Multidrug resistant *Acinetobacter baumannii* inside and outside hospital setting

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Multi-Drug Resistant (MDR) *A. baumannii* are among the most “problematic pathogens” encountered by clinicians.

Infectious Diseases Society of America: *A. baumannii* is one of the “Red Alert” pathogens.

**Urgent Threats**
- *Clostridium difficile*
- Carbapenem-resistant Enterobacteriaceae (CRE)
- Drug-resistant *Neisseria gonorrhoeae*

**Serious Threats**
- Multidrug-resistant *Acinetobacter*
- Drug-resistant *Campylobacter*
- Fluconazole-resistant *Candida* (a fungus)
- Extended spectrum β-lactamase producing Enterobacteriaceae (ESBLs)
- Vancomycin-resistant *Enterococcus* (VRE)
- Multidrug-resistant *Pseudomonas aeruginosa*
- Drug-resistant Non-typhoidal *Salmonella*
- Drug-resistant *Salmonella Typhi*
- Drug-resistant *Shigella*
- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- Drug-resistant *Streptococcus pneumoniae*
- Drug-resistant tuberculosis

**Concerning Threats**
- Vancomycin-resistant *Staphylococcus aureus* (VRSA)
- Erythromycin-resistant Group A *Streptococcus*
- Clindamycin-resistant Group B *Streptococcus*
Countries that have reported an outbreak of carbapenem-resistant *Acinetobacter baumannii*. Red signifies outbreaks reported before 2006, and yellow signifies outbreaks reported since 2006.

Peleg et al, Clin Microbiol Rev. 2008

*Acinetobacter baumannii*: Emergence of a Successful Pathogen
Carbapenem resistance of *A. baumannii* in Croatia for the period 2005 - 2008.
Mechanism of resistance – hyperproduction of OXA-107 due to the ISAbal location upstream of the gene

Evans et al., CMI 2008;14:268-75
Carbapenem resistance of *A. baumannii* in Croatia 2009-2014

Croatian Committee for Antibiotic Resistance Surveillance
Occurrence of carbapenem-resistant *Acinetobacter baumannii* (CRAb) 2013-14
“Mostar clone” = European clone 2 (GC 2) with OXA-72 carbapenemase
Figure 3.20. *Acinetobacter* spp. Percentage (%) of invasive isolates with combined resistance to fluoroquinolones, aminoglycosides and carbapenems, by country, EU/EEA countries, 2014

- **< 1%**
- **1% to < 5%**
- **5% to < 10%**
- **10% to < 25%**
- **25% to < 50%**
- **≥ 50%**
- **No data reported or less than 10 isolates**
- **Not included**
Where does *A. baumannii* come from?
Acinetobacter: an old friend but a new enemy

A. baumannii (and its close relatives of clinical importance) are not ubiquitous organisms. While it is certainly true that A. baumannii can be isolated from patients and hospital environmental sources during outbreaks, this species has no known natural habitat outside the hospital. This species can be isolated only very rarely from soil, water and other environmental samples; indeed, during non-outbreak periods it is often isolated only rarely inside hospitals.

Towner KJ, J Hosp Infect 2009
Environmental *Acinetobacter baumannii* Strain Similar to a Clinical Isolate in Paleosol

- an accidental discovery in 2013
Multicenter investigation in Croatia

- more than 100 clinical isolates of *A. baumannii* (2009)

- focused on ability to form biofilm in correlation to genotypes (clones), origin of tested isolates and resistance to antibiotics

Kaliterna V, PhD thesis 2014
Croatian Committee for Antibiotic Resistance Surveillance
Dendrogram based on Apal-digested DNA from different isolates of \textit{A.baumannii}

Carbapenem-resistant isolates of *Acinetobacter baumannii* in a municipal wastewater treatment plant, Croatia, 2014

Survival of six *Acinetobacter baumannii* isolates (EF1–6) recovered from effluent wastewater in the autoclaved effluent wastewater during 50 days, Croatia, 2014

Point out

• all wastewater *A. baumannii* isolates recovered in this study were MDR and showed comparable levels of antibiotic resistance to clinical *A. baumannii* isolates in Croatia

• the findings of MDR *A. baumannii* after the process of chlorination suggest that conventional disinfection of effluent may not be the best strategy for mitigating the propagation of *A. baumannii* in environment

• currently the standards for discharge of treated municipal wastewater do not prescribe the elimination of MDR bacteria including (untreated) hospital wastewaters
Phylogenetic tree on the basis of \textit{rpoB} gene confirming molecular identification of \textit{A. baumannii}

Strategies to Prevent Transmission

- Hand hygiene
- Isolation precautions
- Active surveillance for MDROs
- Decolonization of patients
- Environmental hygiene including hospital wastewater
The role of ISABA1 in expression of OXA carbapenemase genes in Acinetobacter baumannii

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Occurrence of OXA-107 and ISABA1 in Carbapenem-Resistant Isolates of Acinetobacter baumannii from Croatia

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Genetic environment surrounding *bla*NDM in *Acinetobacter baumannii*

**IS*Aba125** upstream of NDM-1

**IS*Aba125** is an IS specific from *Acinetobacters*pp.

The first and unique **IS*Aba125-NDM** in Enterobacteriaceae!!

**IS*Aba125-NDM** was mobilized from *Acinetobacter* to Enterobacteriaceae

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Thank you

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Natural habitat of clinically important

\textit{Acinetobacter baumannii} (NATURACI)

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