Multidrug resistant *Acinetobacter baumannii* inside and outside hospital setting

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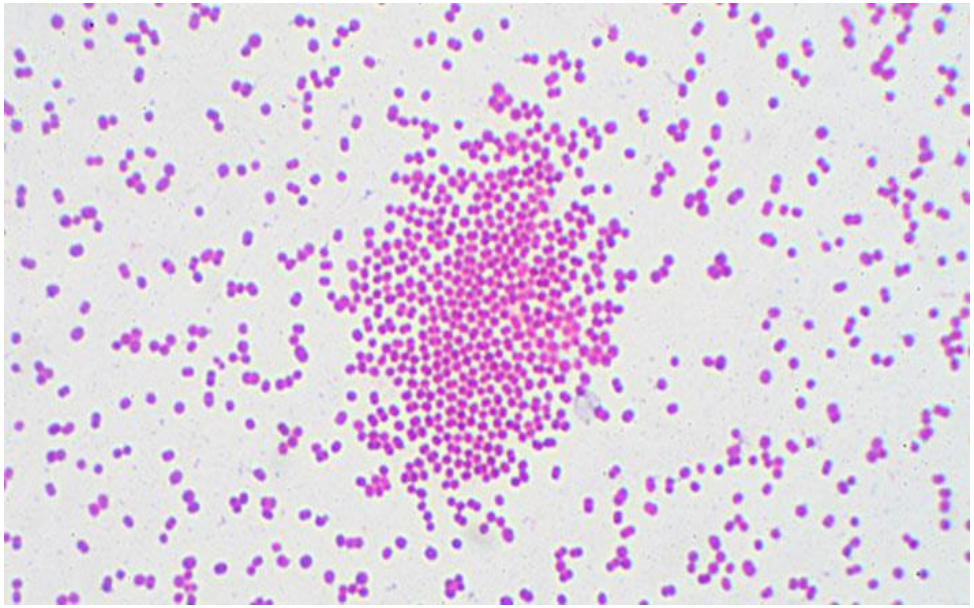
Multi-Drug Resistant (MDR) *A. baumannii* are among the most "problematic pathogens" encountered by clinicians

Infectious Diseases Society of America:
A. baumannii is one of the "Red Alert" pathogens



