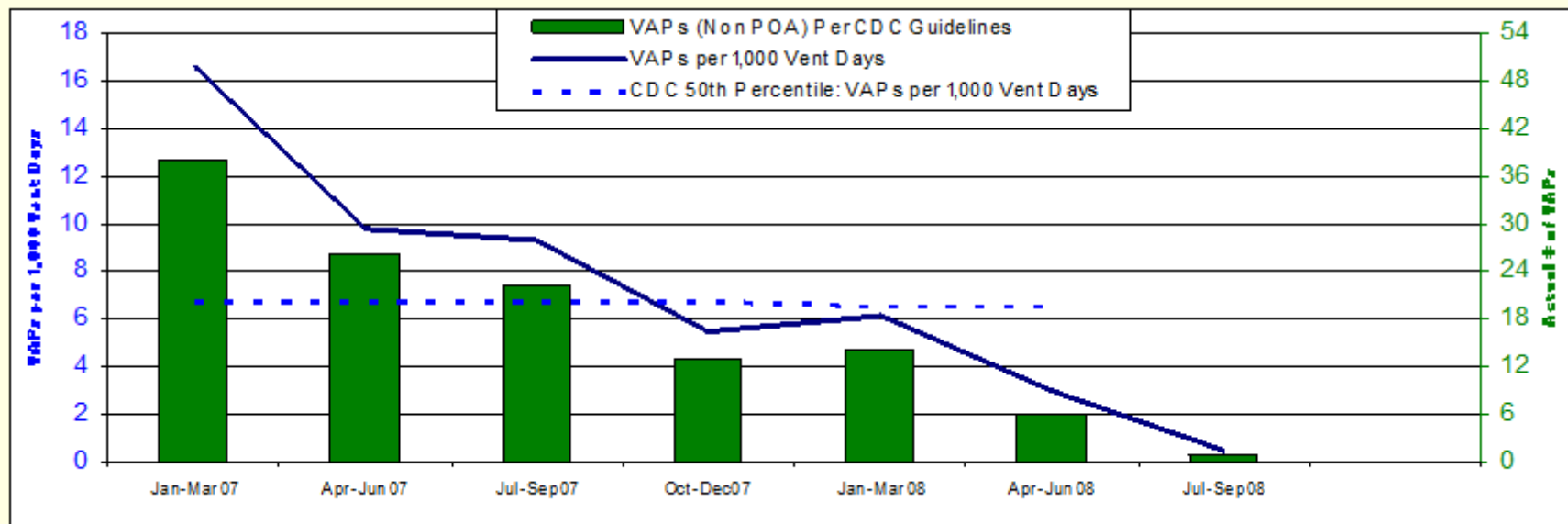
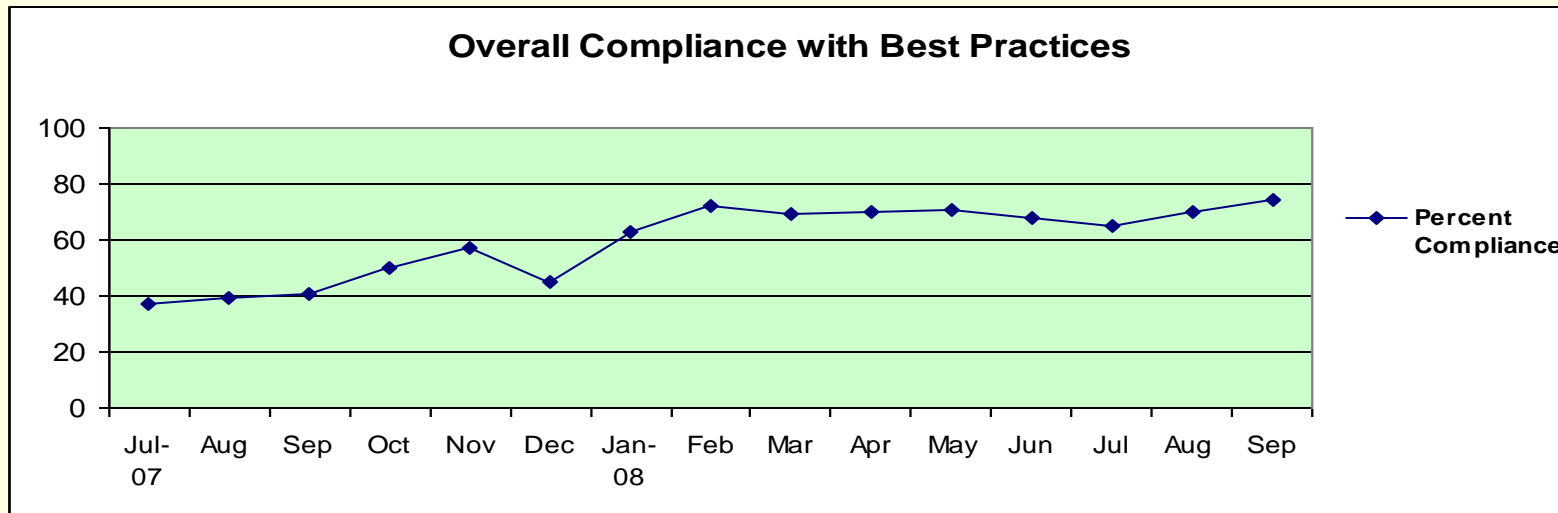
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**EVERYBODY NEEDS A
VACATION SOMETIME...**

