

# Management of Hospital-acquired and Ventilator-associated Pneumonia

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# Disclosures

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- I have no financial disclosures related to this presentation.



# Objectives

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- Define hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP)
- Describe diagnosis of HAP and VAP
- Identify risk factors for infections with multi-drug resistant organisms (MDROs)
- Differentiate empiric therapy recommendations for HAP and VAP
- Discuss the role of short-course therapy, antibiotic de-escalation and use of local antibiograms in the treatment of HAP and VAP



# Epidemiology of HAP and VAP

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- 22% of all hospital-acquired infections (HAIs)
- Mortality rates:
  - VAP range from 20 – 50%
- Economic burden:
  - Prolonged mechanical ventilation
  - Prolonged hospital length of stay (LOS)
  - Excess cost \$40,000 per patient



# Historical Perspective

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**1966:**

ATS-  
Nosocomial  
Infections

**2005:**

ATS/ISDA-  
HAP and VAP  
Guidelines

**2016:**

ATS/IDSA-  
HAP and VAP  
Guideline **UPDATE**



**1996:** ATS-  
HAP Consensus  
Statement

**2014:** SHEA/IDSA  
VAP Prevention  
Guidelines



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*Am J Respir Crit Care Med.* 1996;153:1711–1725.  
*Am J Respir Crit Care Med.* 2005; 171: 388-416.  
*Infect Control Hosp Epidemiol.* 2014;35(8): 915-936.  
*CID.* 2016; 63: 1-51.

# Guideline Update: 2005 Versus 2016

## What's Different

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- Utilization of the GRADE methodology for evaluation of evidence
  - Strong *versus* weak recommendation
  - Quality of evidence
- Removal of Health-care Associated Pneumonia (HCAP)
- Emphasis on use of antibiograms
  - Hospital specific
  - Regional



# Guideline Update: 2005 Versus 2016

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- Use of antibiograms
  - *Recommend* use of antibiogram directed empiric therapy
  - *Recommend* all hospitals generate/disseminate local antibiogram(s)
    - Specific for:
      - ICU population
      - VAP population
      - HAP population



# Guideline Update: 2005 Versus 2016

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- Updates to local antibiogram based on:
  - Rate of change in resistance patterns
  - Resources
  - Data available for analysis





# Guideline Update: 2005 Versus 2016

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- Biomarkers to Diagnose HAP/VAP
  - *Recommend* using clinical criteria alone over:
    - Procalcitonin (PCT)
    - Soluble Triggering Receptor Expressed on Myeloid Cells (sTREM-1)
      - *Strong recommendation; moderate quality evidence*
- *Suggest* using clinical criteria alone over:
  - C-reactive Protein (CRP)
  - Modified Clinical Pulmonary Infection Score (CPIS)
    - *Weak recommendation; low-quality evidence*

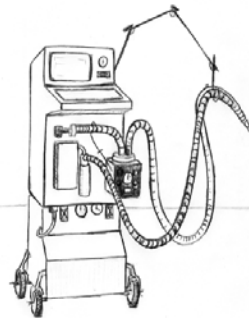
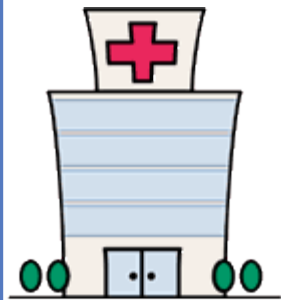


# Differentiating HAP and VAP

Nosocomial  
Pneumonia

Hospital-  
Acquired

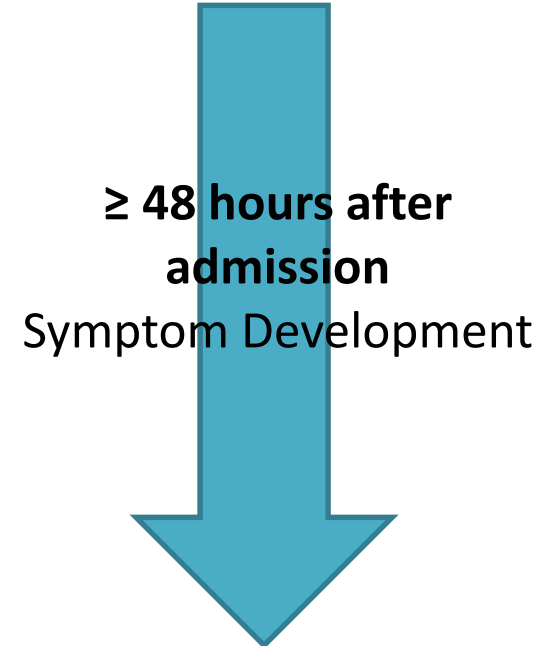
Ventilator-  
Associated



# Definition of HAP

- Unchanged from 2005 guidelines
- Development of symptoms  $\geq 48$  hours after *hospital admission*
  - Radiographic infiltrate
  - Clinical criteria:
    - Fever
    - Leukocytosis
    - Purulent sputum
    - Decline in oxygenation