CDC's Report: Antibiotic Resistance Threats in the United States, 2015

Urgent Threats

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

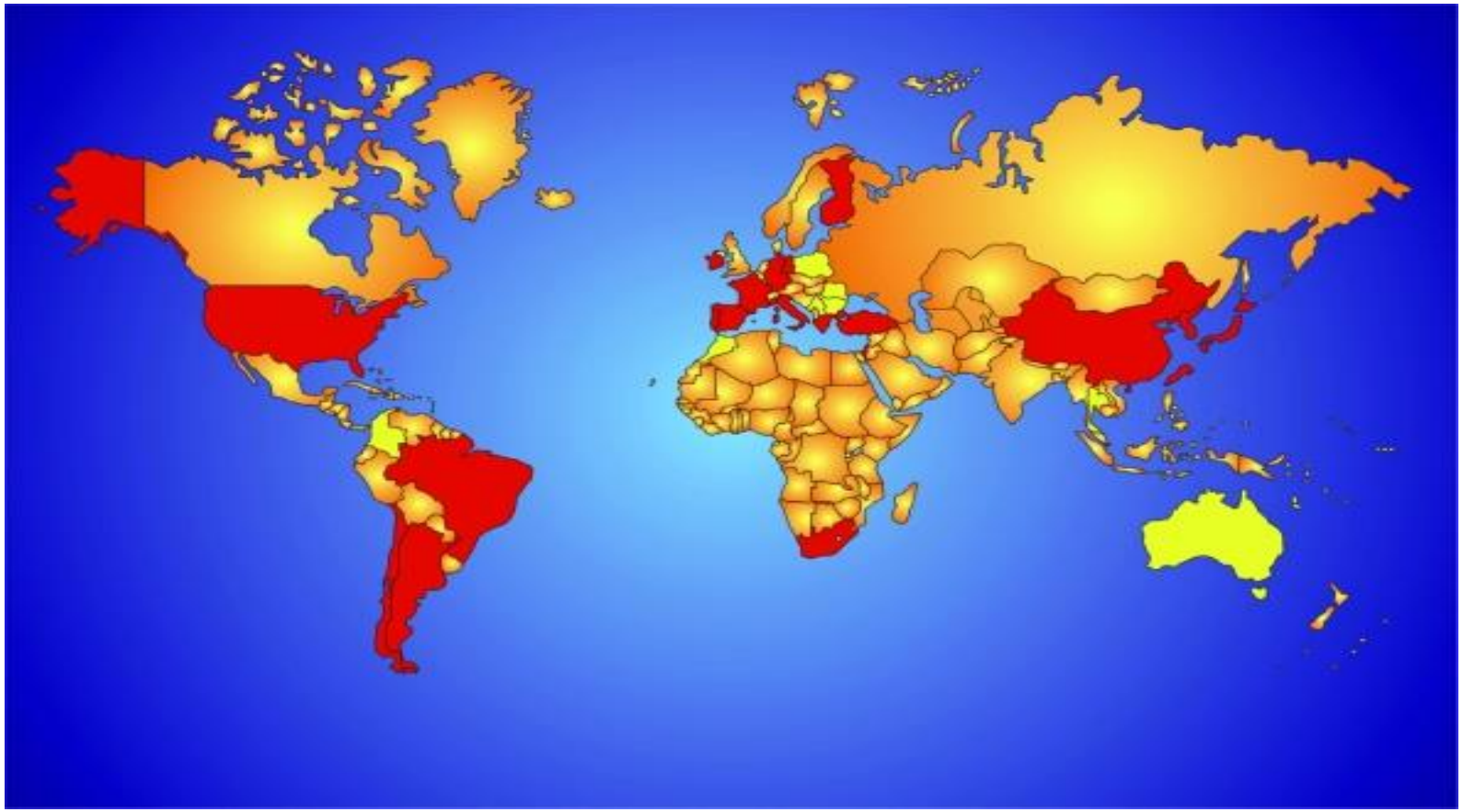
Serious Threats

- 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*

Acinetobacter baumannii: Emergence of a Successful Pathogen



Countries that have reported an outbreak of carbapenem-resistant *Acinetobacter baumannii*. Red signifies outbreaks reported before 2006, and yellow signifies outbreaks reported since 2006.

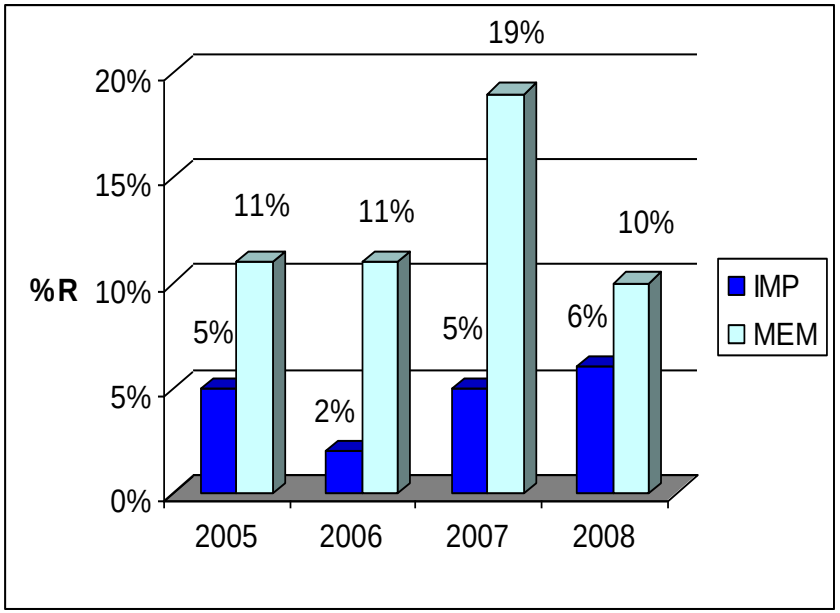
Peleg et al, Clin Microbiol Rev. 2008

Carbapenem resistance of *A. baumannii* in Croatia for the period 2005. - 2008.