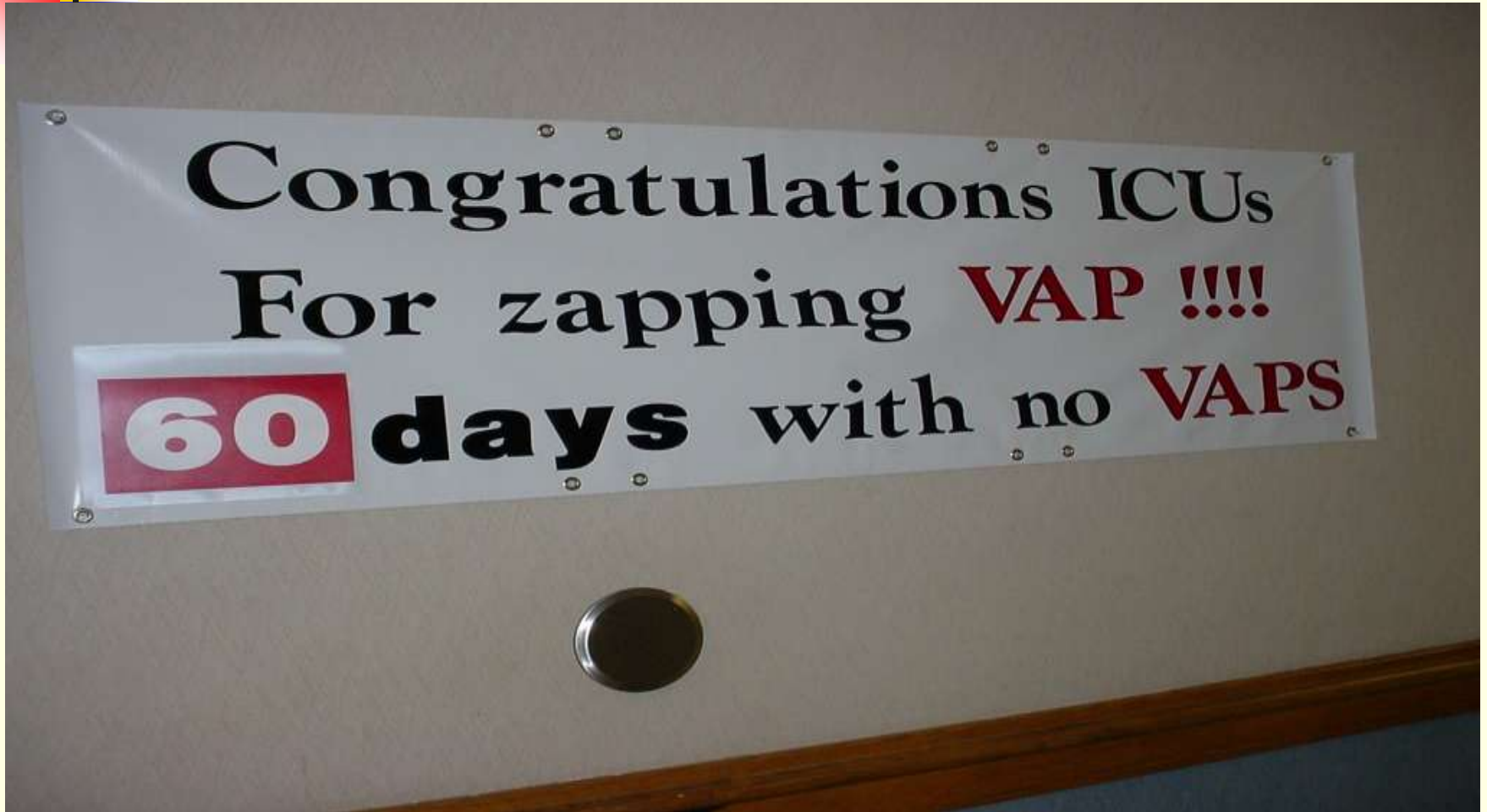


**Reduce the risk of ventilator
associated pneumonia (VAP).
Make sure your patient has
their daily