Time zero = Admission



**Hospital-acquired  
Pneumonia**



# Diagnosis of HAP

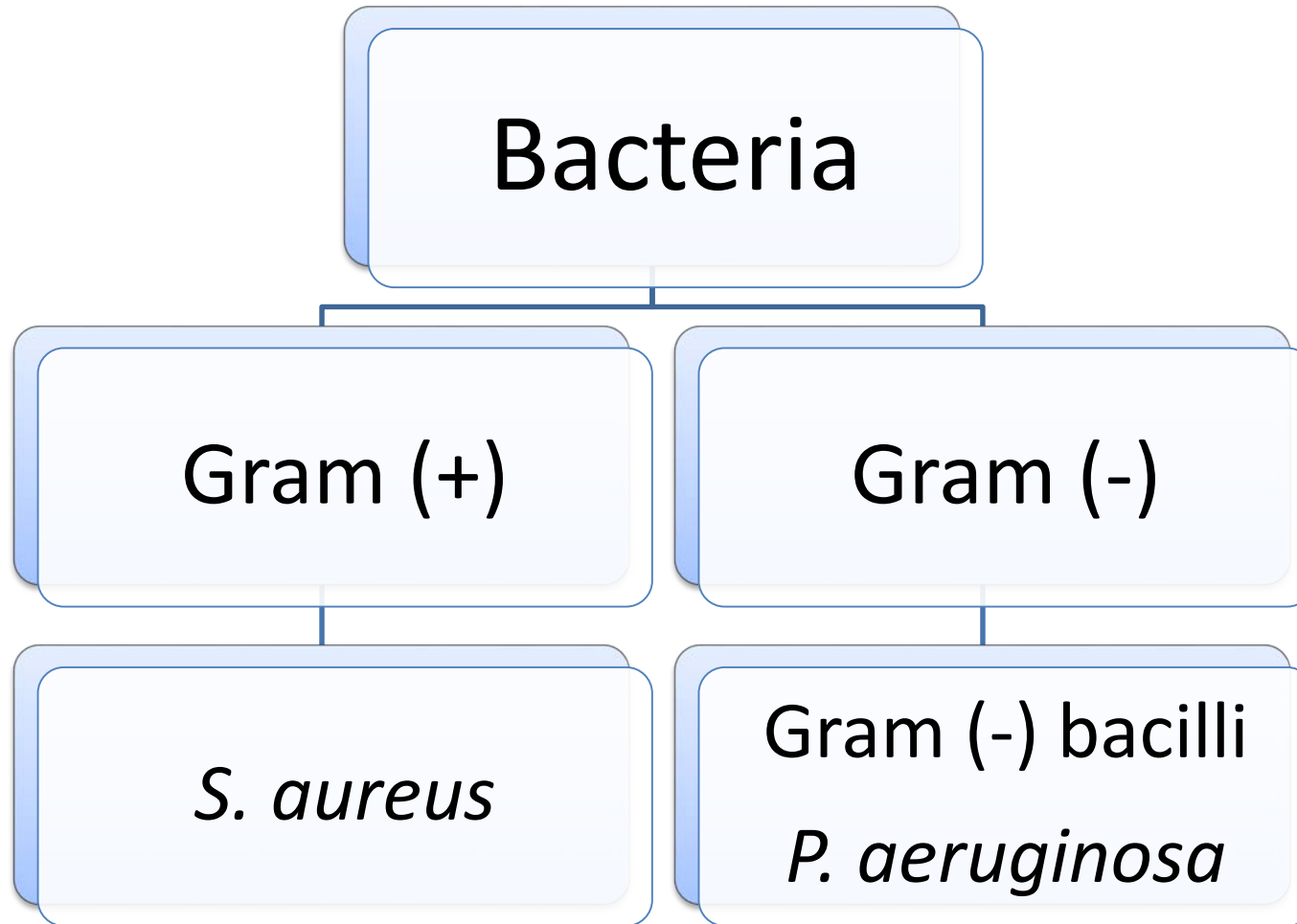
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- Microbiologic cultures
  - Sputum and blood
- Non-invasive sampling preferred:
  - Spontaneous expectoration
  - Sputum induction
  - Nasotracheal suctioning
  - Endotracheal aspiration
  - *Weak recommendation, very low-quality evidence*



# Etiology of HAP

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# Etiology of HAP and Impact of Appropriate Therapy

Organism	Definitive	Possible	Total (%)
<i>S. pneumoniae</i>	14	2	16 (9.7)
<i>L. pneumophila</i>	7		7 (4.2)
<b>Enterobacteria</b>	<b>4</b>	<b>4</b>	<b>8 (4.8)</b>
Aspergillus	3	4	7 (4.2)
<i>P. aeruginosa</i>	<b>2</b>	<b>5</b>	<b>7 (4.2)</b>
Acinetobacter		5	5 (4.2)
<i>S. aureus</i>	<b>1</b>	<b>3</b>	<b>4 (3)</b>
<i>H. influenza</i>		2	2
Other		3	3
<b>Unknown</b>			<b>105 (63.6)</b>
<b>Total (n=165)</b>	<b>31 (18.8)</b>	<b>29 (17.6)</b>	<b>60 (36.4)</b>



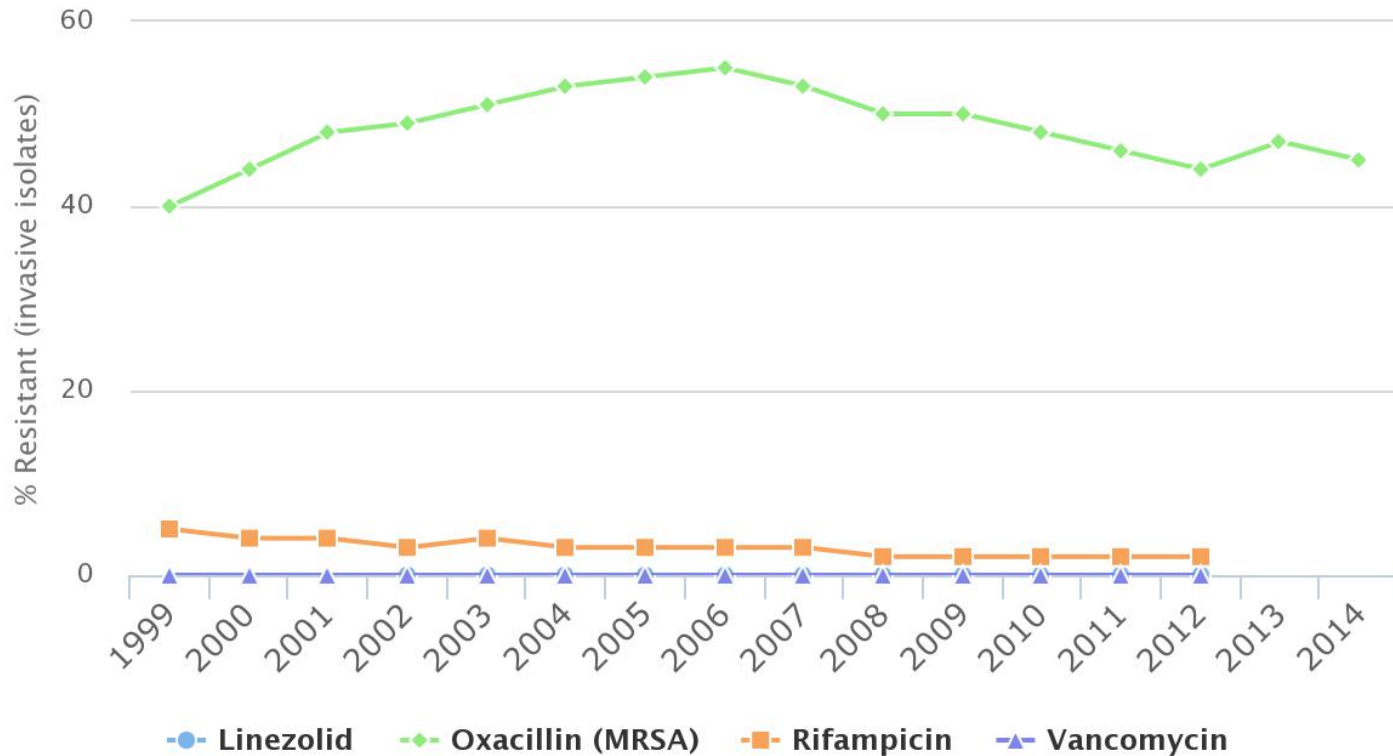
# Etiology of HAP and Impact of Appropriate Therapy

