Improving People's Lives Through Innovations in Personalized Health Care

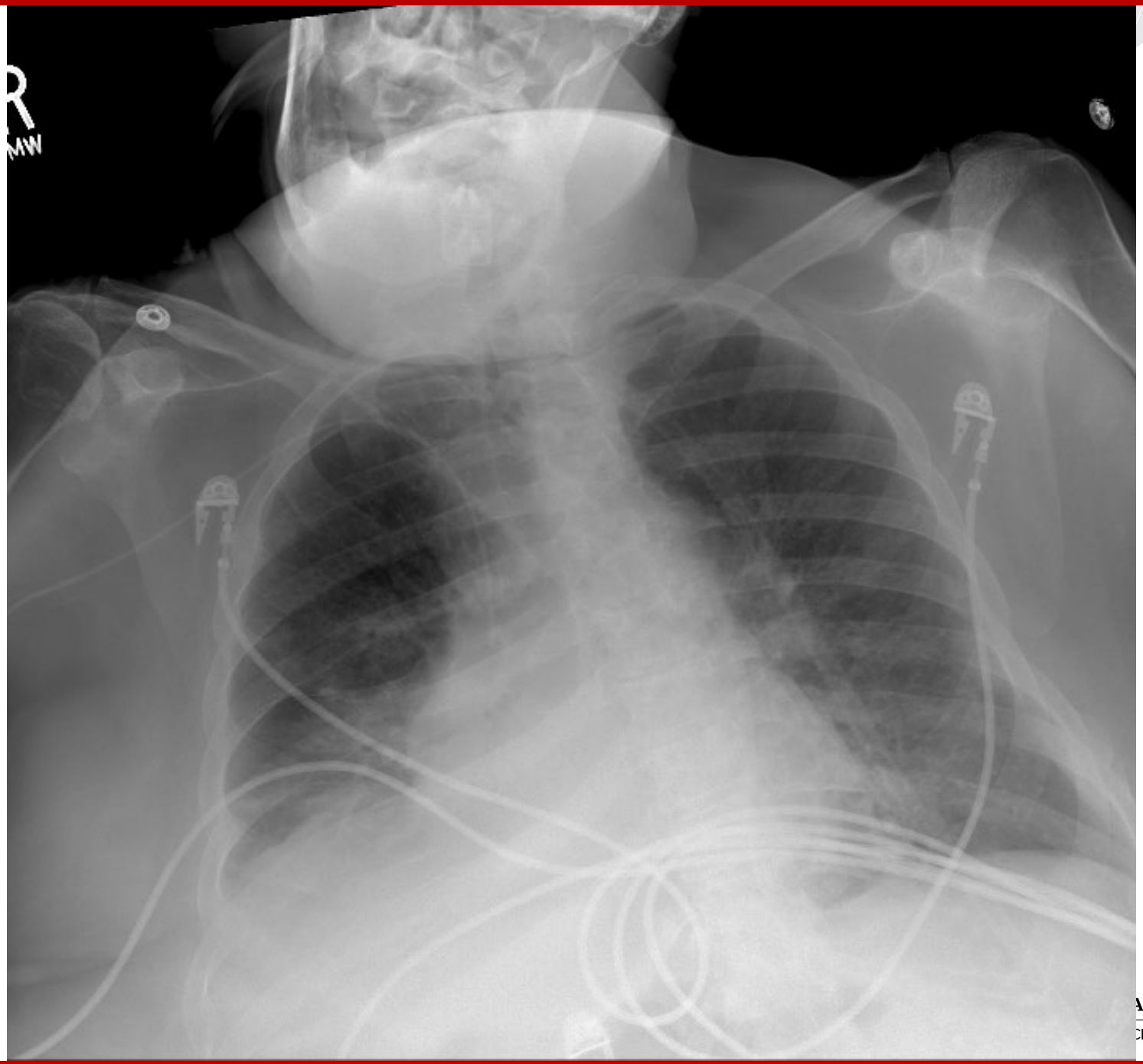
How to Keep Your VAP Rate from Defining You

Matthew Exline, MD MPH
Director MICU
Professor
Division of Pulmonary, Critical Care, and Sleep Medicine

THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER

Ms. LR

- 46 year-old with a history of neurogenic bladder admitted with malaise, nausea, and dark/malodorous urine
- Diagnosed with urosepsis and admitted to the floor
- PMH: HTN, rheumatoid arthritis, spinal stenosis, diabetes, multiple urinary tract infections

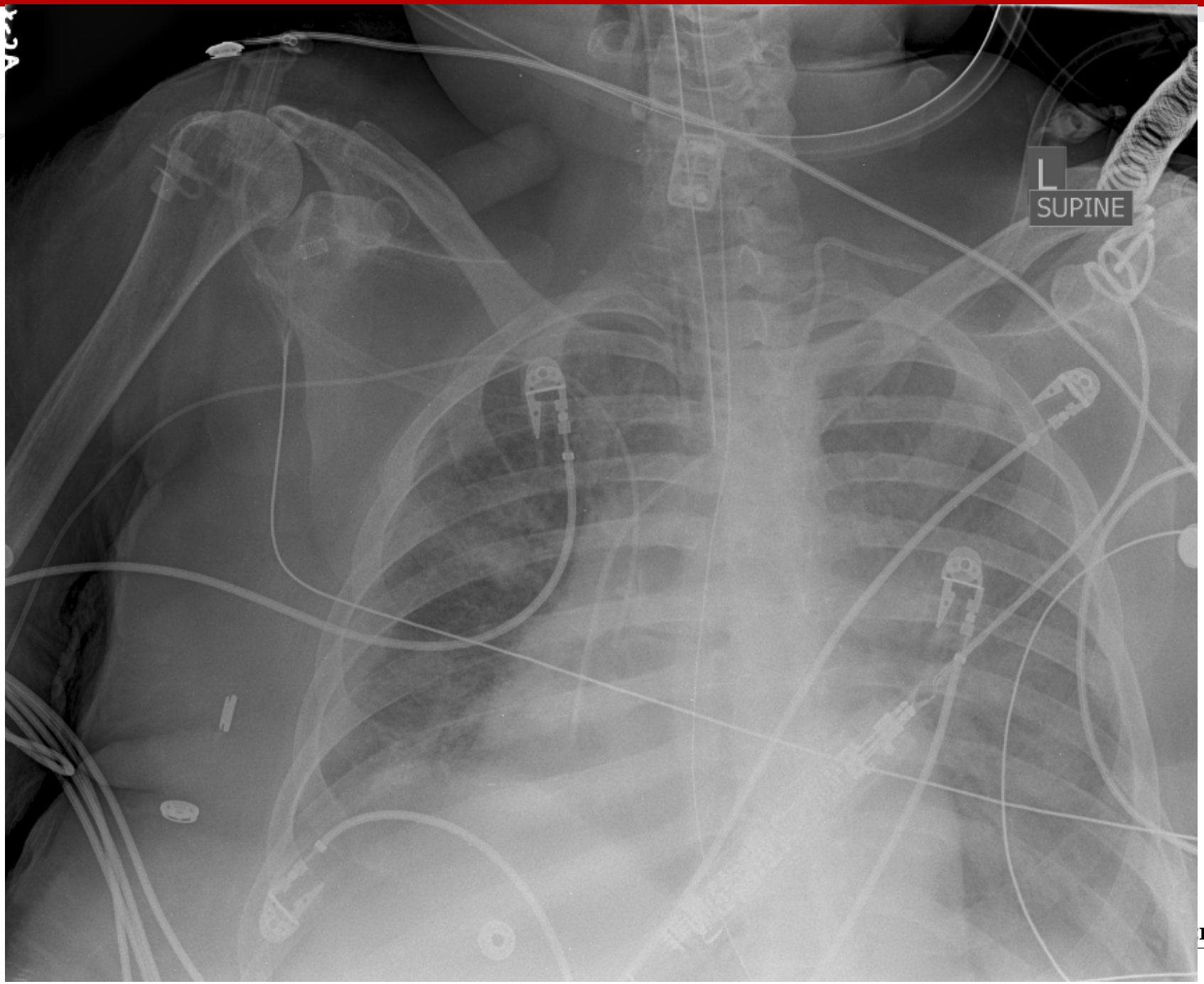


Ms. LR

- Treated for the Pseudomonas and E.coli found in her urine
- Hospital Day #3 transferred to unit for septic shock
- Eventually required intubation for increased work of breathing / septic encephalopathy

Ms. LR

- Weaned off pressors / ventilator settings
- Did not awaken when her sedation was stopped
  - unable to be extubate
- On ventilator day #6 she again became hypotensive, hypoxemic
  - Started on vanco & pip/tazo



RSITY

Ms. LR

- BAL grew Acinetobacter Baumannii
  - Resistant to pip / tazo

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- On day #7 she “coded” repeatedly and was transitioned to comfort care by her family
- Cause of Death – Ventilator-Associated Pneumonia

Ms. LR

- BAL grew Acinetobacter Baumannii
  - Resistant to pip / tazo
- On day #7 she “coded” repeatedly and was transitioned to comfort care by her family
- Cause of Death – Ventilator-Associated Pneumonia

Could we have prevented this patient’s death?