"Sedation Vacation."**

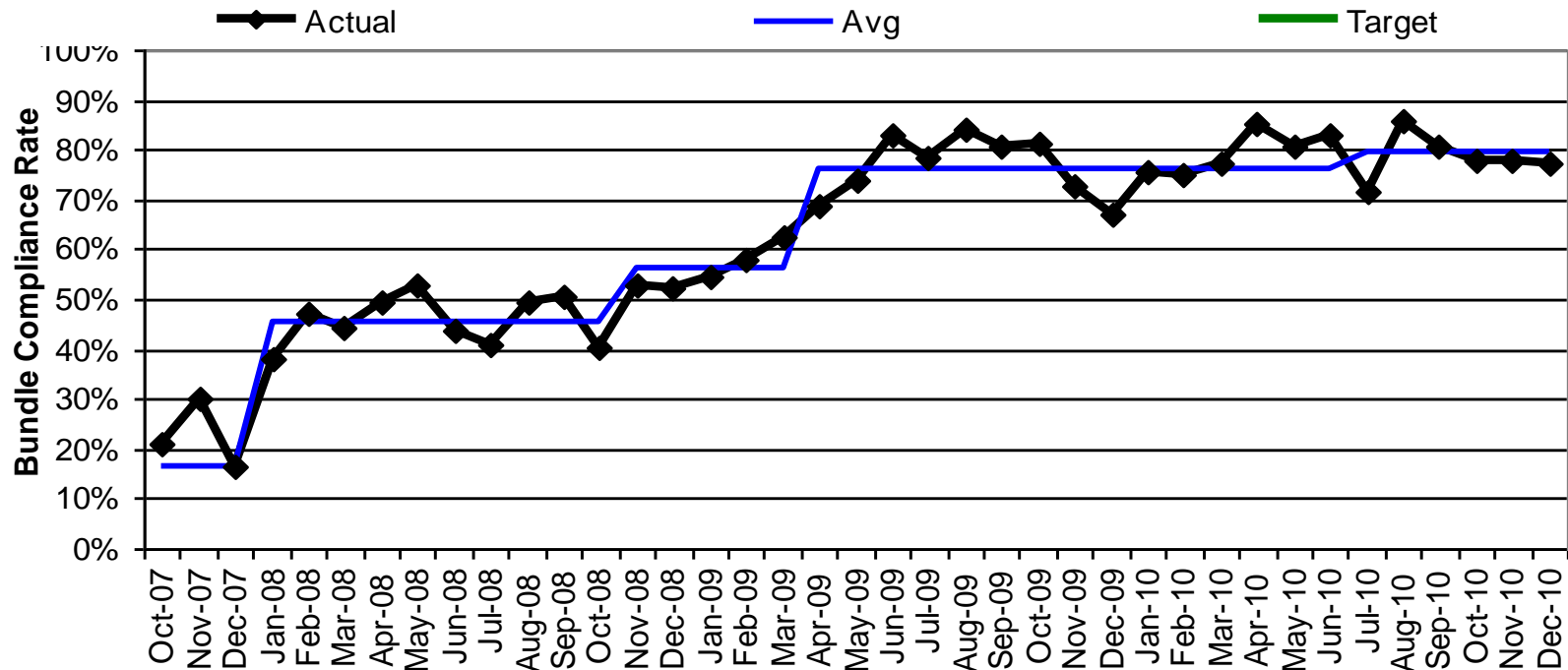
2008 Best Practices Improve and VAPs Decrease



Time to Celebrate!!!!!!