Outcome	Appropriate Antibiotics N=152	Inappropriate Antibiotics N=8	P-value, 95% CI
Crude Mortality	34 (22.4%)	6 (75%)	p=0.003, 2.01-53.95
Attributable Mortality	23 (15.1%)	4 (50%)	p=0.02, 1.31-18.49



# Etiology of HAP

Antibiotic Resistance of *Staphylococcus aureus* in United States



Center for Disease Dynamics, Economics & Policy (cddep.org)

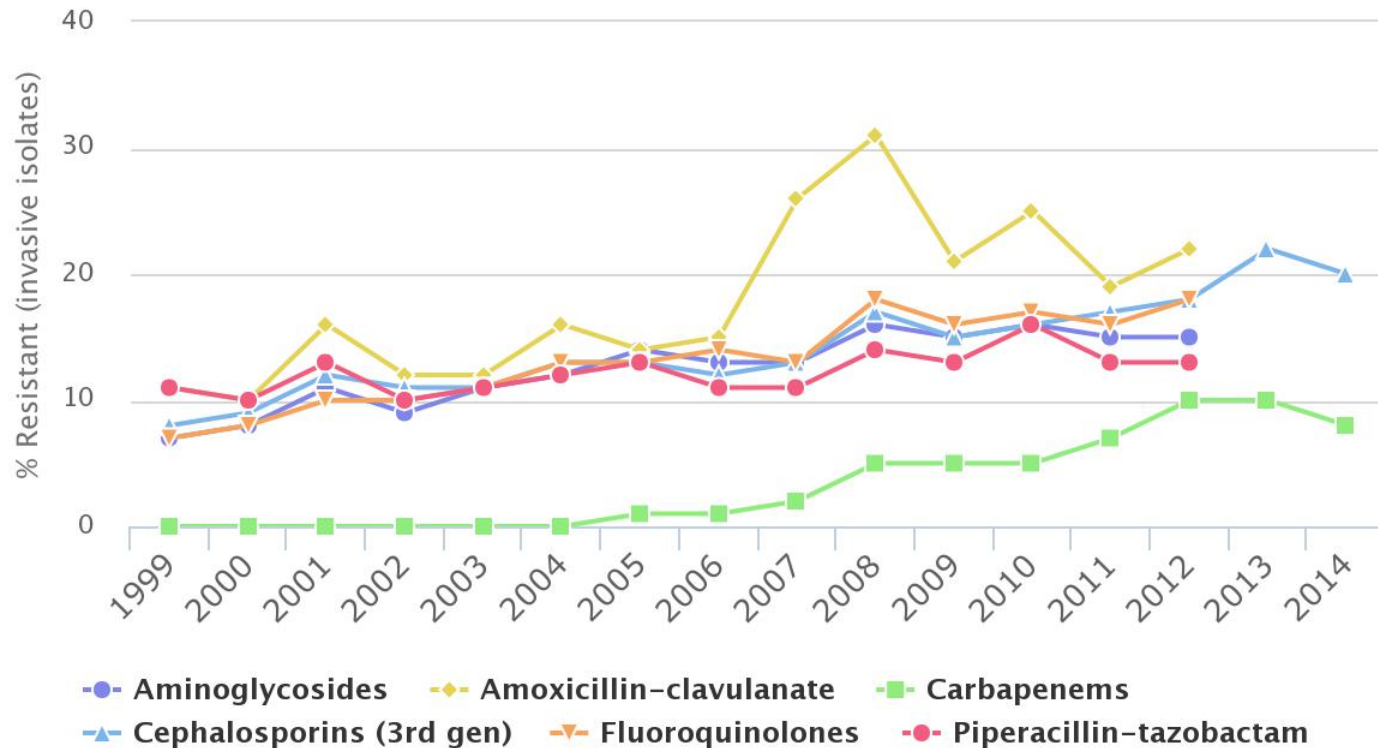


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# Etiology of HAP

Antibiotic Resistance of *Klebsiella pneumoniae* in United States



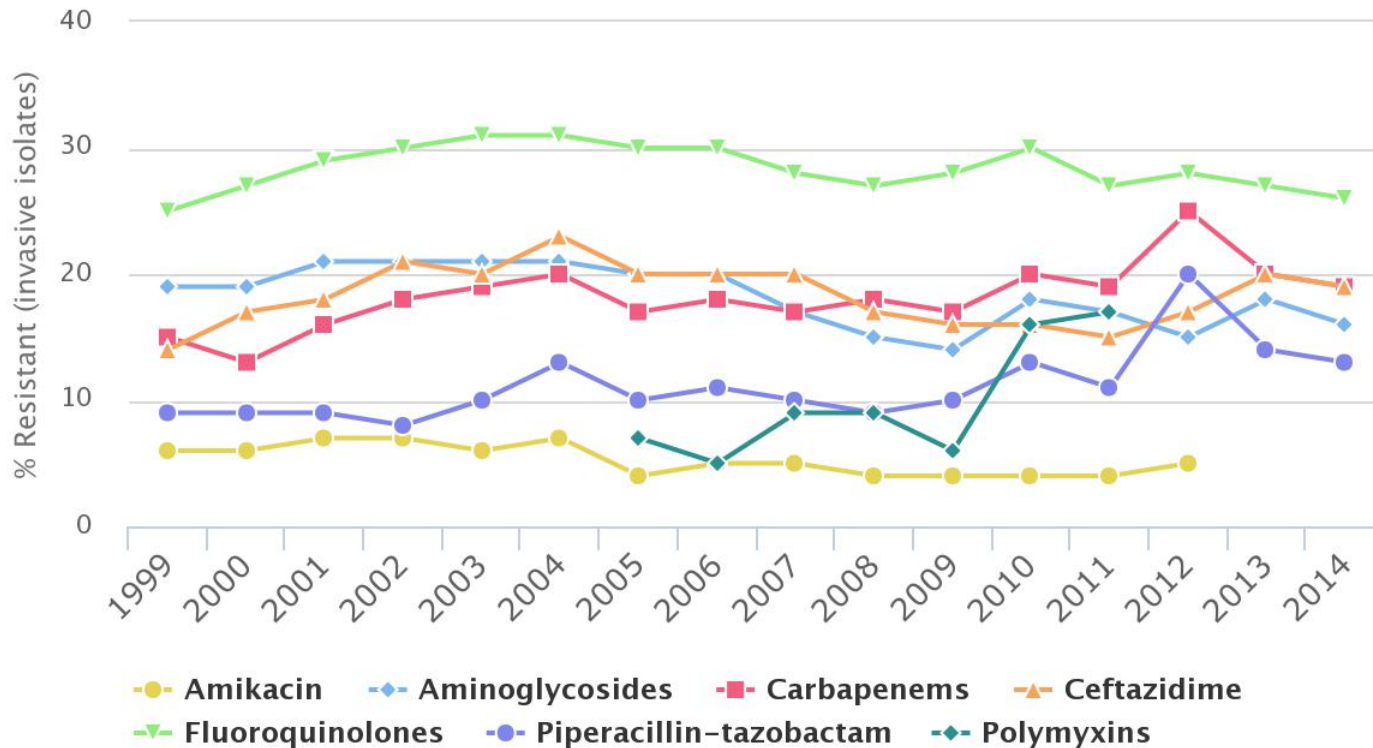
Center for Disease Dynamics, Economics & Policy (cddep.org)