Ventilator-Associated Pneumonia Learning Objectives

- Understand NEW diagnostic criteria for a ventilator-associate pneumonia
- Understand the treatment options for ventilator-associate pneumonia
- Discuss the role of “VAP-bundles” in preventing ventilator-associate infections

Definitions

- VAP – pneumonia after 48-hours on ventilator
- HAP – pneumonia after 48-hours of hospital admission
- CAP – community-acquired pneumonia (everyone else)
- HCAP – Healthcare-Associated Pneumonia
  - Previous definition of pneumonia in patients with long-term exposure to healthcare
  - Examples: dialysis units, ECF/SNF, chronic care areas
  - Eliminated as overly broad and potentially leading to overuse of antibiotics
  - Now evaluate as CAP with risk factors

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Just How Common Is Ventilator-Associated Pneumonia?

Overall Incidence:
8 – 28% of Mechanically Ventilated Patients

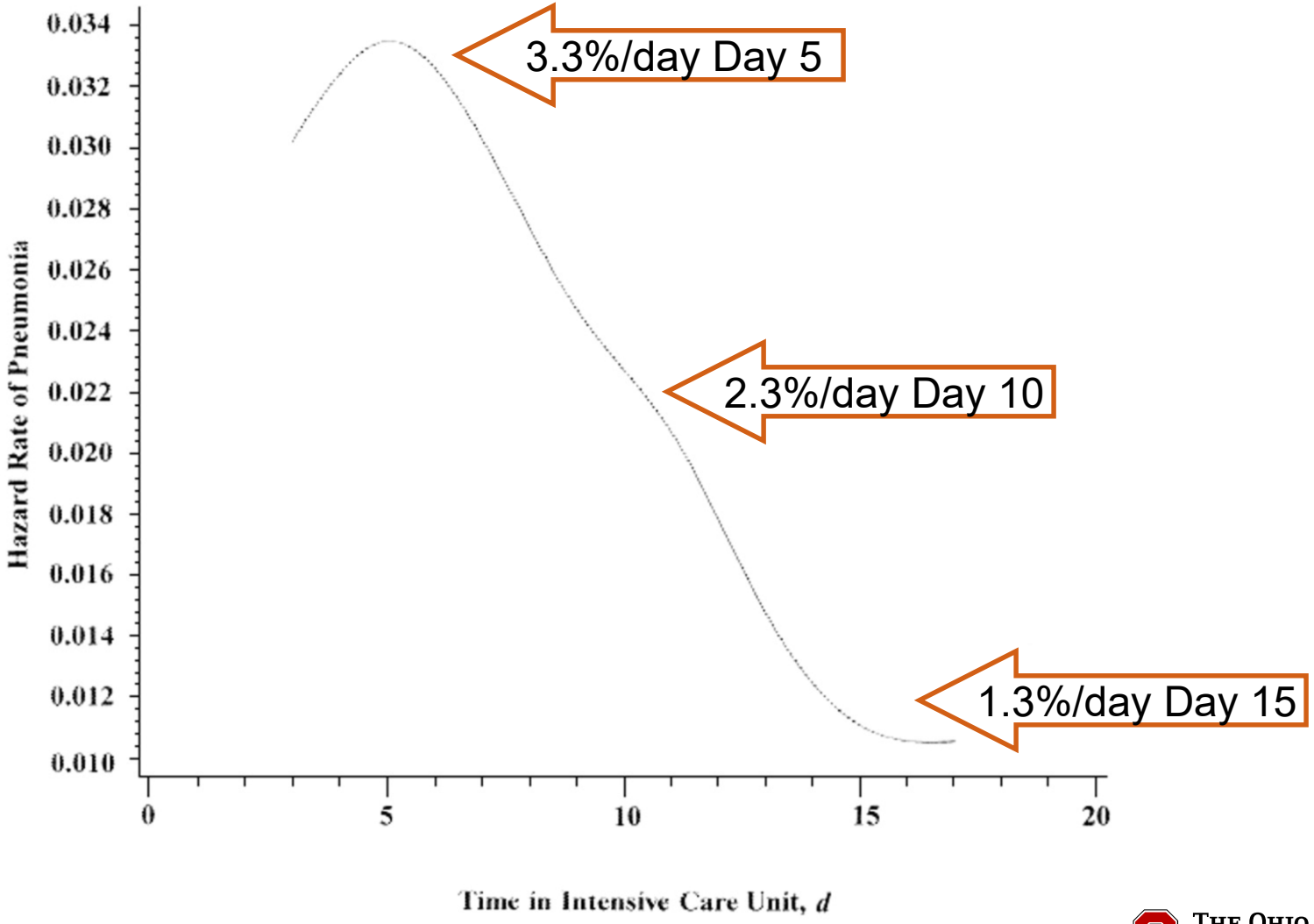
TABLE 1. INCIDENCE AND CRUDE MORTALITY RATES OF VENTILATOR-ASSOCIATED PNEUMONIA

First Author	Ref.	Year of Publication	No. of Patients	Incidence (%)	Diagnostic Criteria	Mortality Rate (%)
Patients in ICU						
~~Salata~~	~~41~~	~~1987~~	~~51~~	~~41~~	~~Clinical–autopsy~~	~~76~~
Craven	15	1986	233	21	Clinical	55
Langer	9	1989	724	23	Clinical	44
Fagon	12	1989	567	9	PSB	71
~~Kerver~~	~~43~~	~~1987~~	~~39~~	~~67~~	~~Clinical~~	~~30~~
Driks	40	1987	130	18	Clinical	56
Torres	14	1990	322	24	Clinical–PSB	33
Baker	44	1996	514	5	PSB/BAL	24
Kollef	45	1993	277	16	Clinical	37
Fagon	51	1996	1,118	28	PSB/BAL	53
Timsit	46	1996	387	15	PSB/BAL	57
Cook	35	1998	1,014	18	Clinical–PSB/BAL	24
Tejada Artigas	47	2001	103	22	PSB	44

Am J Respir Crit Care Med Vol 165. pp 867–903, 2002

Risk of VAP Highest Early On

Overall Rate 14.8 case/1000 Vent-Days



Patients At Risk Ventilator-Associated Pneumonia

TABLE 6. INDEPENDENT FACTORS FOR VENTILATOR-ASSOCIATED PNEUMONIA IDENTIFIED BY MULTIVARIATE ANALYSIS IN SELECTED STUDIES*

Host Factors	Intervention Factors	Other Factors
Serum albumin, < 2.2 g/dl	H_2 blockers $\pm$ antacids	Season: fall, winter
Age, ≥ 60 yr	Paralytic agents, continuous intravenous sedation	
ARDS	> 4 units of blood products	
COPD, pulmonary disease	Intracranial pressure monitoring	
Coma or impaired consciousness	MV > 2 d	
Burns, trauma	Positive end-expiratory pressure	
Organ failure	Frequent ventilator circuit changes	
Severity of illness	Reintubation	
Large-volume gastric aspiration	Nasogastric tube	
Gastric colonization and pH	Supine head position	
Upper respiratory tract colonization	Transport out of the ICU	
Sinusitis	Prior antibiotic or no antibiotic therapy†	

Definition of abbreviations: ARDS = acute respiratory distress syndrome; COPD = chronic obstructive pulmonary disease; ICU = intensive care unit; MV = mechanical ventilation.

Everyone! *If they don't have any of these, why are they in the unit?*

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Diagnostic Challenge of VAP

Criteria	Advantage	Disadvantage
Clinical	Decision made by treating team based on symptoms	Symptoms nonspecific. Only 43% of clinically suspected VAP confirmed by micro.
Radiographic	More objective? Readily available.	Many ICU patients with abnormal x-rays.
Microbiologic	Most objective.	Delay in treatment. Questionable sensitive and specificity.