Compliance with Process Indicators Oct 07 – Dec 10



Significant improvement over time for overall bundle compliance

Process Data Through March 2011, Outcomes Data Through March 2011

VAP Process Indicators

Based on random surveillance of intubated ICU patients

ICU Director

			Current Period (March 2011)				YTD (Jul 10 - Mar 11)			Monthly Trend (Jul 09 - Mar 11)
			Receiving the Req'd Treatment	NOT Receiving the Req'd Treatment	Excluded or Contra-Indicated	% Receiving the Req'd Treatment	% Receiving the Req'd Treatment	Target	Current FY vs Previous FY	
Patients with Pneumonia Present on Admission					17					
V A P P r o c e s I n d i c a t o r s	HOB 30 Degrees	↑	197		3	100%	99%	90%	-0.3%	
	Daily Weaning Parameter Assessment	↑	122	0	78	100%	96%	90%	-0.2%	
	PUD Prophylaxis Protocol Ordered	↑	195	0	5	100%	98%	90%	0%	
	DVT Prophylaxis Protocol Ordered	↑	113	2	85	98%	97%	90%	1%	
	Daily Sedation Vacation Documented	↑	28	0	172	100%	97%	90%	0%	
	Appropriate Mouth Care	↑	168	28	4	86%	83%	90%	-1%	
	Complete Bundle Compliance	↑	166	34	0	83%	78%		-0.7%	
Hi-Lo Tube Used During Intubation	↑	57	6		90%	90%		0%		
NG Residuals Assessed and Documented	↑	124	72		63%	66%		1%		



Keys to Improvement of Processes

- Supported by executive leaders and medical staff
- IHI influence
- Nursing, Respiratory Care, and physicians are all engaged and taking ownership of processes
- Processes are hardwired in critical care standards of practice; No physician order needed to implement bundle
- Dedication of staffing resources