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# Etiology of HAP

Antibiotic Resistance of *Pseudomonas aeruginosa* in United States



Center for Disease Dynamics, Economics & Policy (cddep.org)



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# Risk Factors for MDROs in HAP

## 2005 HAP/VAP Guidelines

- Antimicrobial therapy in preceding 90 days
- Current hospitalization  $\geq$  5 days
- High frequency antibiotic resistance in the community of specific hospital unit
- Presence or RF for HCAP
  - Hospitalization  $\geq$  2 days in last 90 days
  - Residence in NH or LTC
  - Home infusion therapy
  - Chronic dialysis within 30 days
  - Family member with MDRO
- Immunosuppressive disease or therapy

## 2016 HAP Guidelines

### MDR HAP

- Prior use of IV antibiotics within 90 days

### MRSA

- Prior use of IV antibiotics within 90 days

### Pseudomonas

- Prior use of IV antibiotics within 90 days

# Empiric Therapy HAP

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- All regimens should include coverage for:
  - *S. aureus*
    - *Strong recommendation, low-quality evidence*
  - Gram negative bacilli
  - *P. aeruginosa*
    - *Strong recommendation, very low-quality evidence*



# Empiric Gram (+) Coverage HAP

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- Methicillin-susceptible *S. aureus* (MSSA)
  - No RF for antimicrobial resistance
  - Not at high-risk for mortality
    - Septic shock
    - Need for mechanical ventilation
- Drug(s) of choice:
  - Piperacillin-tazobactam
  - Cefepime
  - Levofloxacin
  - Imipenem
  - Meropenem
  - *Weak recommendation, very low-quality evidence*



# Empiric Gram (+) Coverage HAP

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- Methicillin-resistant *S. aureus* (MRSA)
  - RF for antimicrobial resistance
  - Treated in ICU where MRSA rates >20%
  - Units where MRSA rates unknown
  - High risk for mortality
- Drug(s) of choice:
  - Vancomycin
  - Linezolid
- *Weak recommendation, very low-quality evidence*



# MRSA Treatment: Vancomycin or Linezolid?

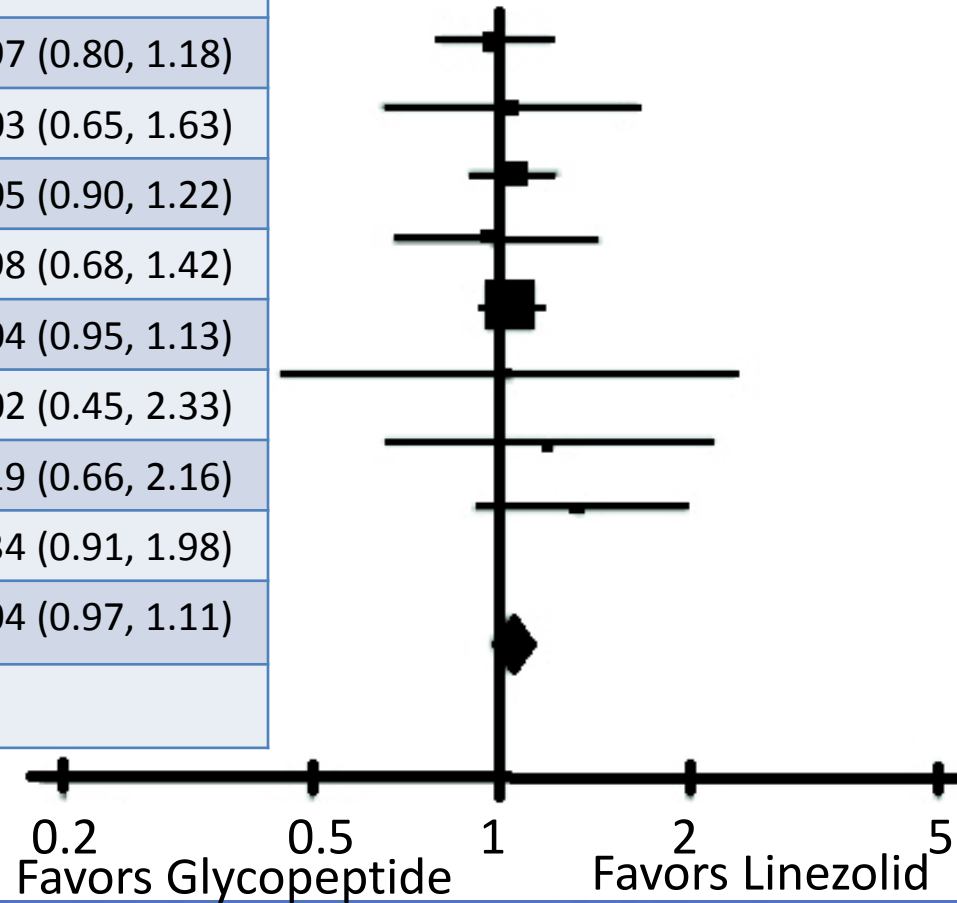
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- 2011 Meta-analysis
- Inclusion:
  - Randomized-controlled trials
  - Compared linezolid to a glycopeptide antibiotic
  - Pneumonia
  - Hospitalized patients
- Primary outcome:
  - Clinical success at test-of-cure (TOC)