2002 – 2009

A. baumannii
- IMI R < 10%

- OXA 107
- European clone 1

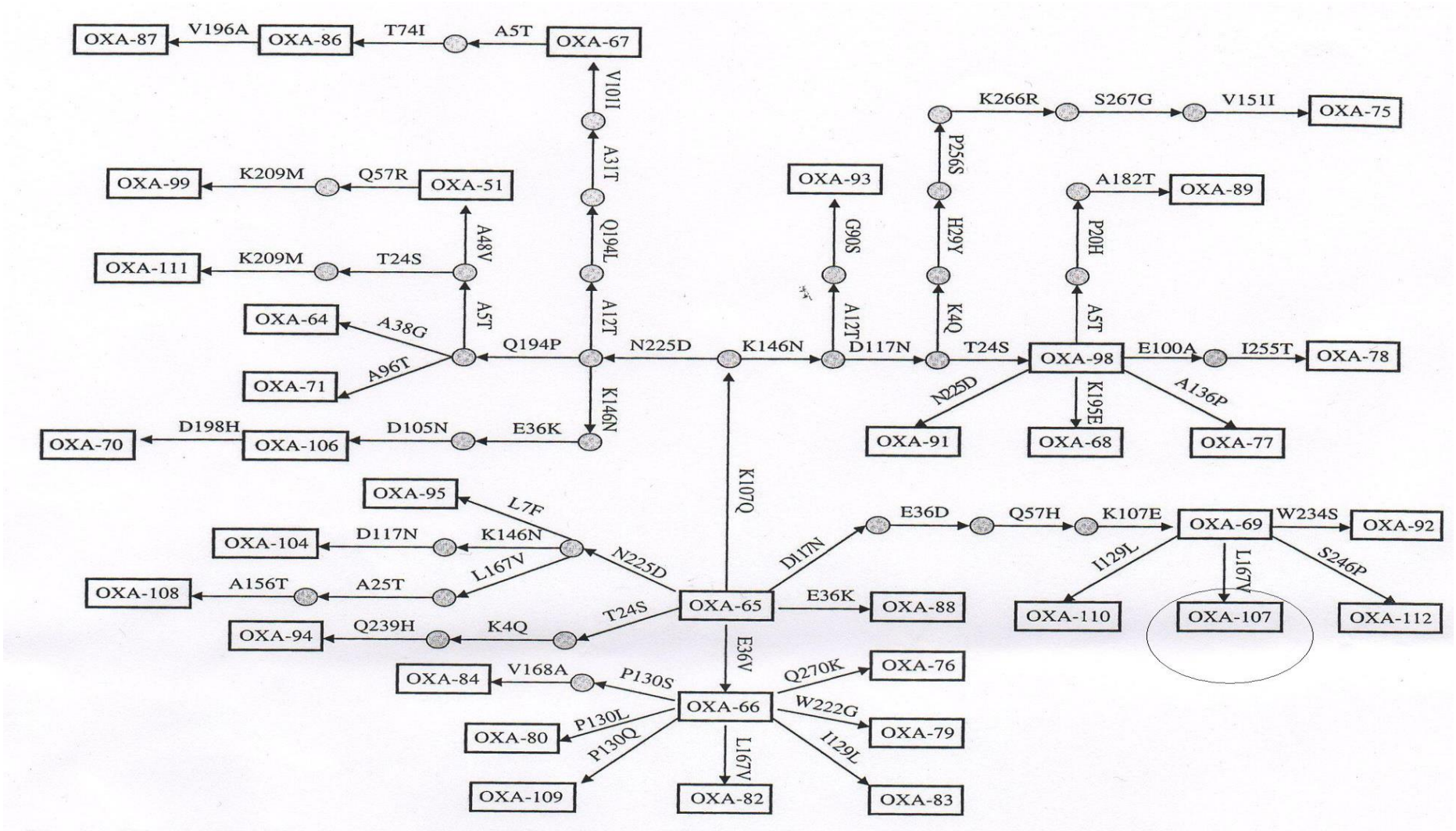


Journal of Chemotherapy

JOURNAL OF Clinical Microbiology JCM

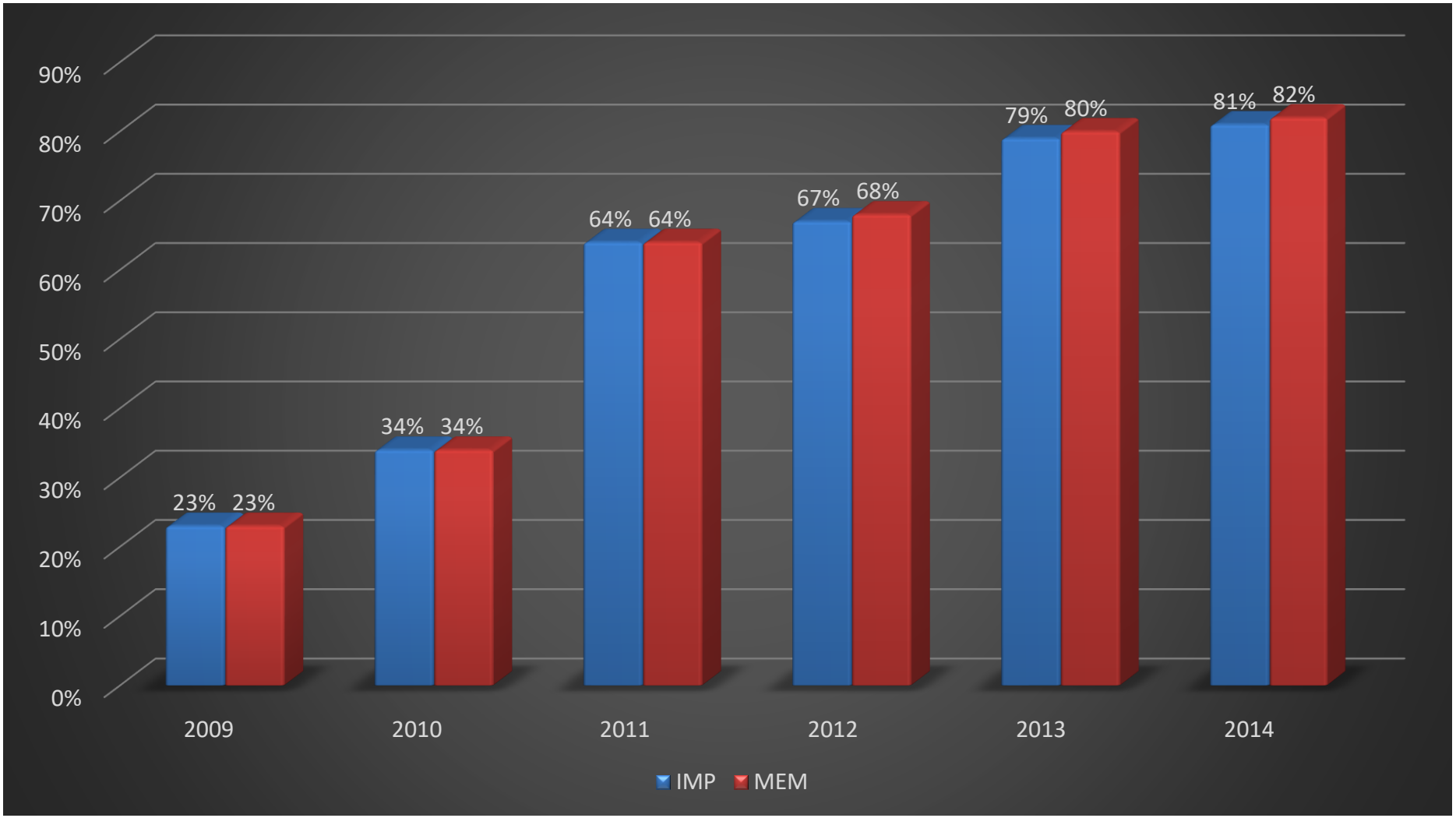
Croatian Committee for Antibiotic Resistance Surveillance