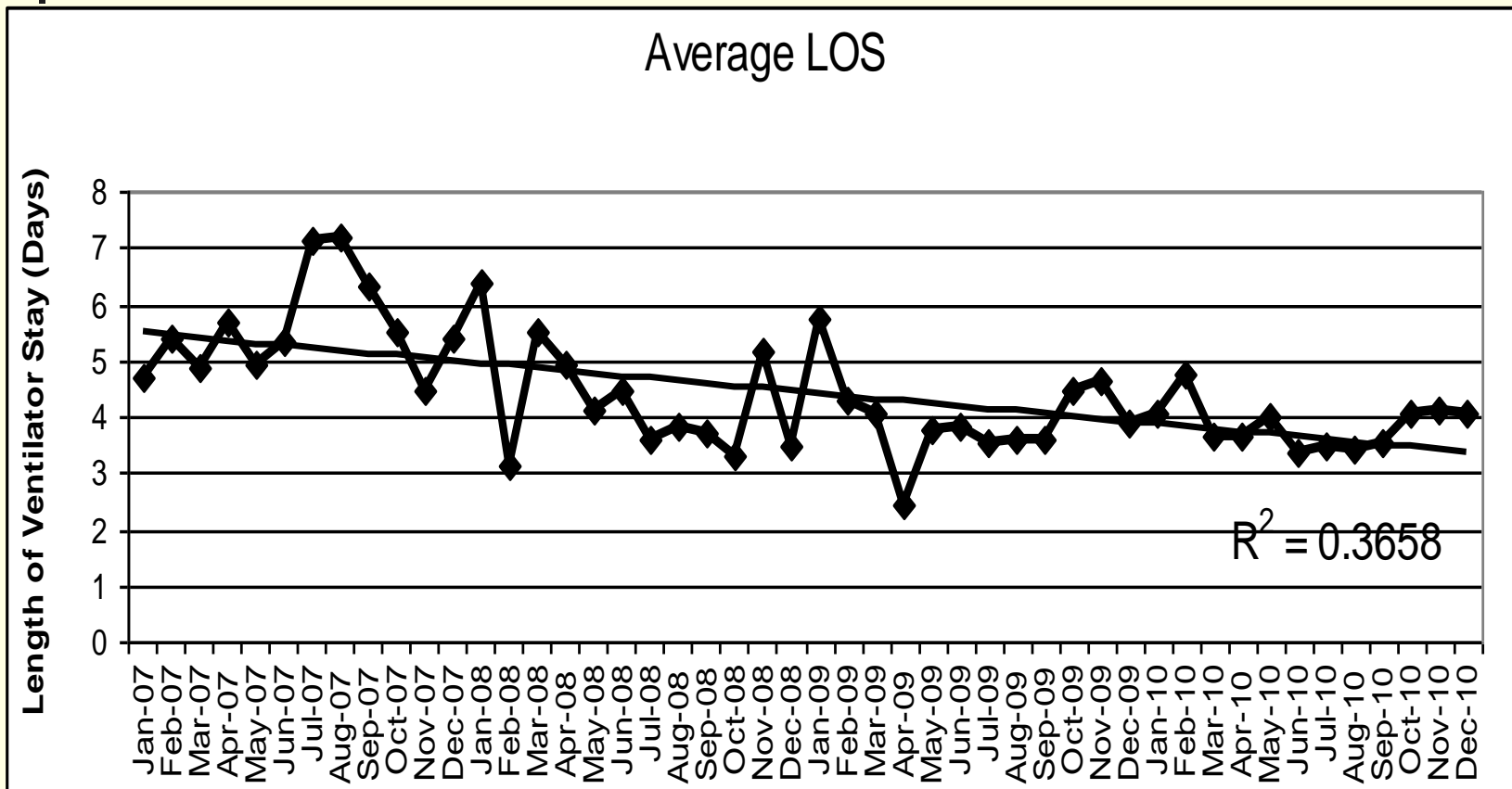


Other Improvements and Considerations

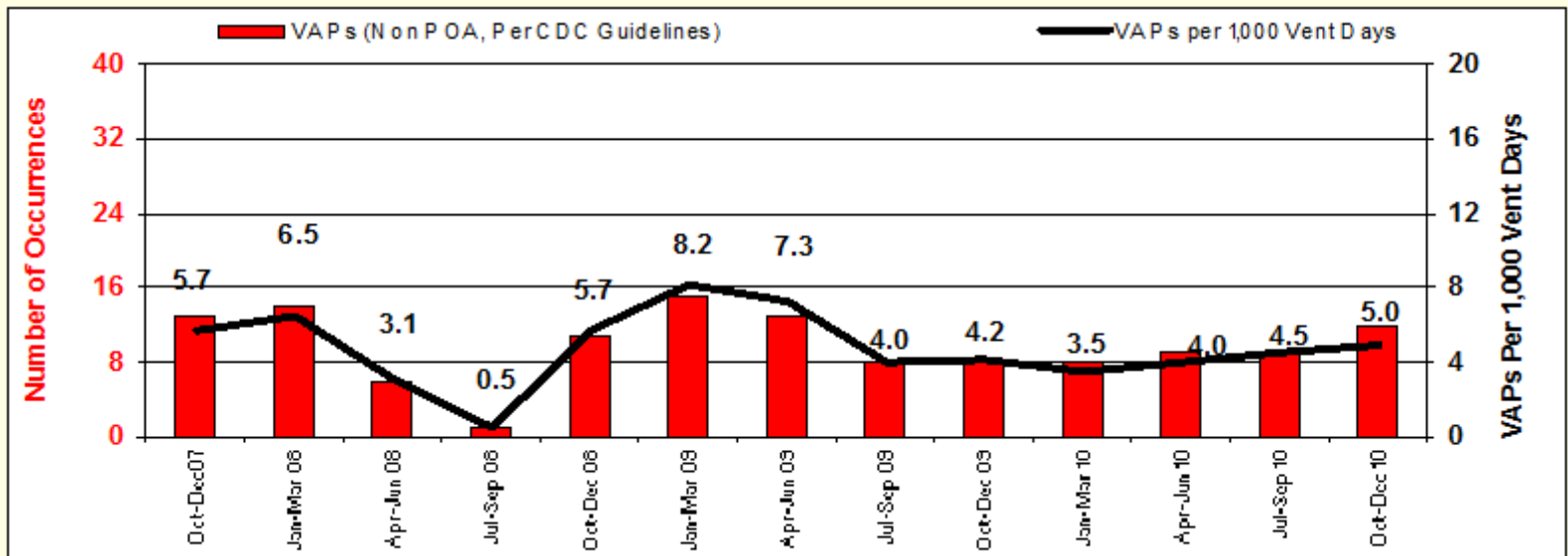
- Critical care consult for all ventilated patients within 48 hours
- Hardwire communication process between nursing and RT for sedation vacation
- Increased inventory and use of non-invasive ventilation devices (BIPAP)
- Trial of 24 hour mouth care kits (100K)
- Rewarding staff for efforts
- Discussed early trachs to decrease VAP – not clearly supported by the literature but does improve patient comfort