# Test-of-Cure Results

Study	Linezolid	Glycopeptide	RR (95% CI)
Rubenstein, 2001	71/107	62/91	0.97 (0.80, 1.18)
Stevens, 2002	20/39	16/32	1.03 (0.65, 1.63)
Wunderink, 2003	114/168	111/171	1.05 (0.90, 1.22)
Cepeda, 2004	23/43	30/55	0.98 (0.68, 1.42)
Wilcox, 2004	51/53	52/56	1.04 (0.95, 1.13)
Kohno, 2007	11/34	6/19	1.02 (0.45, 2.33)
Wunderink, 2008	13/23	9/19	1.19 (0.66, 2.16)
Lin, 2008	19/26	18/33	1.34 (0.91, 1.98)
Total	322/493	304/476	1.04 (0.97, 1.11)
	<b>#success/total</b>		





# Empiric Gram (-) Coverage HAP

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- Coverage of gram (-) bacilli
- Use of 1 anti-pseudomonal agent
  - No RF for antimicrobial resistance
  - Not at high-risk for mortality
- *Weak recommendation, low-quality evidence*



# Empiric Gram (-) Coverage HAP

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- Coverage of gram (-) bacilli
- Use of 2 anti-pseudomonal agents
  - RF for antimicrobial resistance
  - High risk for mortality
- *Weak recommendation, very low-quality evidence*



# Other Recommendations for Empiric Therapy

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- Avoid use of aminoglycosides
  - *Weak recommendation, low-quality evidence*
- Consider use of 2 anti-pseudomonal drugs:
  - Structural lung disease



# Designing an Empiric HAP Regimen

No MRSA RF and NOT High-Risk Mortality	MRSA RF and NOT High-Risk Mortality	MDR RF and/or High-Risk Mortality
Piperacillin-tazobactam <b>OR</b>	Piperacillin-tazobactam <b>OR</b>	Piperacillin-tazobactam <b>OR</b>
Cefepime <b>OR</b>	Cefepime <b>OR</b>	Cefepime <b>OR</b>
Levofloxacin <b>OR</b>	Levofloxacin <b>OR</b>	Levofloxacin <b>OR</b>
Imipenem <b>OR</b> Meropenem	Imipenem <b>OR</b> Meropenem <b>OR</b>	Imipenem <b>OR</b> Meropenem <b>OR</b>
	Aztreonam	Amikacin <b>OR</b> Gentamicin <b>OR</b> Tobramycin <b>OR</b>
	<b>PLUS</b>	Aztreonam
	Vancomycin <b>OR</b>	<b>PLUS</b>
	Linezolid	Vancomycin <b>OR</b>
		Linezolid

# Case #1

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JZ is a 73 year old African American male admitted 4/24/17 with acute ischemic stroke.

- **PMH:** HTN, HLD, DM
- **Current Medications:**
  - Aspirin 81 mg PO daily
  - Atorvastatin 80 mg PO daily
  - Metformin 1000 mg PO daily
  - Amlodipine 10 mg PO daily
  - Lisinopril 20 mg PO daily



# Case #1

Today (4/27) JZ is coughing up purulent sputum, has decreasing O<sub>2</sub>Sat and altered mental status. The primary team decides to intubate JZ.

- **Vital Signs:**

HR 101; RR 22; BP 104/69mmHg; Temp 100.6°F; O<sub>2</sub>Sat 89% on 2L

- **Anthropometrics:**

75 kg; 170 cm

- **Labs:**

134 | 100 | 24 / 113  
3.7 | 22 | 1.1

14.7 \ 10.4 / 213  
/ 31.6 \

- **Chest X-Ray:**

Endotracheal tube present, terminating 3 cm above the carina.  
Left lower lobe infiltrate suggestive of pneumonia vs atelectasis.



# What type of pneumonia does JZ have?

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- A. Ventilator-associated pneumonia
- B. Healthcare-associated pneumonia
- C. Aspiration pneumonia
- D. Hospital-acquired pneumonia



**The medical team asks for your recommendation on empiric antibiotic therapy for JZ. MRSA resistance rates are unknown in this institution. Which of the following is an appropriate empiric regimen for JZ?**

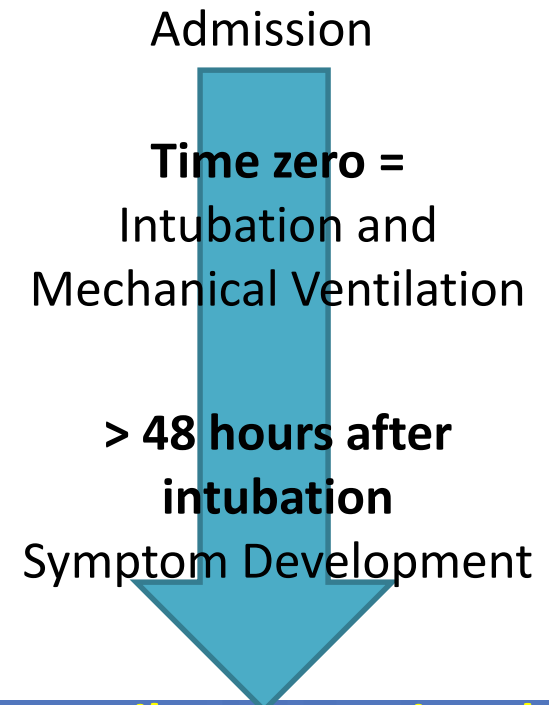
- A. Vancomycin and piperacillin-tazobactam
- B. Meropenem and levofloxacin
- C. Vancomycin, cefepime and levofloxacin
- D. Linezolid and amikacin





# Definition of VAP

- Unchanged from 2005 guidelines
- Development of symptoms > 48 hours after *endotracheal intubation*
  - Radiographic infiltrate
  - Clinical criteria:
    - Fever
    - Leukocytosis
    - Purulent sputum
    - Decline in oxygenation



**Ventilator-associated  
Pneumonia**



# Diagnosis of VAP

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- Microbiologic cultures recommended
  - Sputum
  - Blood
- Sampling via the non-invasive route preferred
  - Invasive route
    - Bronchoscopy
    - Blind bronchial sampling
  - Non-invasive route
    - Endotracheal aspiration (ETA)
- *Weak recommendation, low quality evidence*