Mechanism of resistance – hyperproduction of OXA-107 due to the IS*Aba*1 location upstream of the gene



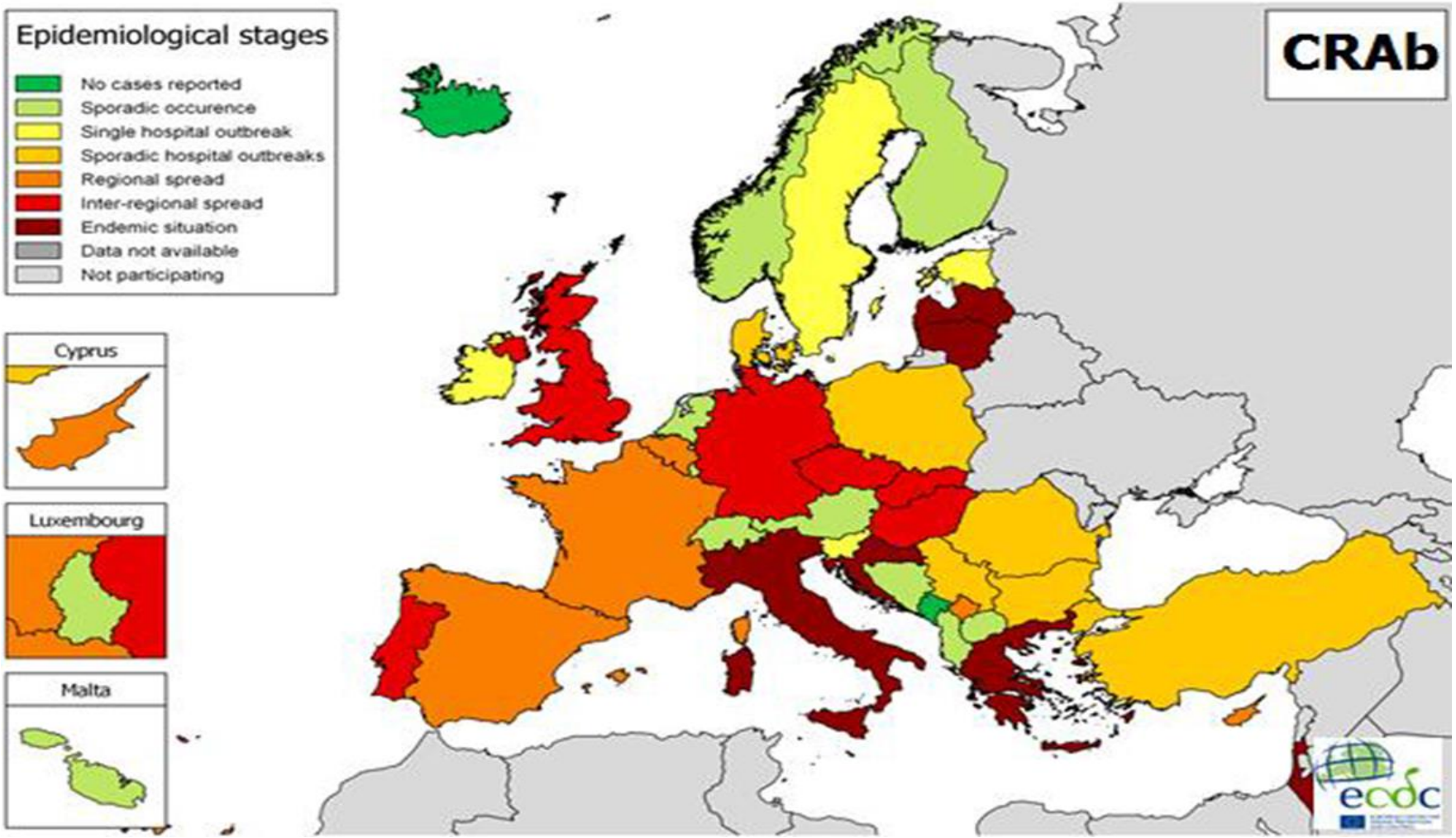
Evans et al., CMI 2008;14:268-75

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

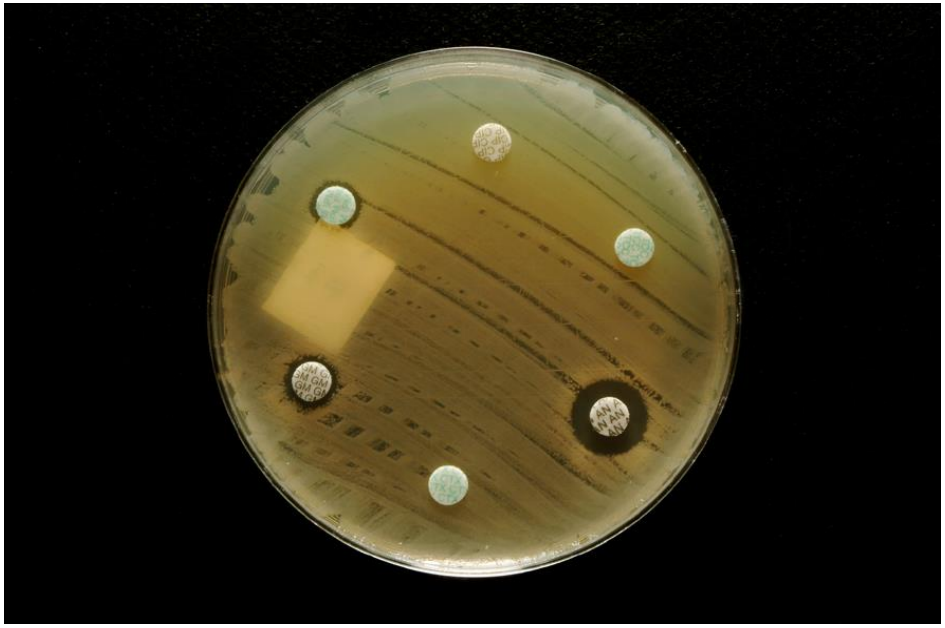
