

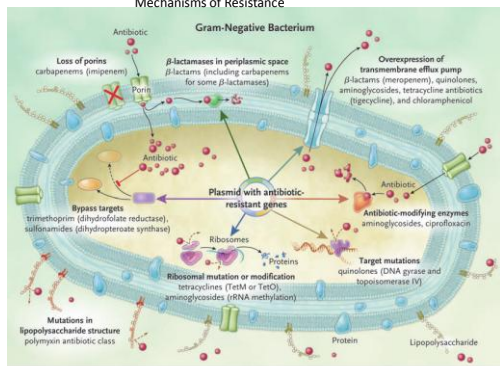
Gram Negative MDROs in Long Term Care

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Hospital-acquired Infections

- Gram-negative bacteria are the cause of > 30% of hospital-acquired infections (NHSN)
- Pneumonia
 - Association with mechanical ventilation
- Bloodstream
 - Presence of central venous catheter or other gram-negative focus in the body
- Urinary tract
 - Association with urinary catheters
- **Resistant gram-negative infections associated with long term care exposure**

Mechanisms of Resistance



Peleg AY NEJM 2010;362:1804-13

Two Rapidly Changing Situations

- *Acinetobacter baumannii*

- *Enterobacteriaceae*

Acinetobacter species

- Associated with adverse outcomes
 - Increased morbidity and mortality
- Prolonged hospital stays
- Increased health care cost
- *Acinetobacter* infections associated with water reservoirs

Acinetobacter baumannii (*A. baumannii*)

- Non-fermenter
- Carbapenem resistance has



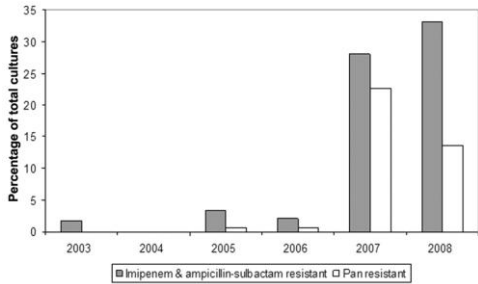
Can cause infection anywhere:

- Respiratory tract
- Blood
- Soft tissues
- Urinary tract
- Central nervous system

Changing Epidemiology of *A. baumannii*

- 1987-1996, a mean of 345 nosocomial *Acinetobacter* infections per year were reported to CDC
- 2006-2007, NHSN reported *A. baumannii* as the 5th most common gram-negative nosocomial pathogen, causing 8.4% of all ventilator-associated pneumonia.
 - Of isolates causing infection, 29% were resistant to carbapenems.....

Evolving resistance profile of *Acinetobacter baumannii* among patients aged >60 years in 4 community hospitals.



Sengstock D M et al. Clin Infect Dis. 2010;50:1611-1616

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Clinical Infectious Diseases

A. Baumannii Antibiotic Resistance and Discharge Disposition

- Increasing degrees of antibiotic resistant strains were associated with discharge to extended care facilities or death
- Increasingly resistant strains of *Acinetobacter* among patients discharge to nursing homes
- 2003-2006, no patients admitted to nursing homes had panresistant *Acinetobacter* strains; in 2007-2008, 10 (13%) patients identified

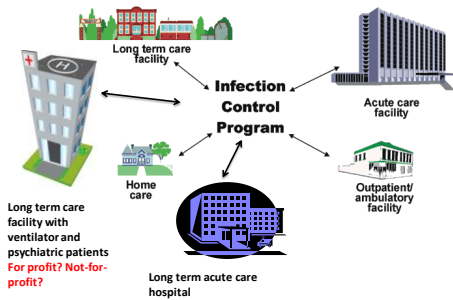
Sengstock D M et al. Clin Infect Dis. 2010;50:1611-1616

Healthcare Surveillance Needed "Now"



Jarvis WR Emerg Infect Dis 2001;7: 170-3

Healthcare Surveillance Needed Now-Addendum



Bad *Enterobacteriaceae*

• "It is much harder to be positive about the situation with *Enterobacteriaceae*....."

• David Livermore, J Antimicrob Chemoth (2009) 64, Suppl. 1, i29-136

Carbapenem-hydrolyzing β -lactamases

- Metallo- β -lactamases:
 - New Delhi metallo-beta-lactamase (NDM-1)
 - Vernona integron-encoded metallo-beta-lactamase (VIM) carbapenemase
- Class A carbapenemase:
 - *K. pneumoniae* carbapenemases (KPCs)

History of KPCs

- First reported in 2001 in North Carolina
- Until 2005 limited to the eastern part of the US
- Now identified as a nosocomial pathogen in many parts of the US
- KPCs identified in *Enterobacteriaceae*, but also *Pseudomonas* spp.

Carbapenemases are Everywhere

- KPCs have been identified in several countries
- The US has imported KPCs to France, Israel
- Also has been reported in South America, People's Republic of China, Greece....
- Locations are increasing.....