# Microbiologic Diagnosis of VAP

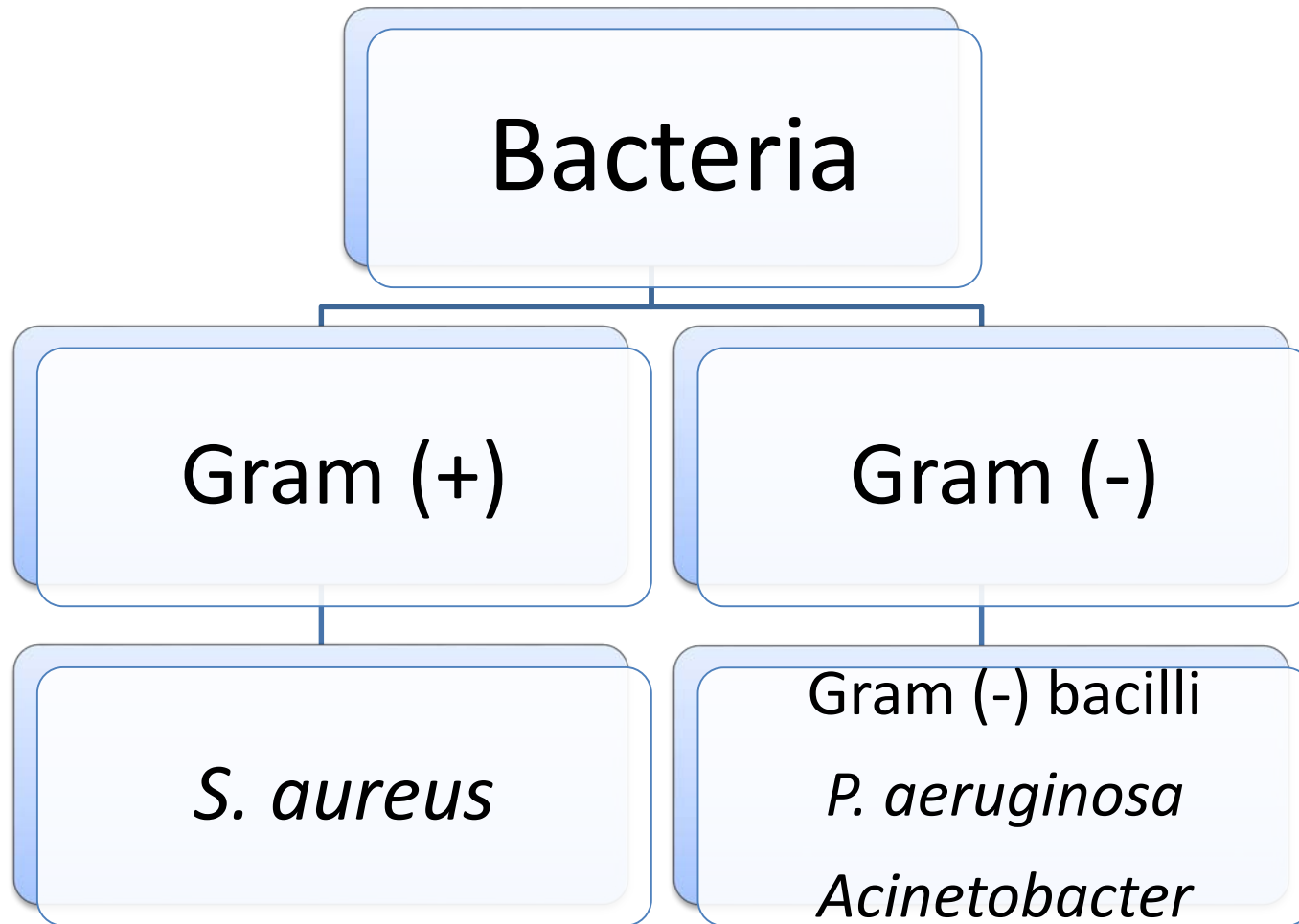
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- Semi-quantitative results preferred
  - Quantitative
  - Semi-quantitative
- *Weak recommendation, low quality evidence*



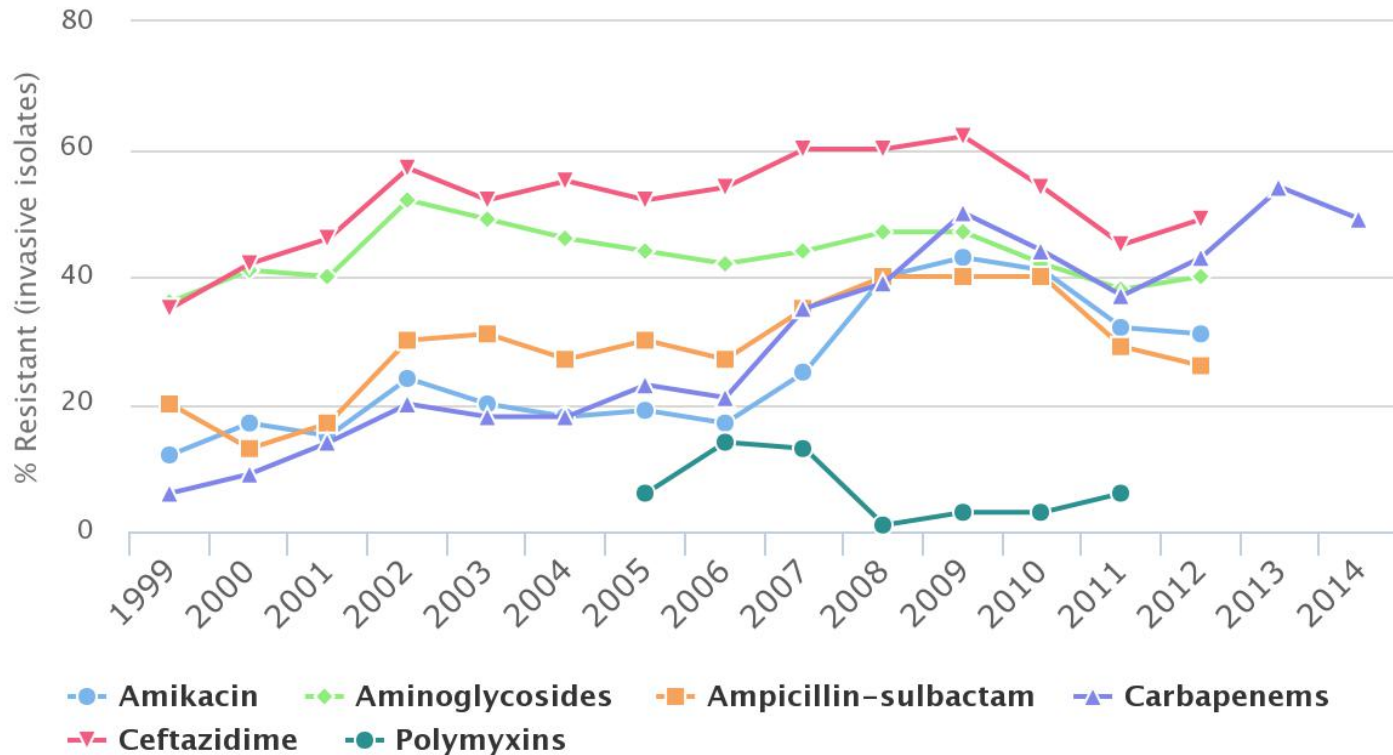
# Etiology of VAP

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# Etiology of VAP

Antibiotic Resistance of *Acinetobacter baumannii* in United States



Center for Disease Dynamics, Economics & Policy (cddep.org)