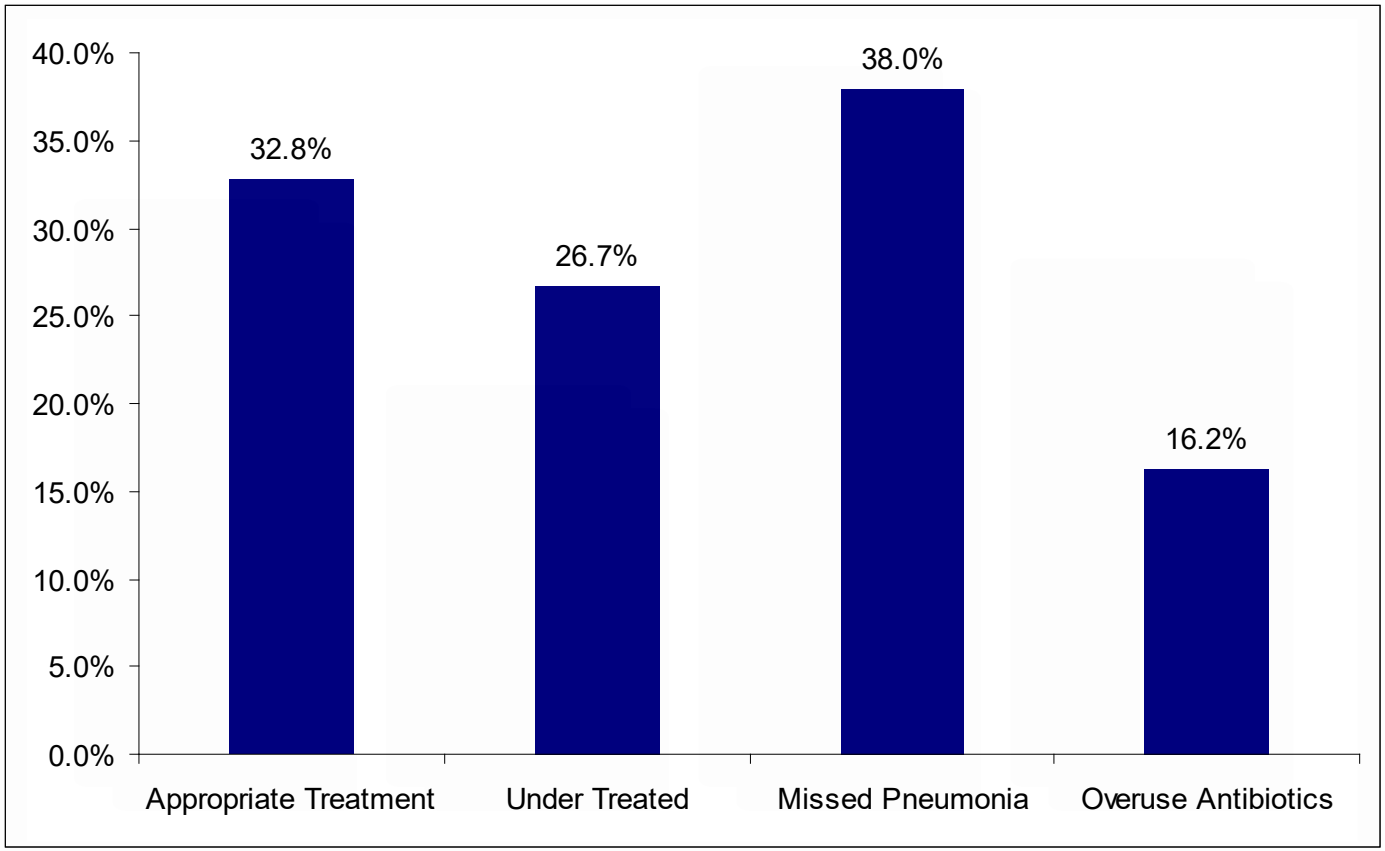
Maybe Listen to the Resident…

Table 4—*Evaluation of Clinical Diagnosis of Pneumonia in 84 Patients Studied*

Predictions	Percentage of Accurate Prediction		
	All patients (n = 84)	Patients Who Had Pneumonia (n = 27)	Patients Who Did Not Have Pneumonia (n = 57)
All predictions	77	62	84
Predictions of			
Senior consultants (n = 110)	77	57	84
Staff physicians (n = 186)	72	56	81
Residents (n = 112)	78	70	81
Predictions			
Of best predictor	82	72	86
Of worst predictor	71	50	83
When decision was unanimous (n = 49)	90	79	94

Chest 1993;103;547-553

Even with residents we are bad



Chest 1993;103;547-553

Diagnostic Challenge of VAP

Technique	Sensitivity	Specificity
Chest X-ray	92%	33%
Leukocytosis	77%	58%
Fever	46%	42%
Purulent Secretions	69%	42%
CXR + 2 Signs	69%	75%
Sputum Culture	69%	92%
BAL	39%	100%

N = 25

Thorax 1999;54:867–873

The New Definition

Pity your Infection Preventionist

Figure 1: Ventilator-Associated Events (VAE) Surveillance Algorithm

Patient has a baseline period of stability or improvement on the ventilator, defined by ≥ 2 calendar days of stable or decreasing daily minimum* FiO_2 or PEEP values. The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO_2.
*Daily minimum defined by lowest value of FiO_2 or PEEP during a calendar day that is maintained for at least 1 hour.

After a period of stability or improvement on the ventilator, the patient has at least one of the following indicators of worsening oxygenation:
1) Increase in daily minimum* FiO_2 of ≥ 0.20 (20 points) over the daily minimum FiO_2 in the baseline period, sustained for ≥ 2 calendar days.
2) Increase in daily minimum* PEEP values of ≥ 3 cmH_2O over the daily minimum PEEP in the baseline period†, sustained for ≥ 2 calendar days.
*Daily minimum defined by lowest value of FiO_2 or PEEP during a calendar day that is maintained for at least 1 hour.
†Daily minimum PEEP values of 0-5 cmH_2O are considered equivalent for the purposes of VAE surveillance.

Ventilator-Associated Condition (VAC)

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, the patient meets both of the following criteria:

1) Temperature > 38 °C or < 36°C, **OR** white blood cell count ≥ 12,000 cells/mm^3 or ≤ 4,000 cells/mm^3.
AND
2) A new antimicrobial agent(s) (see Appendix for eligible antimicrobial agents) is started, and is continued for ≥ 4 calendar days.

Infection-related Ventilator-Associated Complication (IVAC)

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, ONE of the following criteria is met (**taking into account organism exclusions specified in the protocol**):

1) Criterion 1: Positive culture of one of the following specimens, meeting quantitative or semi-quantitative thresholds as outlined in protocol, without requirement for purulent respiratory secretions:
   - Endotracheal aspirate, ≥ 10^5 CFU/ml or corresponding semi-quantitative result
   - Bronchoalveolar lavage, ≥ 10^4 CFU/ml or corresponding semi-quantitative result
   - Lung tissue, ≥ 10^4 CFU/g or corresponding semi-quantitative result
   - Protected specimen brush, ≥ 10^3 CFU/ml or corresponding semi-quantitative result
2) Criterion 2: Purulent respiratory secretions (defined as secretions from the lungs, bronchi, or trachea that contain ≥25 neutrophils and ≤10 squamous epithelial cells per low power field [lpf, x100])† plus organism identified from one of the following specimens (to include qualitative culture, or quantitative/semi-quantitative culture without sufficient growth to meet criterion #1):
   - Sputum
   - Endotracheal aspirate
   - Bronchoalveolar lavage
   - Lung tissue
   - Protected specimen brush

   † If the laboratory reports semi-quantitative results, those results must correspond to the above quantitative thresholds. See additional instructions for using the purulent respiratory secretions criterion in the VAE Protocol.
3) Criterion 3: One of the following positive tests:
   - Organism identified from pleural fluid (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube)
   - Lung histopathology, defined as: 1) abscess formation or foci of consolidation with intense neutrophil accumulation in bronchioles and alveoli; 2) evidence of lung parenchyma invasion by fungi (hyphae, pseudohyphae or yeast forms); 3) evidence of infection with the viral pathogens listed below based on results of immunohistochemical assays, cytology, or microscopy performed on lung tissue
   - Diagnostic test for *Legionella* species
   - Diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus

January 2017

Possible Ventilator-Associated Pneumonia (PVAP)

Ventilator-Associated Condition (VAC)

- After 2 days of stable improving ventilator settings
- Patient has either
  - FiO_2 increase ≥ 20%
  - PEEP increase ≥ 3 cmH_2O
- Patient has VAC

Patient has a baseline period of stability or improvement on the ventilator, defined by ≥ 2 calendar days of stable or decreasing daily minimum* FiO_2 or PEEP values. The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO_2.

*Daily minimum defined by lowest value of FiO_2 or PEEP during a calendar day that is maintained for at least 1 hour.