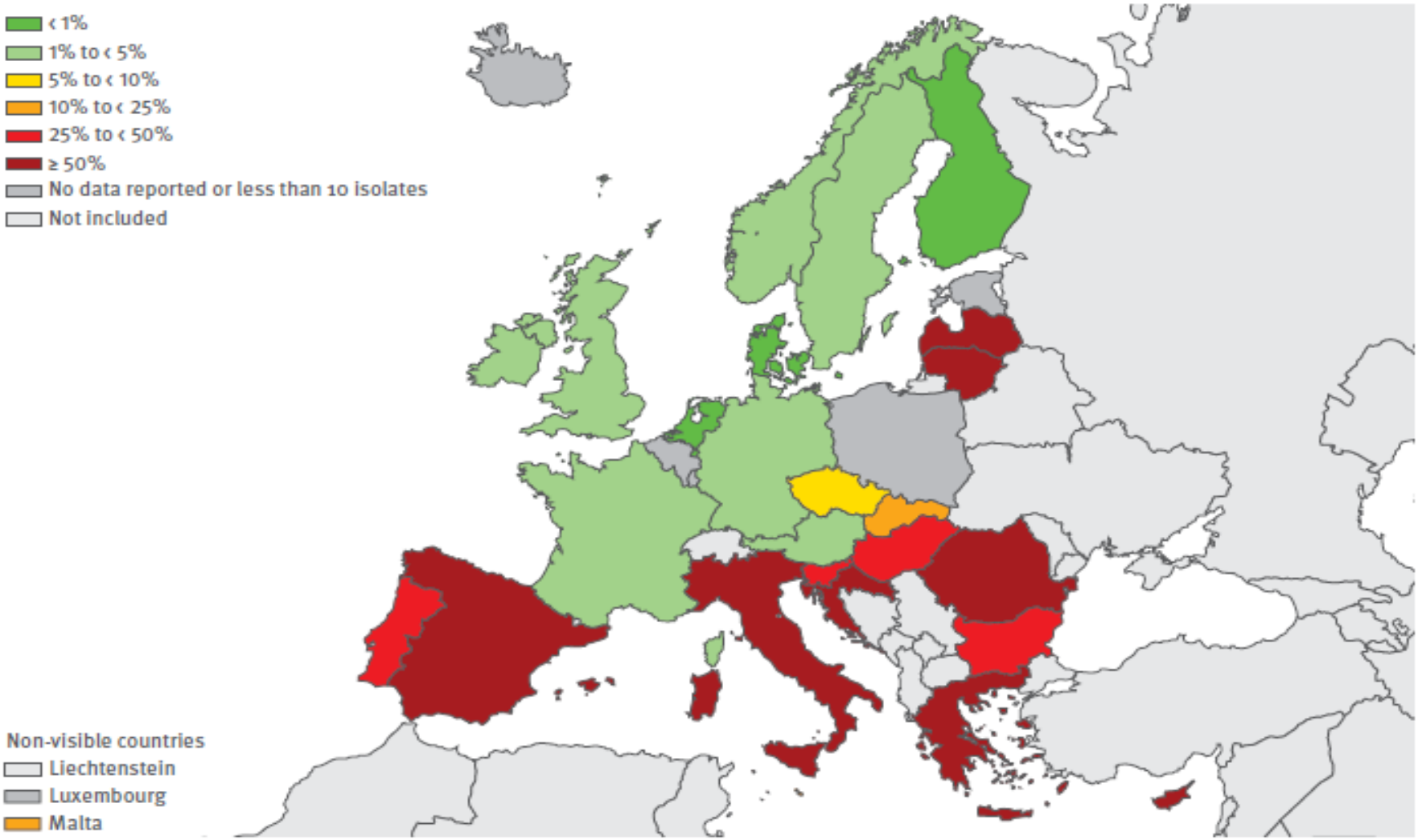


Figure 3.20. *Acinetobacter* spp. Percentage (%) of invasive isolates with combined resistance to fluoroquinolones, aminoglycosides and carbapenems, by country, EU/EEA countries, 2014



Where does *A. baumannii* come from?

?