Ventilator Length Of Stay Jan 07 – Dec 10 All Units

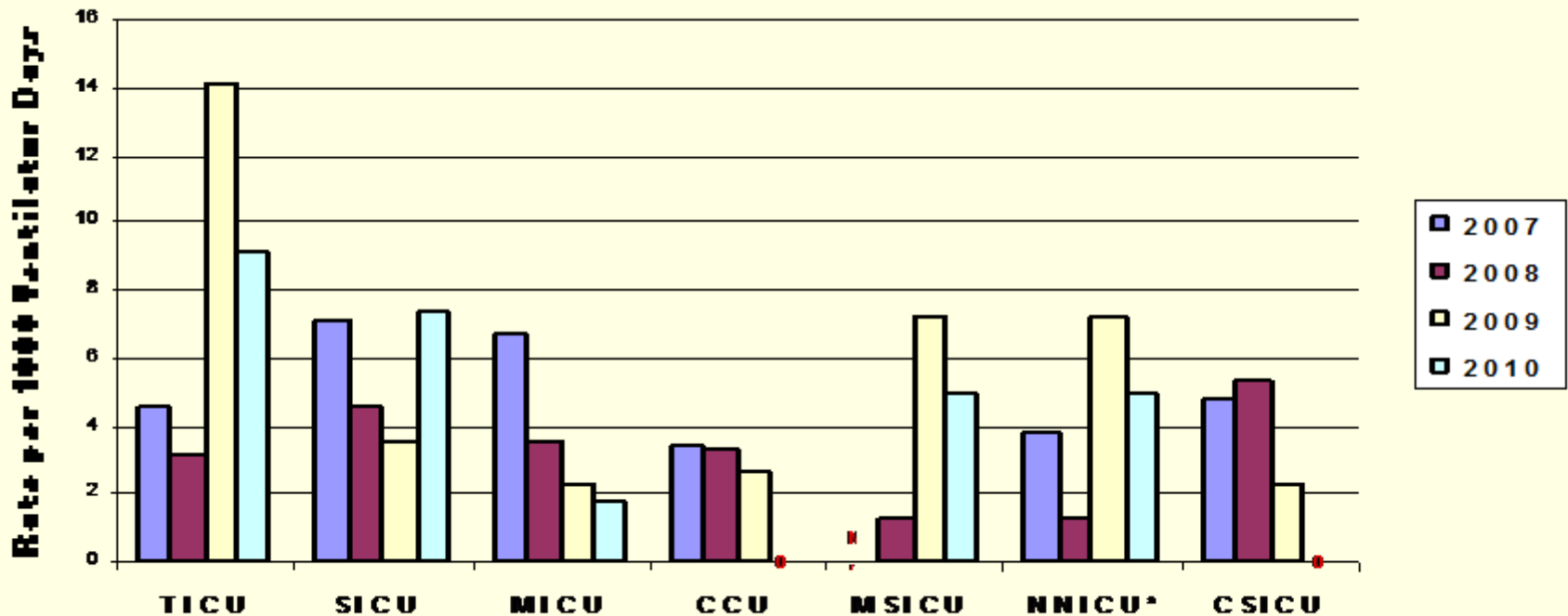


Overall VAP Rate Oct 07 – Dec 10



Analysis of overall rate shows no statistical improvement over time

VAP Trends by Unit





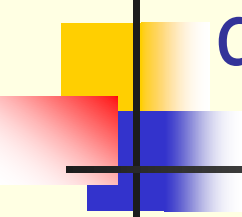
VAP Organism Summary 2008-2010

N=117

- 48% (56) had no organism identified
- VAPs with organisms identified
 - 32% MSSA/MRSA
 - 15% Pseudomonas Aeruginosa
 - 11% Haemophilis
 - 10% S. Pneumo

Data reported to NHSN

Improved processes not translating to decreased VAPS???