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After a period of stability or improvement on the ventilator, the patient has at least one of the following indicators of worsening oxygenation:

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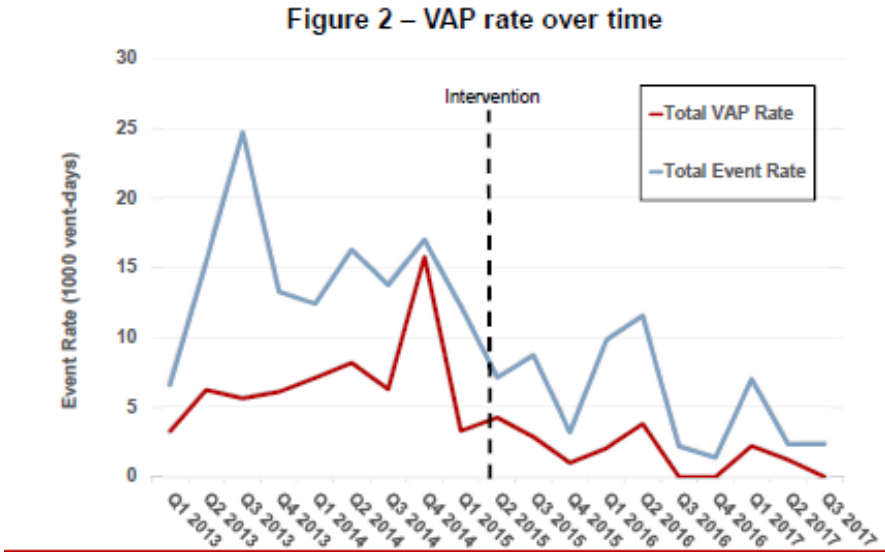
Think about your PEEP settings

PEEP Levels Matter

- We looked at VAP rates based on the default PEEP
  - 5 vs. 6 cmH20
- VAP Rate
  - PEEP 5
    - 4.81 / 1000 days
    - 57% VAPs triggered due to incr PEEP
  - PEEP 6
    - 1.98 / 1000 days
    - 25% VAPs triggered due to incr PEEP



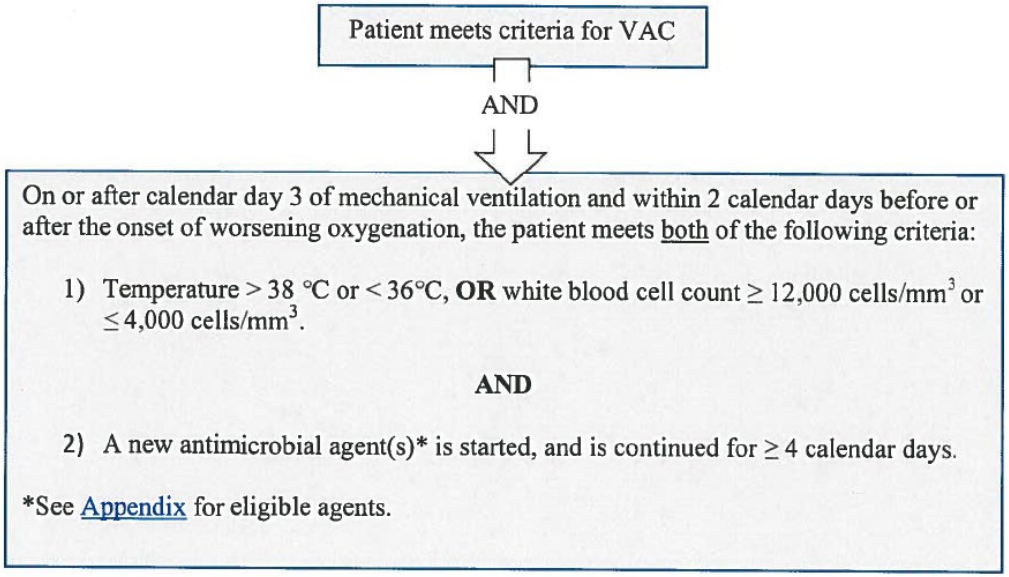
Presented ATS 2018

Infection-related Ventilator-Associated Complication (IVAC)

- After 3 days on vent
- Patient has VAC
  - Worsening oxygenation
- Patient has
  - Fever, hypothermia, leukocytosis, or leukopenia

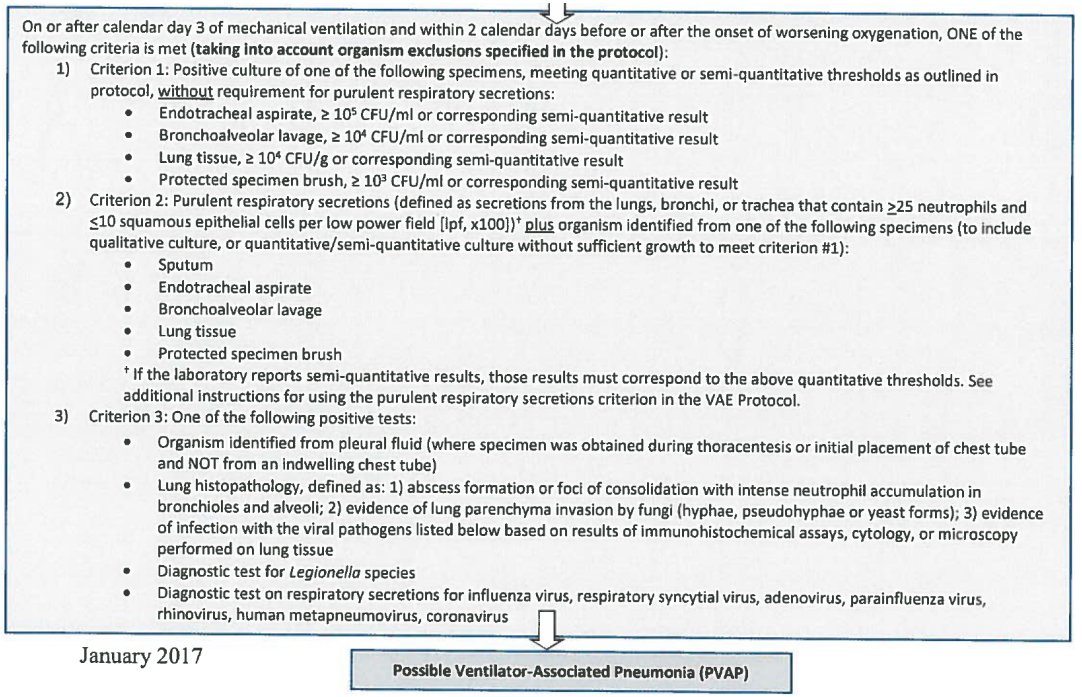
AND

  - New antibiotic is started and continued for at least 4 days



Possible VAP

- On or after 3 days on vent
- Patient has iVAC
  - Worsening oxygenation
  - Signs of infection
- Patient has
  1. Positive quantitative / semi-quantitative culture
     - Endotracheal aspirate
     - BAL
     - Lung tissue
     - Protected specimen brushing
  2. Purulent sputum plus organism identified from specimen (see above)



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Possible Ventilator-Associated Pneumonia (PVAP)

Possible VAP using criterion 3

3) Criterion 3: One of the following positive tests:

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Possible Ventilator-Associated Pneumonia (PVAP)

- After 3 days on vent
- Patient has iVAC
  - Worsening oxygenation
  - Signs of infection
- Patient has
  - Organisms from pleural fluid
  - Lung histo
  - Positive Legionella species
  - Positive viral diagnostic tests

Exclusions

- Patients on high frequency ventilation or extracorporeal life support (ECHMO) are excluded from surveillance
- Culture results reported as normal respiratory flora, normal oral flora, mixed respiratory flora, mixed oral flora, altered oral flora
- *Candida* species or yeast not otherwise identified
- Coagulase-negative *Staphylococcus* species
- *Enterococcus* species
- Airway Pressure Release Ventilation (APRV) is NOT EXCLUDED.

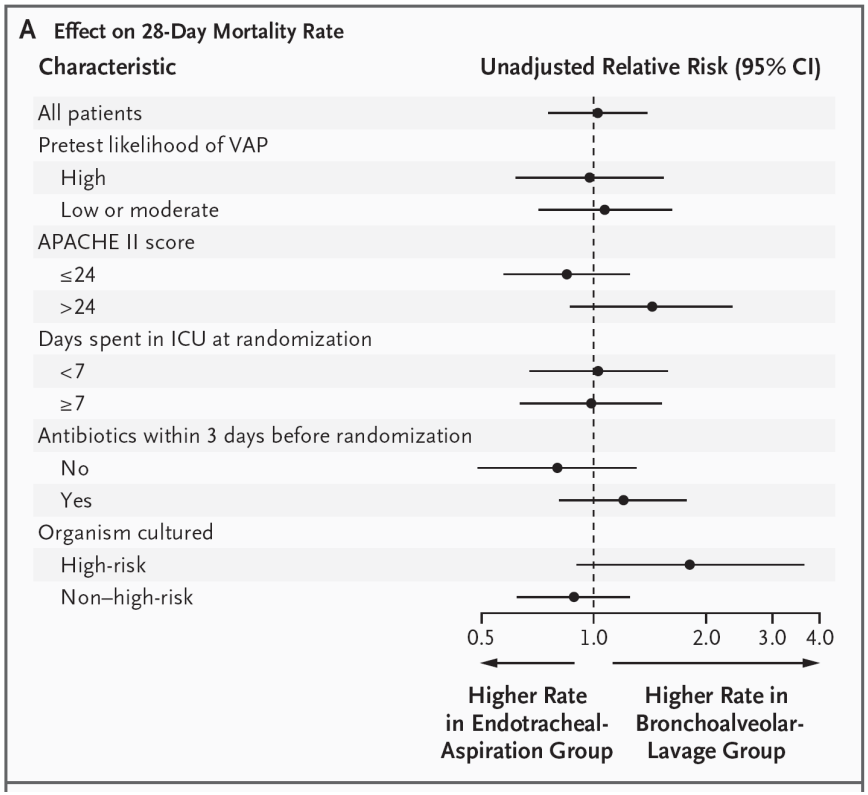
Summary

- Vent changes (FiO2 / PEEP) matter
- Antibiotic starting / stopping times matter
- Pulmonary secretion sampling matters