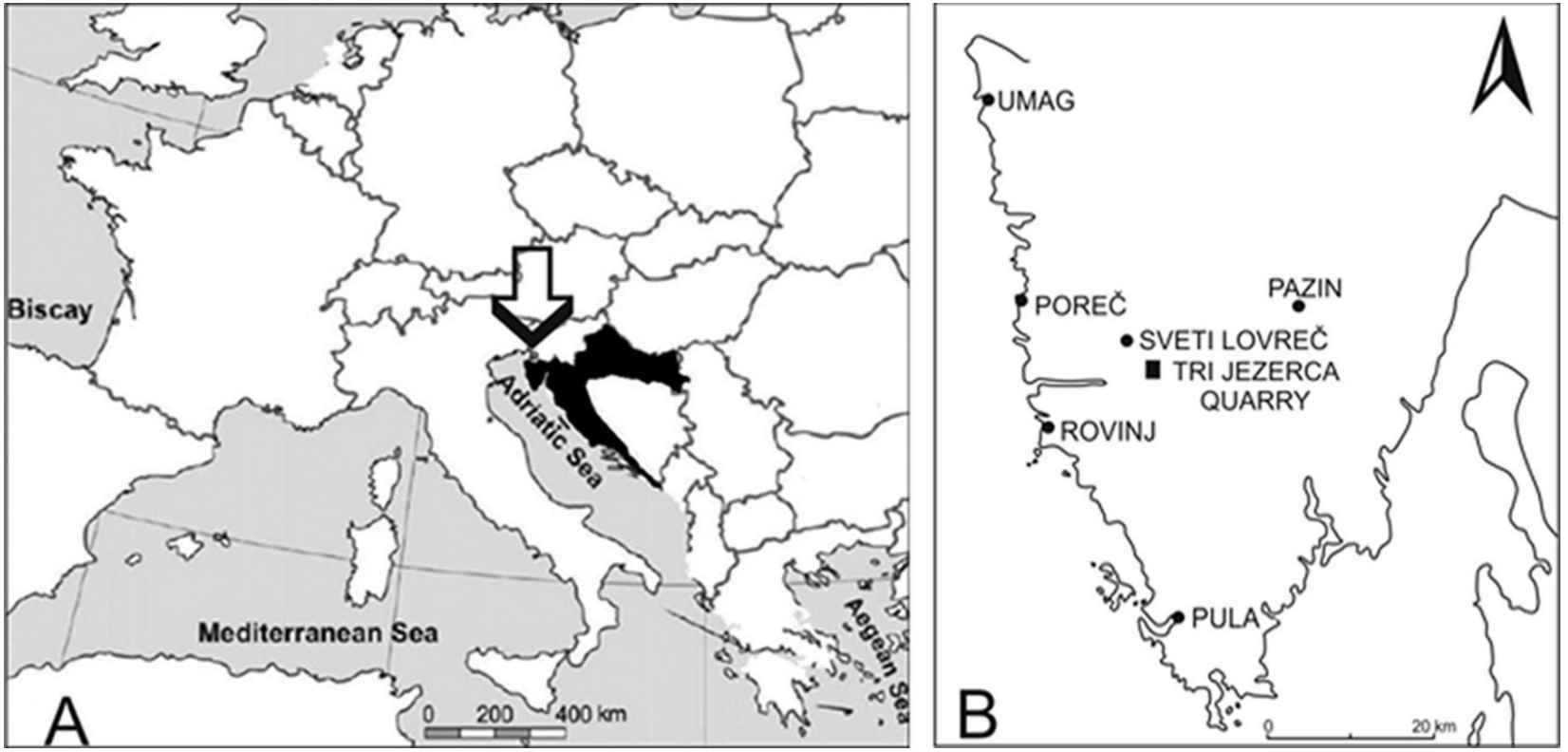
Acinetobacter: an old friend but a new enemy