- Limitations in identifying VAPs even with the same IPs surveying the unit
- Inconsistent compliance with basic IP (e.g hand hygiene, disinfection of devices between patients)
- Nursing turnover in ICUs
- Continued low compliance with mouth care
- Poor compliance with assessment of NG residuals
- Lag time to good compliance with subglottic suction ETT (TaperGuard™)



Limitations in Identifying VAP

- Surveillance definitions and clinical diagnosis is neither sensitive nor specific
- Many clinical conditions mimic VAP (e.g. ARDS)

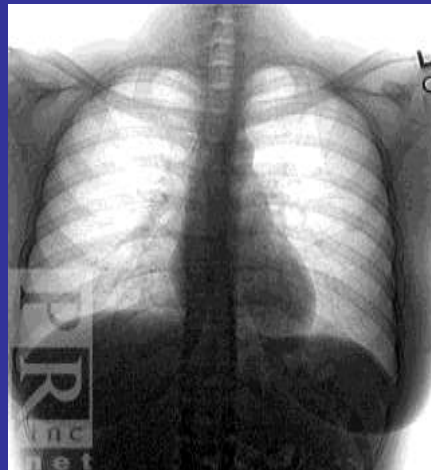
Diagnosis of VAP

Clinical

- fever
- tachycardia
- leukocytes
- increased RR or FIO₂
- purulent secretions

Chest X ray

- new infiltrates
- new consolidation



Microbiological

- BAL



NOTE: Identification of VAPs using surveillance definitions by Infection Control can differ from clinical diagnosis

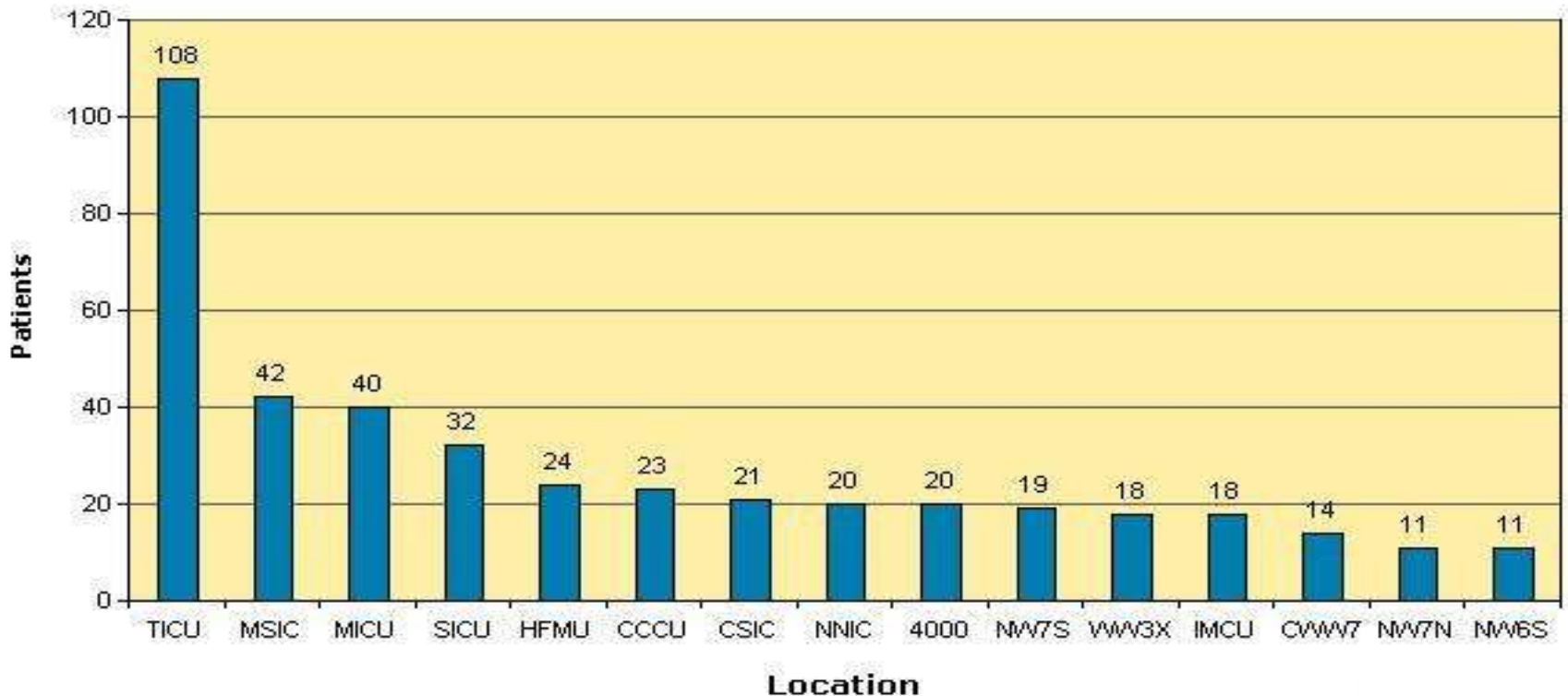


BAL...Gold Standard for Diagnosing VAP?