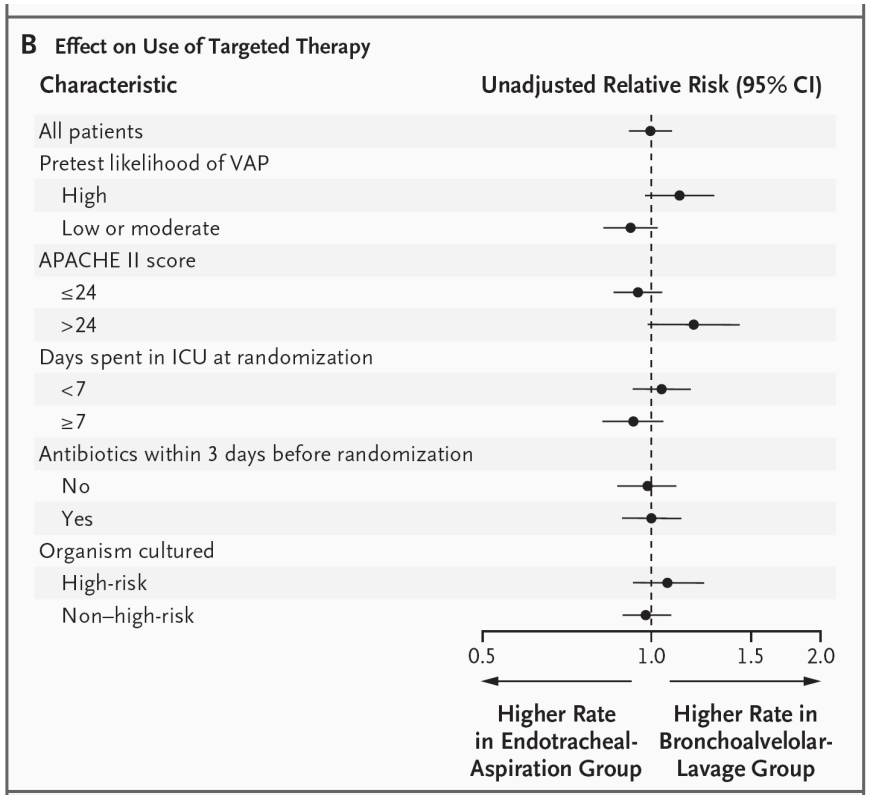
How to Confirm Microbiology?

Sputum Culture versus BAL

Mortality



Targeted Therapy



N = 740

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Bronchoscopy

- Bronchoscopy versus sputum culture study excluded:
  - Immune suppressed patients
  - Patients with known pseudomonas or MRSA in past
  - Beta-lactam / ciprofloxacin allergic patients
- Many would advocate fiberoptic bronchoscopy in these groups

Bronchoscopy vs. Sputum Culture

Non-Invasive Testing

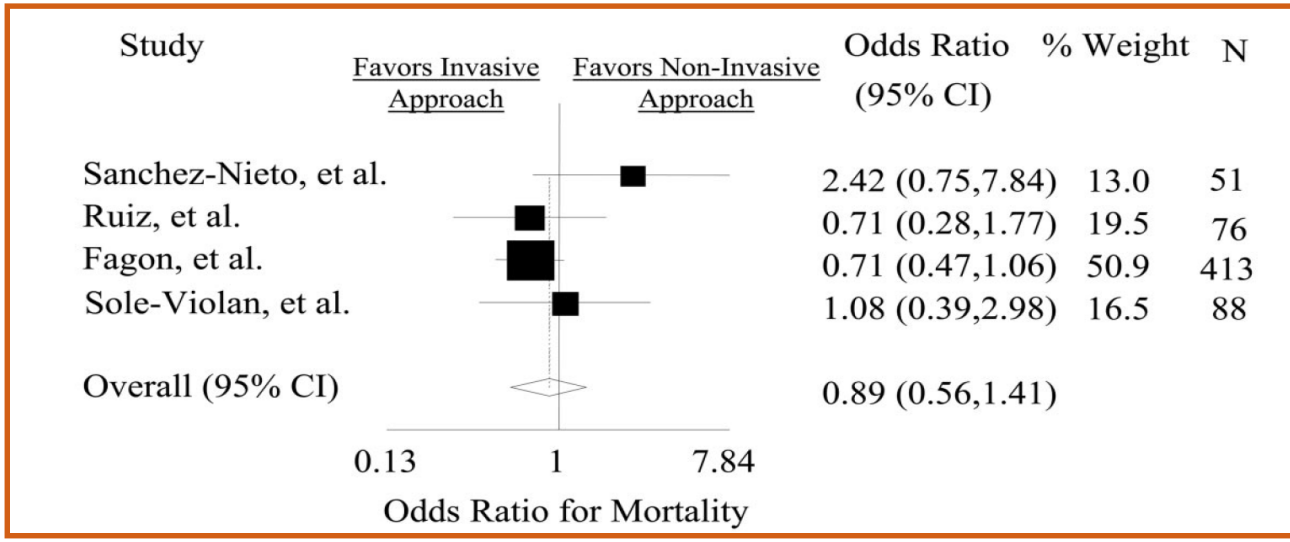
- Pro's
  - Cheap
  - Available 24/7
  - Sensitive
- Con
  - Non-specific
  - May lead to increased use of antibiotics

Invasive Testing

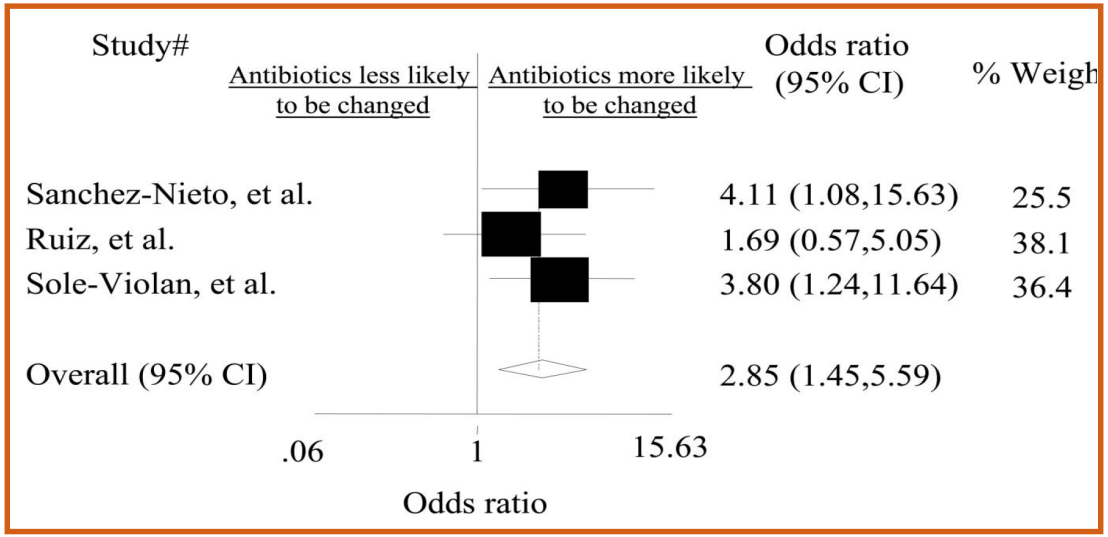
- Pro's
  - Specific
  - Likely leads to fewer antibiotic days
  - May improve short-term mortality
  - Reassurance
- Con
  - Expensive
  - Not readily available 24/7

Bronchoscopy vs. Sputum Culture

Mortality
No Difference



Antibiotics
CHANGED!



Crit Care Med 2005 Vol. 33, No. 1

A Compromise The mini-BAL

- Compared with Fiberoptic BAL
  - Sensitivity 63-100%
  - Specificity 66-96%

Endotracheal Aspirate Growth Level	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)
Rare, light, moderate, or heavy	65.4	56.1	61.7	60.0
Light, moderate, or heavy	63.2	65.0	67.2	60.9
Moderate or heavy	44.4	83.3	76.8	54.6
Heavy	30.4	94.4	88.2	49.8
Rare, light, moderate, or heavy (antibiotic decision)	81.2	61.9	71.3	73.7

17.5% False positive sputum cultures compared with mini-BAL
42.2% of false positives were for MDR pathogens

Respir Care 2009;54(11):1453–1461.