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

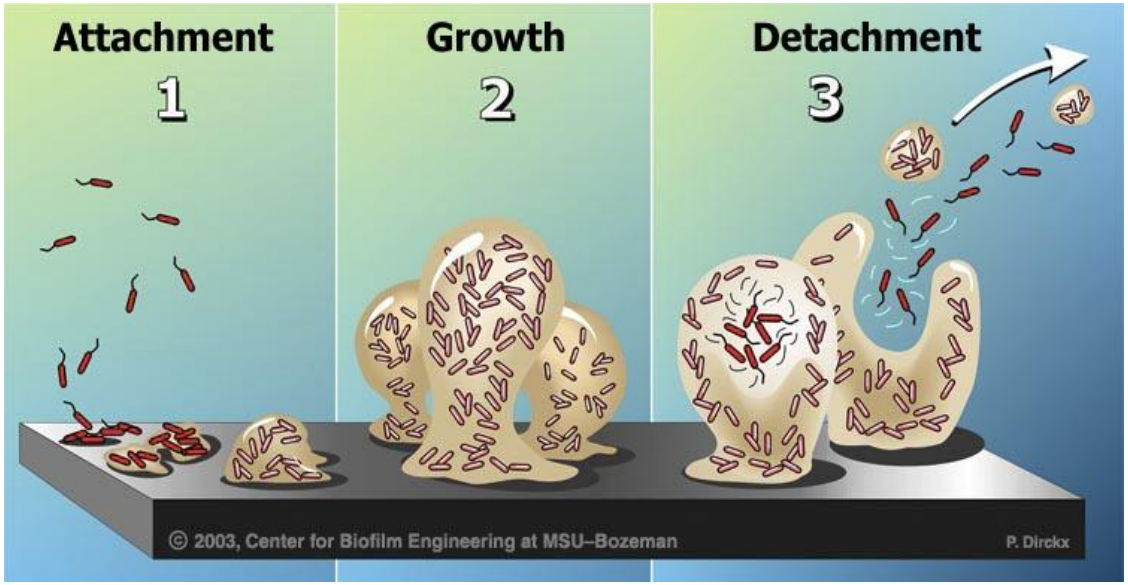
- an accidental discovery in 2013



Jasna Hrenovic et al. Appl. Environ. Microbiol. 2014;80:2860-2866

Applied and Environmental Microbiology

Multicenter investigation in Croatia



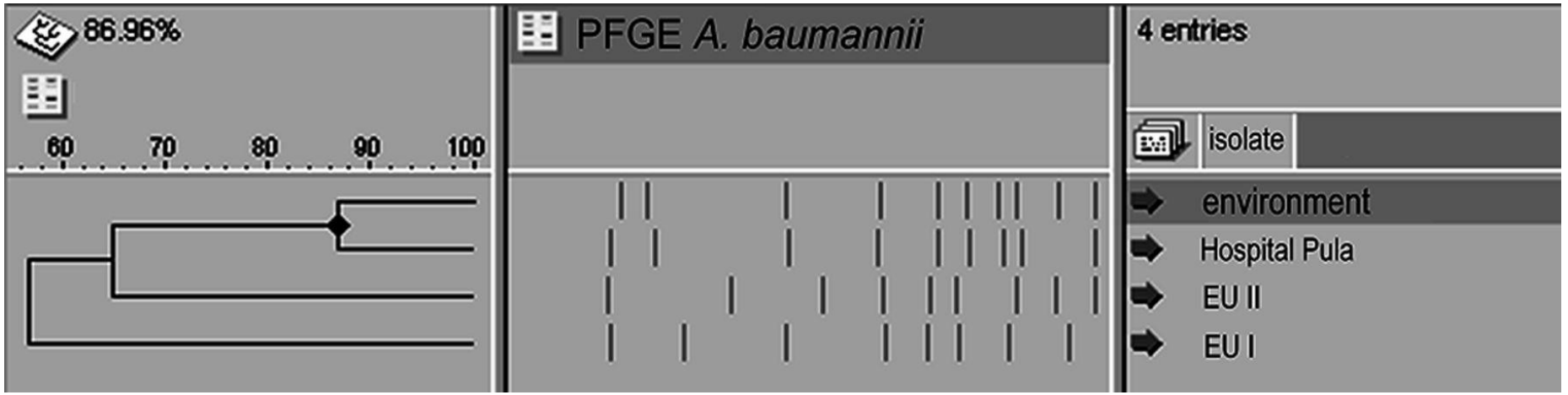
- more than 100 clinical isolates of *A. baumannii (*2009)