- BAL culture quality can be affected by
 - Prior antibiotic therapy
 - Contamination with endotracheal and oropharyngeal colonizers
 - Missing the segment of lung with active disease/highest concentration of organisms
 - Lack of data related to the effects of multiple bronchoscopes on single patient

Distribution of BAL Specimens

Top Locations for BAL All Units for Erlanger Hospital - Baroness Campus [TN] 1/1/2010 to 12/31/2010





Physician Diagnosis Poor

84 ICU patients with abnormal chest x-rays and purulent sputum

- Evaluated by 7 physicians
- True diagnosis established by histology or quantitative bronchoscopy cultures
- 32% found to have VAP
- Physicians disagreed on presence or absence of VAP in 35/84(42%) of patients
 - **The “best” doc missed 28% of true VAPs**
 - **The “worst” doc missed 50% of true VAPs**
 - **Both labeled ~20% of patients without VAP as having VAP**



Agreement Among Infection Preventionists - Fair

- 50 Ventilated patients with respiratory deterioration reviewed by 3 IPs: 2 using conventional approach (C) & 1 using quantitative approach (Q)
 - C-IP – 11 VAPs
 - C-IP – 20 VAPs
 - Q-IP – 15 VAPs
- 62% agreement among IPs

Klomas, AJIC 2010:38:237

Review of data with Trauma Surgery

Jan 09 - Feb 09

•*Trauma called 24 VAPS*

•*Infection Prevention called 8 VAPS*

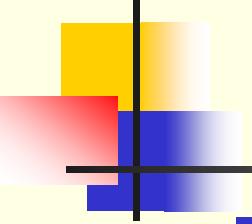
VAPs- Called by both Trauma and Infection Prevention	No-per IP & Radiologist read (yes-infiltrate per Trauma)	Disease process on admission to unit (48hr rule) or prior to intubation- includes transfers	No CXR changes- but yes per + BAL	Did not meet IC/CDC surveillance criteria
Total – 8 33%	Total- 8 33%	Total- 5 21%	Total-1 4%	Total -2 8%

Implications for Ongoing VAP Surveillance at Erlanger

- Rates are dependent upon:
 - The observer
 - Diagnostic tools used
 - Methods for sampling lower respiratory tract will impact VAP rates
 - Frequency of mimicking conditions in the ICU
 - Prevalence of ARDS or pulmonary edema ↑ rates.
 - Compliance with basic infection prevention practices



CDC Assessment of the Future of VAP Surveillance

- 
- Recognize current definitions won't work in current environment
 - Too burdensome and case finding too variable
 - Recognize inaccuracies in VAP diagnosis in NHSN and in clinical settings
 - Validity is going to be a problem no matter what

New VAP Definition from CDC

- Focus on a surveillance definition that is objective, streamlined, reliable, and potentially automated
 - Not a clinical definition but ideally has clinical credibility
- Draft of ventilator-associated lower respiratory infection (VALORI) being reviewed by experts
- Pilot in near future



Future Plans @ Erlanger to Decrease VAP/ Improve Patient Outcomes

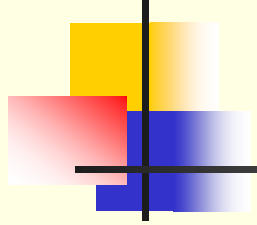
- Implement chlorhexidine gluconate (CHG) mouth rinsing in TICU and NNICU
- Implement CHG bathing in selected ICUs
- Implement Pressure EZ cuff monitoring device for all ventilated patients
- Improve assessment of re-intubation events
- Increase IP Staffing
 - Work with frontline to improve basic IP practices
 - To cover new organizational and process improvement and reporting priorities





Future Considerations

- Partner with Trauma services to improve IP case finding
- Partner with Radiology to develop a trigger from radiologic procedures
- Partner with Respiratory Care and critical care physicians to improve routine practice for spontaneous breathing trials for all vent patients and ↑use of non-invasive ventilation
- Continue to search literature for new evidence based practices to decrease vent LOS



Thanks!!!

Questions???