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# Risk Factors for MDROs in VAP

## 2005 HAP/VAP Guidelines

- Antimicrobial therapy in preceding 90 days
- Current hospitalization  $\geq$  5 days
- High frequency antibiotic resistance in the community of specific hospital unit
- Presence or RF for HCAP
  - Hospitalization  $\geq$  2 days in last 90 days
  - Residence in NH or LTC
  - Home infusion therapy
  - Chronic dialysis within 30 days
  - Family member with MDRO
- Immunosuppressive disease or therapy

## 2016 VAP Guidelines

### MDR VAP

- Prior use of IV antibiotics within 90 days
- Septic shock at time of VAP
- ARDS preceding VAP
- $\geq$  5 days of hospitalization prior to VAP
- Acute RRT prior to VAP

### MRSA

- Prior use of IV antibiotics within 90 days

### Pseudomonas

- Prior use of IV antibiotics within 90 days

# Empiric Therapy VAP

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- All regimens should include coverage for:
  - *S. aureus*
  - *P. aeruginosa*
  - Gram negative bacilli
- *Strong recommendation, low-quality evidence*



# Empiric Gram (+) Coverage VAP

---

- Methicillin-susceptible *S. aureus* (MSSA)
  - No RF for antimicrobial resistance
  - Treated in ICU where MRSA rates <10 – 20%
- Drug(s) of choice:
  - Piperacillin-tazobactam
  - Cefepime
  - Levofloxacin
  - Imipenem
  - Meropenem
- *Weak recommendation, very low-quality evidence*





# Empiric Gram (+) Coverage VAP

---

- Methicillin-resistant *S. aureus* (MRSA)
  - RF for antimicrobial resistance
  - Treated in ICU where MRSA rates >10 – 20%
  - Units where MRSA rates unknown
- Drug(s) of choice:
  - Vancomycin
  - Linezolid
- *Weak recommendation, very low-quality evidence*



# Empiric Gram (-) Coverage VAP

---

- Coverage of gram (-) bacilli
- Use of 1 anti-pseudomonal agent
  - No RF for antimicrobial resistance
  - <10% of gram (-) isolates are resistant to an agent being considered for monotherapy
- *Weak recommendation, low-quality evidence*



# Empiric Gram (-) Coverage VAP

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- Coverage of gram (-) bacilli
- Use of 2 anti-pseudomonal agents from 2 different classes
  - RF for antimicrobial resistance
  - >10% of gram (-) isolates are resistant to an agent being considered for monotherapy
  - ICU where local antimicrobial susceptibility rates are unknown
- *Weak recommendation, low-quality evidence*



# Summary of Meta-Analyses Comparing Different Classes of Gram-Negative Agents for Empiric Treatment of VAP

Comparison	Mortality RR (95% CI)	Clinical Response RR (95% CI)	Acquired Resistance RR (95% CI)	Adverse Events RR (95% CI)
Combination vs monotherapy	1.11 (0.9, 1.38)	0.89 (0.75, 1.07)	1.13 (0.42, 3.00)	0.90 (0.69, 1.18)
Cephalosporin vs non-cephalosporin	0.97 (0.74, 1.27)	0.92 (0.78, 1.09)	2.36 (0.63, 8.86)	1.01 (0.82, 1.25)
Quinolone vs non-quinolone	1.13 (0.92, 1.39)	1.05 (0.91, 1.20)	0.77 (0.59, 1.01)	0.88 (0.78, 0.99)
Anti-Pseudomonal PCN vs non-anti-Pseudomonal PCN	1.12 (0.76, 1.66)	1.10 (0.80, 1.52)	Not Reported	0.96 (0.77, 1.20)
Aminoglycoside vs non-aminoglycoside	1.15 (0.88, 1.50)	0.82 (0.71, 0.95)	Not Reported	0.96 (0.70, 1.33)
Carbapenem vs non-carbapenem	0.78 (0.65, 0.94)	1.02 (0.93, 1.12)	1.16 (0.53, 2.55)	1.08 (0.90, 1.28)

# Designing an Empiric VAP Regimen

Gram (+) Antibiotics with MRSA Activity	MSSA, Gram (-) and Antipseudomonal Antibiotics	Gram (-) Antibiotics with Antipseudomonal activity: Non-β-Lactam
Vancomycin <b>OR</b>	Piperacillin-tazobactam <b>OR</b>	Ciprofloxacin Levofloxacin <b>OR</b>
Linezolid	Cefepime Ceftazidime <b>OR</b>	Amikacin Gentamicin Tobramycin <b>OR</b>
	Imipenem Meropenem <b>OR</b>	Colistin Polymyxin B
	Aztreonam	

# Emerging Therapies

Generic Name	Ceftolozane/Tazobactam	Ceftazidime/Avibactam
Brand Name	Zerbaxa	Avycaz
FDA Indications	cIAI (with metronidazole) cUTI (incl. pyelonephritis)	cIAI (with metronidazole) cUTI (incl. pyelonephritis)
<b><i>In vivo</i> Gram-negative Activity</b>	<i>Enterobacter cloacae</i> <i>Escherichia coli</i> <i>Klebsiella oxytoca</i> <i>Klebsiella pneumonia</i> <i>Proteus mirabilis</i> <i>Pseudomonas aeruginosa</i>	<i>Citrobacter freundii</i> <i>Citrobacter koseri</i> <i>Enterobacter cloacae</i> <i>Escherichia coli</i> <i>Klebsiella oxytoca</i> <i>Klebsiella pneumonia</i> <i>Proteus mirabilis</i> <i>Pseudomonas aeruginosa</i>
<b><i>In vivo</i> Gram-positive Activity</b>	<i>Streptococcus anginosus</i> <i>Streptococcus constellatus</i> <i>Streptococcus salivarius</i>	N/A
<b><i>In vivo</i> Anaerobic Activity</b>	<i>Bacteroides fragilis</i>	N/A
<b>ESBL Activity</b>	Class A, C, D	Class A, C, D Carbapenemases (KPC)

Avycaz [package insert]. Irvine, CA. Allergan USA, Inc. 2016.