KPCs Worldwide

- The genetic element carrying the *bla*_{KPC-2} gene, Tn4401
- This transposon has been identified on different plasmids from different isolates
- Contributes to spread?

Cuzon G, et al. EID 2009 16:1349-1356

More Bad News

- These genetic elements are mobile
- Can coexist with other resistance genes
 - ESBL gene
 - Aminoglycoside-resistance determinants
 - Plasmid-mediated quinolone-resistance genes
- *K. pneumoniae* strains containing KPCs have also been identified as being resistant to the polymyxins.....

Morbidity and Mortality Weekly Report

Update: Detection of a Verona Integron-Encoded Metallo-Beta-Lactamase in *Klebsiella pneumoniae* — United States, 2010

In July 2010, CDC was notified of a patient with a carbapenem-resistant *Klebsiella pneumoniae* strain that produced a Verona integron-encoded metallo-beta-lactamase (VIM) carbapenemase (1) not reported previously among Enterobacteriaceae in the United States. The patient was a woman from the United States who became ill with diarrhea during a Mediterranean cruise and was hospitalized in Greece, where she received a diagnosis of sepsis and *Clostridium difficile* infection. After 12 days in two hospitals in Greece, she was transferred to a hospital in the United States for continued management of sepsis and acute renal failure. On admission, blood was drawn for culture through a central venous catheter that had been placed while the patient was hospitalized in Greece. The blood subsequently grew carbapenemase-producing *Klebsiella pneumoniae* exhibiting the VIM resistance mechanism, which has been described previously in Greece but not in the United States. Further testing showed the isolate to be nonsusceptible to all antimicrobials usually used to treat *Klebsiella*. Despite the resistance of the *Klebsiella* strain, the patient recovered sufficiently to be discharged after 26 days in the U.S. hospital.

Morbidity and Mortality Weekly Report

Detection of *Enterobacteriaceae* Isolates Carrying Metallo-Beta-Lactamase— United States, 2010
 Weekly
 June 25, 2010 / 59(24);750

During January–June 2010, three *Enterobacteriaceae* isolates carrying a newly described resistance mechanism, the New Delhi metallo-beta-lactamase (NDM-1) (1), were identified from three U.S. states at the CDC antimicrobial susceptibility laboratory. This is the first report of NDM-1 in the United States, and the first report of metallo-beta-lactamase carriage among *Enterobacteriaceae* in the United States. These isolates, which include an *Escherichia coli*, *Klebsiella pneumoniae*, and *Enterobacter cloacae*, carry *bla_{NDM-1}*, which confers resistance to all beta-lactam agents except aztreonam (a monobactam antimicrobial) (1); all three isolates were aztreonam resistant, presumably by a different mechanism. In the United Kingdom, where these organisms are increasingly common, carriage of *Enterobacteriaceae* containing *bla_{NDM-1}* has been closely linked to receipt of medical care in India and Pakistan (2). All three U.S. isolates were from patients who received recent medical care in India.

KPCs in our Neighborhood

- First identified in Illinois in 2007
- Increasingly identified in healthcare institutions
- Outbreaks of KPC reported among ventilated, chronically ill patients
- Long term care is a reservoir

An Outbreak in Greece

- KPC-2 producing *K. pneumoniae* outbreak at a tertiary care hospital in Greece
- Carbapenem resistance <1% in 2001 to 30% in wards and 60% in ICUs in 2008.
- VIM-1 producing *K. pneumoniae* was already endemic

Souli M et al. CID 2010;50:364-73

Containment of KPCs in Israel

- In 2006 outbreak of KPCs in Israeli hospitals (thought to be imported from the US)
- Clonal expansion of KPC-3
- National public health program to perform a centrally coordinated intervention

Schwaber MJ et al. CID 2011;52: 1-8

Plan of Action

- All acute care facilities in the country
- Daily monitoring of carriers vs. non-carriers
- 3 component intervention:
 - Mandatory reporting to public health
 - Mandatory isolation of every hospitalized carrier
 - Strict adherence to contact isolation
 - Placement of patients in self-contained nursing units (single rooms or cohorts) that contained all materials needed for their care and staffed by dedicated nurses on all shifts

Schwaber MJ et al. CID 2011;52: 1-8

The Intervention Plan Continued

- Known carriers were re-isolated on subsequent hospitalizations
- Creation of the Task Force on Antimicrobial Resistance and Infection Control
 - Professionals in infection control, clinical microbiology, and public health
 - Reported to the ministry of health
 - Authority to collect data from hospitals
 - Authority to intervene when necessary to contain an outbreak

Schwaber MJ et al. CID 2011;52: 1-8

Conclusions

- Infection now more important than ever
- Interfacility communication more important than ever
- Surveillance more important than ever

Discussion

- Questions:
 - Task force?
 - Reporting?
 - Coordination?
 - Resources??????????????/