Diagnosis of VAP

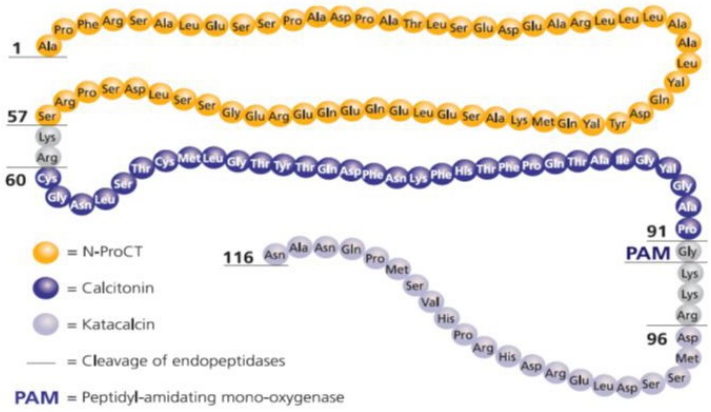
- Have a high index of suspicion in patients with change in pulmonary status
- Chest x-rays useful to confirm suspicion, but daily x-rays are unwarranted
- Consider an invasive testing for microbiologic confirmation of infection
  - miniBAL or BAL
- DO NOT DELAY TREATMENT FOR MICRO

Treatment of VAP

- Know your antibiogram
- In general target:
  - Resistant gram positives (MRSA)
  - Pseudomonas (and other resistant gram negatives)
  - This usually means vanco + anti-PSA β-lactam
  - If critically ill, consider double covering for gram negatives
- Specific anaerobic coverage is usually not needed, even if “aspiration” is suspected

How Do I Stop the Madness? Procalcitonin (PCT) – Super Hero!

- By Day:
  - Mild mannered 116AA peptide responsible for calcium metabolism released by thyroid
- By Night:
  - Highly specific marker of systemic bacterial infection released by many different tissues



Morgenthaler N. et al., Clin Lab 2002, 48: 263-270

Efficacy and safety of procalcitonin guidance in reducing the duration of antibiotic treatment in critically ill patients: a randomised, controlled, open-label trial

Evelien de Jong, Jos A van Oers, Albertus Beishuizen, Piet Vos, Wytze J Vermeijden, Lenneke E Haas, Bert G Loef, Tom Dormans, Gertrude C van Melsen, Yvette C Kluiters, Hans Kemperman, Maarten J van den Elsen, Jeroen A Schouten, Jörn O Streefkerk, Hans G Krabbe, Hans Kieft, Georg H Kluge, Veerle C van Dam, Joost van Pelt, Laura Bormans, Martine Bokelman Otten, Auke C Reidinga, Henrik Endeman, Jos W Twisk, Ewoudt M W van de Garde, Anne Marie G A de Smet, Jozef Kesecioglu, Armand R Girbes, Maarten W Nijsten, Dylan W de Lange

- 1575 admitted to the ICU on antibiotics
  - Excluded: severe immune suppression, endocarditis, severe viral/mycobacteria/parasitic
- PCT measured baseline and then daily
- Suggested abx stopped for either:
  - PCT decreased by > 80% baseline
  - PCT ≤ 0.5 ug/L
- Primary outcome consumption of antibiotics

www.thelancet.com/infection Vol 16 July 2016

We can use this on sick patients

- 82% severe sepsis
- 18% septic shock
- 81% mechanically ventilated
- 9% on dialysis
- 96% on vasopressors
- 54% on steroids

Can we reduce ICU antibiotics?

- Antibiotic Consumption
  - Standard 9.3 (5.0-16.5) days
  - PCT 7.5 (4.0-12.8) days
- Reinfection (with same bacteria)
  - Standard 2.9%
  - PCT 5%
- Compliance
  - 44% stopped within 24-hours
  - 97% stopped within 48-hours

Checking Procalcitonin Saves Lives

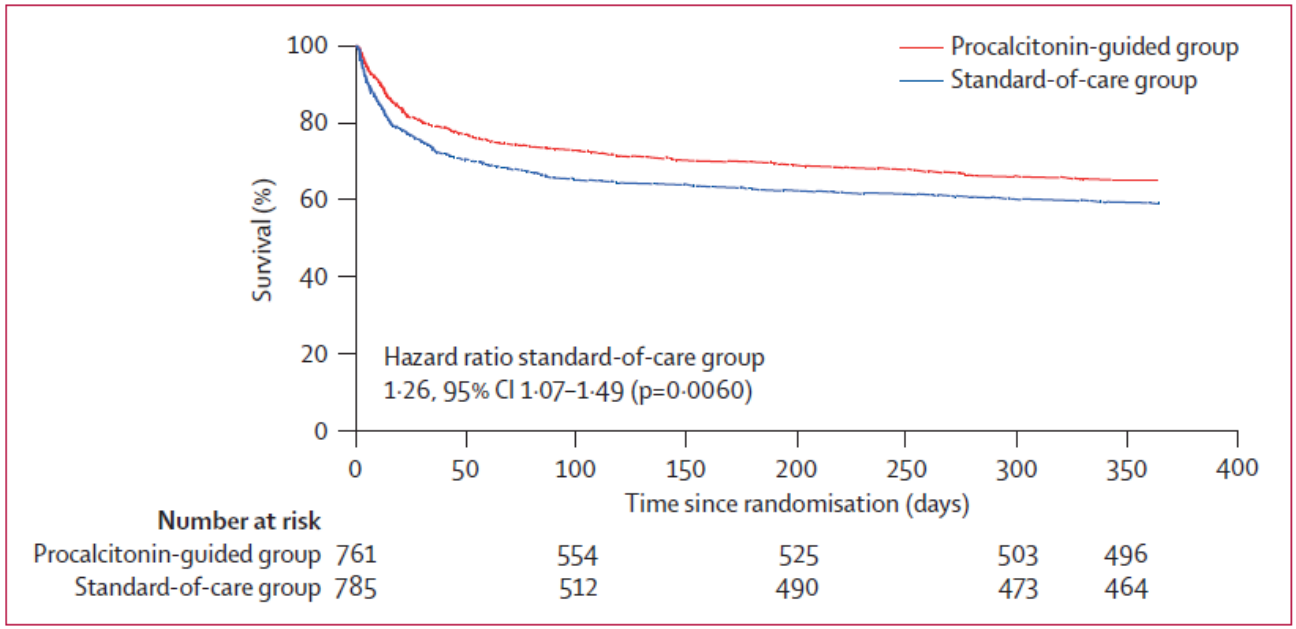


Figure 2: **Kaplan-Meier plot for probability of survival from random assignment to day 365, in the modified intention-to-treat population**

- 28-Day Mortality
  - Standard care 25%, PCT 19.6%
- 1-Year Mortality
  - Standard care 40.9%, PCT 34.8% (difference 6.1%)

NNT = 16!

Interim Summary

- VAP is a common nosocomial infection associated with increase costs and mortality
- There is no gold standard for diagnosis of VAP
- Maintain clinical suspicion and start treatment while awaiting microbiologic confirmation by sputum or invasive culture methods
- Early (**STAT**) antibiotics and appropriate de-escalation are the mainstay of treatment

The Best Way to Treat VAP is to Prevent It

Ventilator-Associated Pneumonia Learning Objectives

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Prevention of VAP
The Ventilator Bundle

Collection of best practices designed to reduce the duration of ventilator use and thus ventilator-associated pneumonia

- Head of bed elevation $\geq$ 30°
- Oral Care
- Daily ventilator liberation trials
- Daily continuous sedation stops
- DVT prophylaxis
- Stress-ulcer prophylaxis

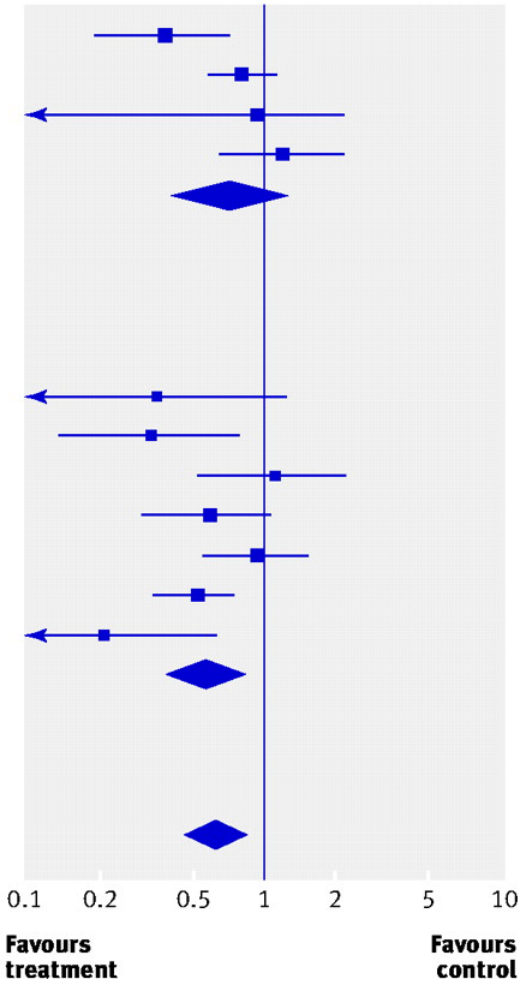
Ventilator Bundle

Practice	Rationale
HOB elevation	Prevent micro-aspiration of oral flora
Oral care	Reduced bacterial load of oral flora
Daily vent liberation trials	Ensure early awareness of readiness for self-breathing
Daily sedation stops	Ensure lowest effective dose of sedatives are used
DVT prophylaxis	Prevent complication known to prolong ventilator use
Stress-ulcer prophylaxis (H2-blocker)	Prevent complication known to prolong ventilator use

Why do these work?