Zerbaxa [package insert]. Whitehouse Station, NJ. Merck & Co., Inc. 2015.

# Clinical Trials

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- **Ceftolozane/Tazobactam**

- Phase III Trial (ASPECT-NP) currently enrolling patients
- Comparing ceftolozane/tazobactam to meropenem for VAP and HAP requiring ventilation

- **Ceftazidime/Avibactam**

- Phase III Trial completed January 2016
- Comparing ceftazidime/avibactam to meropenem in patients with nosocomial pneumonia



# Case #2

EK is a 26 year old Caucasian male admitted to the trauma ICU on 4/23/17 with multiple fractures and bilateral pneumothoraces requiring chest tube placement s/p ATV accident. EK is currently mechanically ventilated.

- **PMH:** None

- **Current medications:**

Enoxaparin 30 mg subcutaneously Q 12 hours

Fentanyl Infusion IV 250 mcg/hr

Propofol Infusion IV 22 mcg/kg/min

Famotidine 20 mg via OGT Q 12 hours





# Case #2

Today (4/27) EK has new onset of fever and a change in his chest x-ray.

- **Vital Signs:**

HR 97; RR 18; BP 120/71mmHg; Temp 101.7°F; O<sub>2</sub>Sat 94% on 40% FiO<sub>2</sub>

- **Anthropometrics:**

87 kg; 182 cm

- **Labs:**

140 | 99 | 17 / 97

3.7 | 21 | 0.8

16.9 \ 12.4 / 178

/ 35.9 \

- **Chest X-Ray:**

Endotracheal tube present, terminating 2 cm above the carina.

New right lower lobe opacity compared to previous studies.

Representing pneumonia vs atelectasis, correlate clinically.



**Based on the EK's patient specific factors and the hospital's antibiogram below. Which of the following is an appropriate empiric regimen for EK?**

Organism	Oxacillin	Vancomycin	Piperacillin-tazobactam	Meropenem	Cefepime	Levofloxacin
<i>S. aureus</i>	91	99	87	89	93	86
<i>E. coli</i>	--	--	85	90	93	79
<i>P. aeruginosa</i>	--	--	78	84	86	81
<i>P. mirabilis</i>	--	--	96	91	84	83

- A. Piperacillin-tazobactam plus levofloxacin
- B. Linezolid plus cefepime
- C. Meropenem
- D. Vancomycin plus meropenem plus levofloxacin

# De-escalation of Antibiotics

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- De-escalation therapy
  - Changing empiric broad-spectrum therapy to narrower spectrum regimen
- Fixed therapy
  - Maintaining broad-spectrum therapy for the duration of treatment
- *Suggest* antibiotic therapy be de-escalated rather than fixed
  - *Weak recommendation, very low-quality evidence*



# Optimal Antibiotic Duration

- VAP, a 7-day course of therapy recommended
  - No difference:
    - Mortality
    - Recurrent pneumonia
    - Treatment failure
    - Hospital LOS
    - Duration of mechanical ventilation
  - Includes non-glucose fermenting gram (-) bacilli
  - *Strong recommendation; moderate quality evidence*



# 8-Day vs 15-Day Course of Therapy

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- 2003 Chastre, et al.
  - Prospective, randomized, double-blind, controlled study
- Inclusion criteria:
  - Mechanical ventilation for  $\geq 48$  hours
  - $\geq 18$  years old
  - Clinical suspicion of VAP
  - Positive quantitative cultures from bronchoscopy
  - Initiation of appropriate antibiotics within 24 hours of bronchoscopy



# 8-Day vs 15-Day Course of Therapy

- Primary outcomes:

Event	8-Day Regimen (n=197)	15-Day Regimen (n=204)	Between-Group Risk Difference (90% CI)
Death from all causes	37/197 (18.8)	35/204 (17.2)	1.6 (-3.7 to 6.9)
Pulmonary infection recurrence	57/197 (28.9)	53/204 (26)	2.9 (-3.2 to 9.1)
<ul style="list-style-type: none"> <li>• NF GNB</li> </ul>	26/64 (40.6)	16/63 (25.4)	15.2 (3.9 to 26.6)
	Mean (SD)		Mean Difference (95% CI)
No. Antibiotic-free days	13.1 (7.4)	8.7 (5.2)	4.4 (3.1 to 5.6)



# Short vs Long Course Therapy

- 2015 Cochrane Systematic Review

Outcomes	Assumed Risk Long-Course	Corresponding Risk Short-Course (95% CI)	Relative Effect (95% CI)	No. of Participants (Studies)
<b>Mortality</b> F/u: 28 days	175 per 1000	201 per 1000 (141 to 277)	<b>OR 1.18</b> (0.77 to 1.8)	598 (3 studies)
<b>Mortality</b> <b>NF-GNB</b> F/u: 28 days	265 per 1000	255 per 1000 (123 to 450)	<b>OR 0.95</b> (0.39 to 2.27)	179 (2 studies)



# Short vs Long Course Therapy

- 2015 Cochrane Systematic Review

Outcomes	Assumed Risk Long-Course	Corresponding Risk Short-Course (95% CI)	Relative Effect (95% CI)	No. of Participants (Studies)
Recurrence of PNA	180 per 1000	237 per 1000 (171 to 318)	<b>OR 1.41</b> (0.94 to 2.12)	733 (19 studies)
Recurrence of PNA NF-GNB	247 per 1000	417 per 1000 (272 to 577)	<b>OR 2.18</b> (1.14 to 4.16)	176 (2 studies)
28-Day Antibiotic-free Days	The mean 28-day antibiotic free days in the intervention group was <b>4.02 higher</b> (2.26 to 5.78 higher)			431 (2 studies)





# Optimal Antibiotic Duration

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- HAP, a 7-day course of therapy recommended
  - No specific studies available for HAP
  - Data extrapolated from VAP
    - Increased 28-day antibiotic free days
    - Reduced recurrent VAP due to MDR pathogens
  - *Strong recommendation; very-low quality evidence*



# Summary

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- Definitions of HAP and VAP are unchanged from 2005 guidelines
- Diagnosis of HAP and VAP should be based on clinical criteria and non-invasive semi-quantitative cultures
- Risk factors for MDROs differ between HAP and VAP patients
- Empiric therapy should be based on patient risk factors and local antimicrobial resistance patterns
- Short-course therapy with de-escalation recommended



# THANK YOU

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**QUESTIONS?**



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