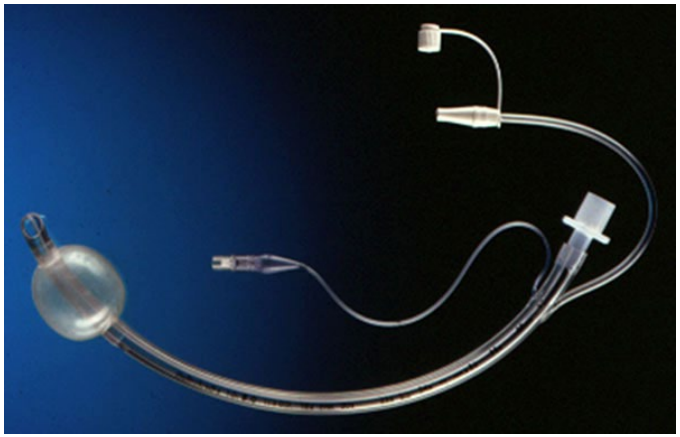
Can a Tooth Brush Really Help?

Study	No with event/No of patients: Treatment group	Control group	Relative risk (random) (95% CI)	Weight (%)	Relative risk (random) (95% CI)
Antibiotics					
Bergmans 2001[w1]	9/87	38/139		9.71	0.38 (0.19 to 0.74)
Kollef 2006[w2]	52/362	62/347		15.81	0.80 (0.57 to 1.13)
Laggner 1994[w3]	1/33	4/34		1.72	0.26 (0.03 to 2.19)
Rios 2005[w10]	15/47	13/49		10.47	1.20 (0.64 to 2.25)
Subtotal (95% CI)	529	569		37.71	0.69 (0.41 to 1.18)
Test for heterogeneity: χ^2=7.39, df=3, P=0.06, I^2=59.4%					
Test for overall effect: z=1.35, P=0.18					
Antiseptics					
De Riso 1996[w4]	3/173	9/180		4.11	0.35 (0.10 to 1.26)
Fourrier 2000[w5]	5/30	15/30		7.18	0.33 (0.14 to 0.80)
Fourrier 2005[w6]	13/114	12/114		8.79	1.08 (0.52 to 2.27)
Koeman 2006[w7]	13/127	23/130		10.33	0.58 (0.31 to 1.09)
MacNaughton 2004[w11]	21/101	21/93		12.01	0.92 (0.54 to 1.57)
Segers 2005[w9]	35/485	67/469		14.81	0.51 (0.34 to 0.75)
Seguin 2006[w8]	3/36	25/62		5.07	0.21 (0.07 to 0.64)
Subtotal (95% CI)	1066	1078		62.29	0.56 (0.39 to 0.81)
Test for heterogeneity: χ^2=11.59, df=6, P=0.07, I^2=48.2%					
Test for overall effect: z=3.08, P=0.002					
Total (95% CI)	1595	1647		100.00	0.61 (0.45 to 0.82)
Test for heterogeneity: χ^2=21.07, df=10, P=0.02, I^2=52.5%					
Test for overall effect: z=3.31, P=0.0009					



BMJ 2007;334:889

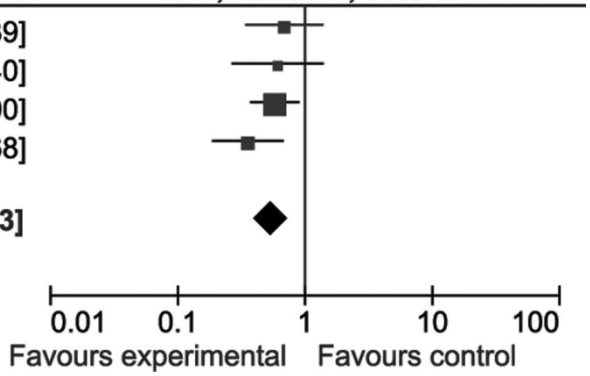
Subglottic Suctioning Prevents VAP



Study or Subgroup	SSD Events	SSD Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
Bouza 2008	12	331	19	359	18.4%	0.69 [0.34, 1.39]
Kollef 1999	8	160	15	183	13.3%	0.61 [0.27, 1.40]
Lacherade 2010	25	169	42	164	46.3%	0.58 [0.37, 0.90]
Lorente 2007	11	140	31	140	22.0%	0.35 [0.19, 0.68]
Total (95% CI)		**800**		**846**	**100.0%**	**0.54 [0.40, 0.73]**
Total events	56		107			

Heterogeneity: Tau² = 0.00; Chi² = 2.23, df = 3 (P = 0.53); I² = 0%

Test for overall effect: Z = 3.99 (P < 0.0001)



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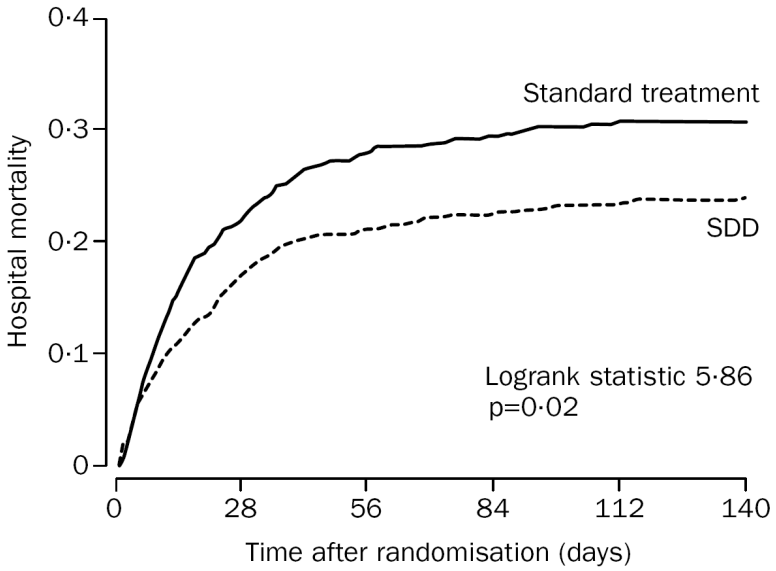
Why Not Gut Decontamination?

- Mortality benefit!
- BUT unit had
  - NO MRSA
  - < 5% resistant gram negatives



Numbers of patients at risk

SDD	457	383	360	354	350	348
Non-SDD	460	363	331	324	318	318

Figure 2: **Cumulative hospital mortality for SDD treatment and standard treatment**

Speaking of the Gut

- Acid suppression increased risk of VAP, but only in group on PPI therapy
- GI prophylaxis still recommended due to high risk of GI bleed, but focus on H_2-blockers

Table 4. Rates of Hospital-Acquired Pneumonia According to Type of Acid-Suppressive Medication

	Acid-Suppressive Medication	No Acid-Suppressive Medication	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Proton-Pump Inhibitors[a]				
Total admissions, No.	25 374	30 956	56 330	56 330
Hospital-acquired pneumonia, No. (%)	1340 (5.3)	610 (2.0)	2.8 (2.5-3.1)	1.3 (1.1-1.4)[b]
Histamine$_2$ Receptor Antagonists[c]				
Total admissions, No.	5686	30 956	36 642	36 642
Hospital-acquired pneumonia, No. (%)	176 (3.1)	610 (2.0)	1.6 (1.3-1.9)	1.2 (0.98-1.4)[b]

Abbreviations: CI, confidence interval; OR, odds ratio.
[a] Patients prescribed histamine$_2$ receptor antagonists were excluded from this analysis.
[b] Adjusted for all variables listed in Table 1, plus admission day of the week, using a multivariable generalized estimating equation (GEE) to take into account dependency of the data due to repeated admissions.
[c] Patients prescribed proton-pump inhibitors were excluded from this analysis.

JAMA, May 27, 2009—Vol 301, No. 20

Head of Bed and VAP Prevention

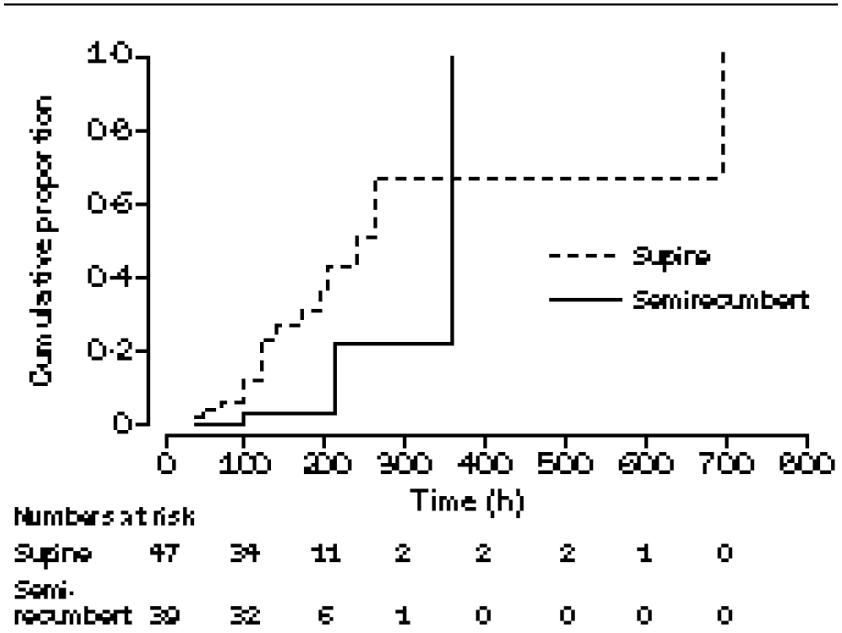


Figure 2: **Cumulative proportion of patients with clinically suspected pneumonia**
Comparison of semirecumbent and supine body position (log-rank test, p=0·018).

Lancet 1999; **354**: 1851–58

- Semi-recumbent position reduce VAP rate by 26% (10-42%) p = 0.003

- Supine position increased odds of VAP 6.8 [1.7-26.7] (p=0.006)

Spontaneous Breathing Trials

Protocol Weaning of Mechanical Ventilation in Medical and Surgical Patients by RespiratoryCare Practitioners and Nurses* : Effect on Weaning Time and Incidence of Ventilator-Associated Pneumonia

Gregory P. Marelich, Susan Murin, Felix Battistella, John Inciardi, Terry Vierra and Marc Roby

Garry Kasparov

Outcomes	MD	VMP	p Value
Duration of mechanical ventilation, median h (interquartile range)			
Medicine (n = 170)	232 (63–435)	78 (38–168)	0.0003
Surgery (n = 165)	111 (52–181)	64 (30–156)	NS
Combined (n = 335)	124 (54–334)	68 (33–164)	0.0001
VAP, No. of patients in treatment arms (%)			
Medicine (n = 170)	8 (9)	6 (7)	0.674
Surgery (n = 165)	12 (15)	5 (6)	0.061
Combined (n = 335)	20 (12)	11 (7)	0.100

*NS = not significant.

(CHEST 2000; 118:459–467)

Sedation Holiday and VAP

- Increased sedation increases odds of VAP 2.3 (1.3 – 4.1)
- Paralytic agents increased odds of VAP 2.7 (1.6 – 4.5)

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Nursing Driven Protocol Reduces VAP

Table 2. Ventilator-associated pneumonia (VAP), duration of mechanical ventilation, length of intensive care unit (ICU) and hospital stay, ICU and in-hospital mortality, and extubation failure according to study group

Variable	Control Group (n = 226)	Protocol Group (n = 197)	*p* Value
VAP, n (%)	34 (15)	12 (6)	.005
Duration of mechanical ventilation, days			.001
Median	8	4.2	
Interquartile range	2.2–22	2.1–9.5	
Unscheduled self-extubation, n (%)	16 (7)	21 (10.7)	.09
Extubation failure, n (%)	29 (13)	11 (6)	.01
Time from end of sedative infusion to extubation, hrs			.01
Median	65	33	
Interquartile range	36–123	12–75	
Length of stay in ICU, days			.004
Median	11	5	
Interquartile range	2.5–27	2.5–13	
Length of stay in hospital, days			.003
Median	21	17	
Interquartile range	5–33	5–22	
ICU mortality, n (%)	88 (39)	63 (31)	.19
In-hospital mortality, n (%)	101 (45)	75 (38)	.22

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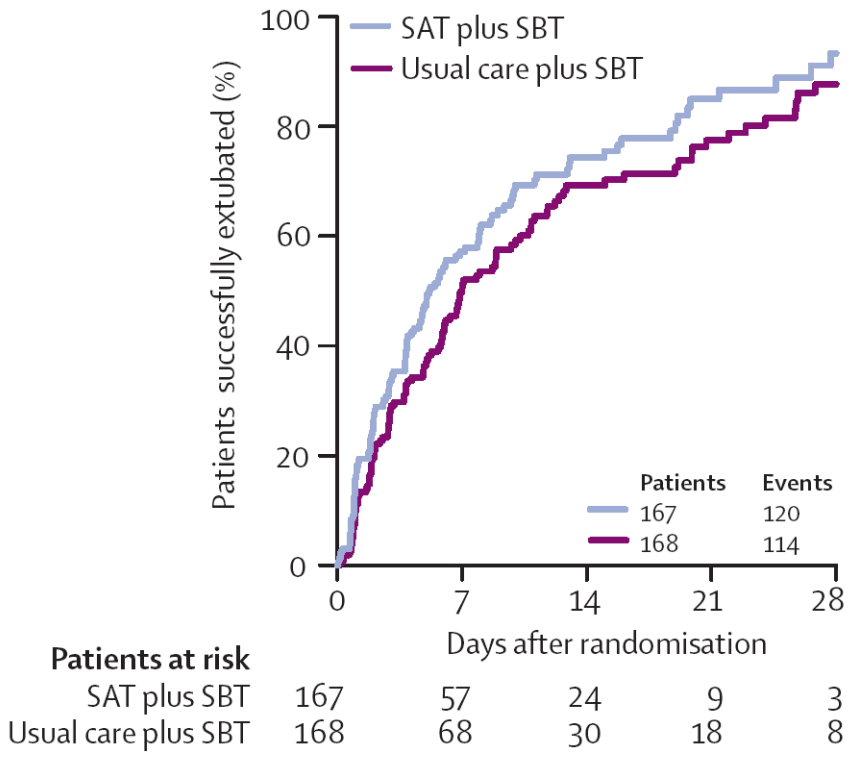
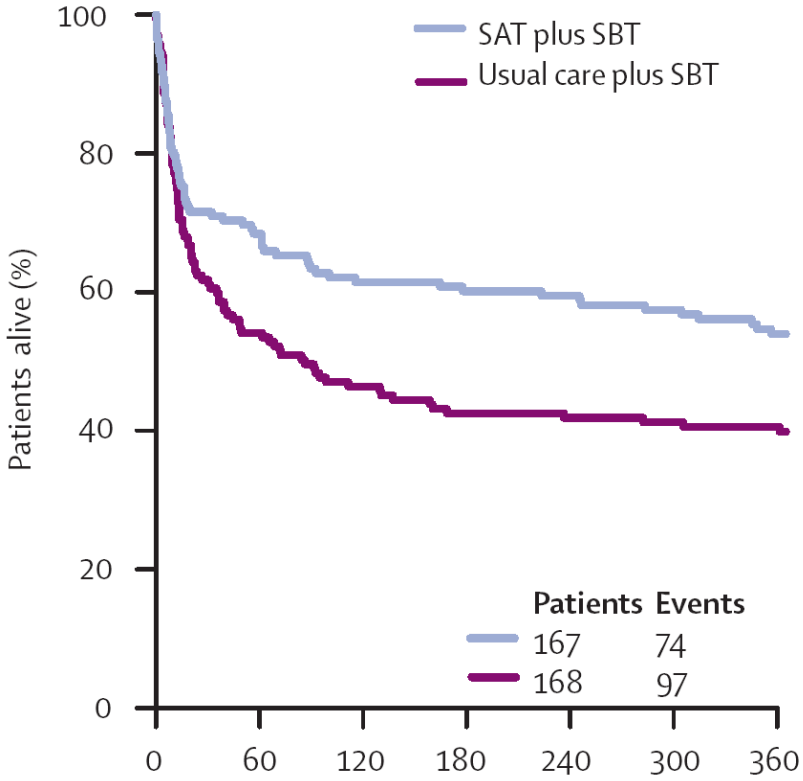
Putting it All Together
Awake and Breathing Trial





Rate of self-extubations was 10% in intervention group (4% control), but no increased risk of reintubation

Conclusions

- Ventilator-Associated Pneumonia has a significant cost in dollars and lives
- New definition makes screening challenging, but…
- Adherence to “Vent Bundles” can reduce the incidence of VAP
- Appropriate antibiotic use can reduce ICU-time and antibiotic resistance

Questions / Comments