- 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

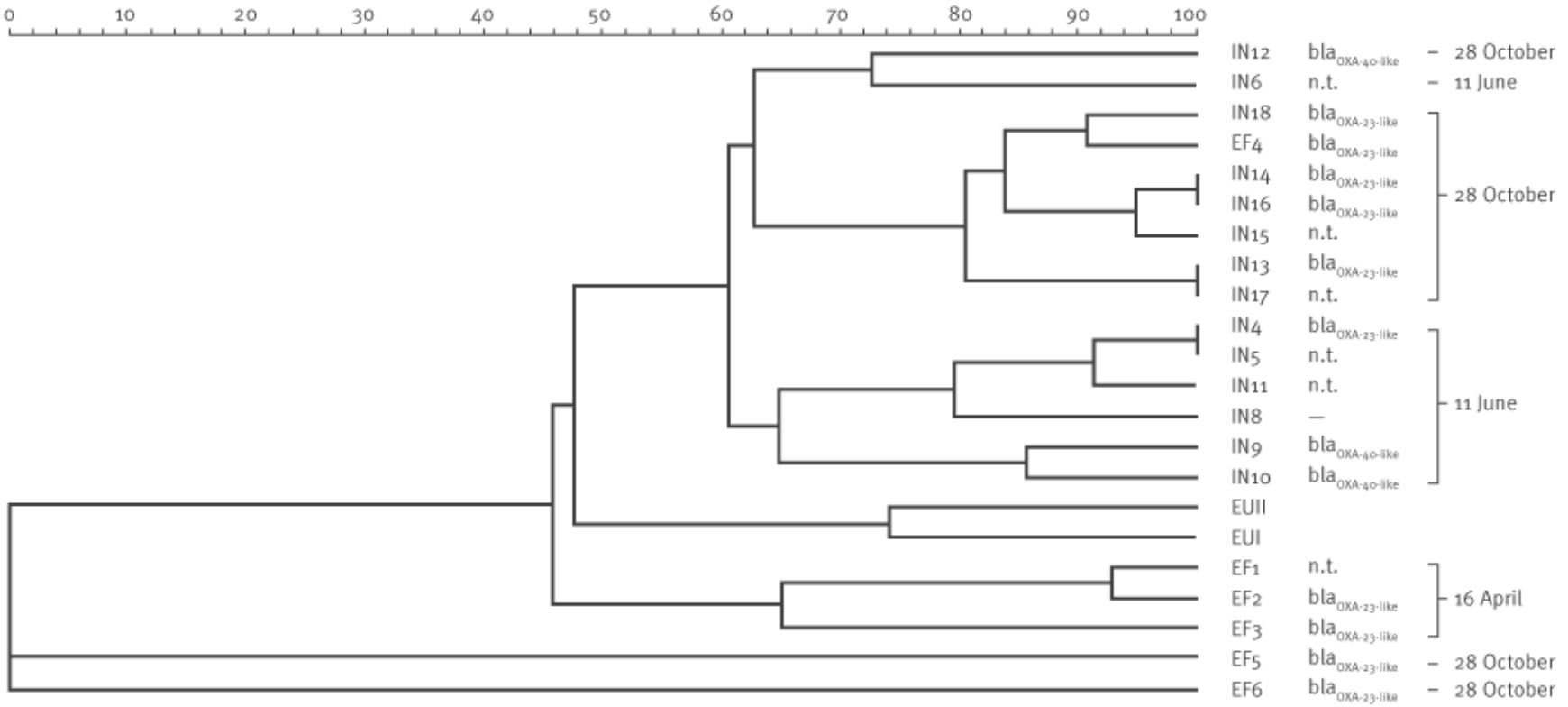
Kaliterna V, PhD thesis 2014

Dendrogram based on ApaI-digested DNA from different isolates of *A. baumannii*



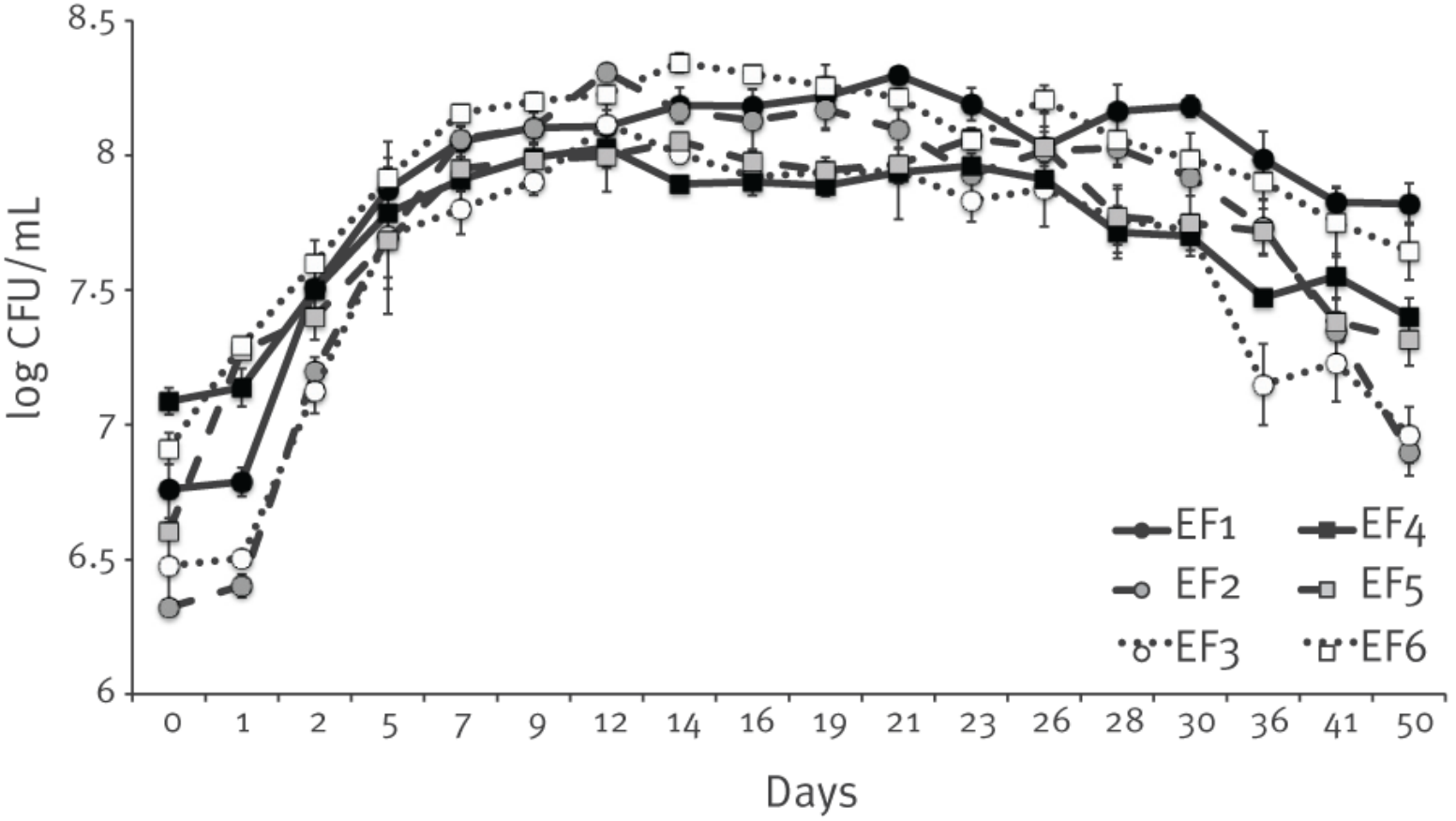
Jasna Hrenovic et al. Appl. Environ. Microbiol. 2014;80:2860-2866

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



Hrenovic J, Goic-Barisic I et al. Euro Surveill. 2016

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



Eurosurveillance 20 years 1996–2016 Europe's journal on infectious disease epidemiology, prevention and control

Hrenovic J, Goic-Barisic I et al 2014. Euro Surveill. 2016

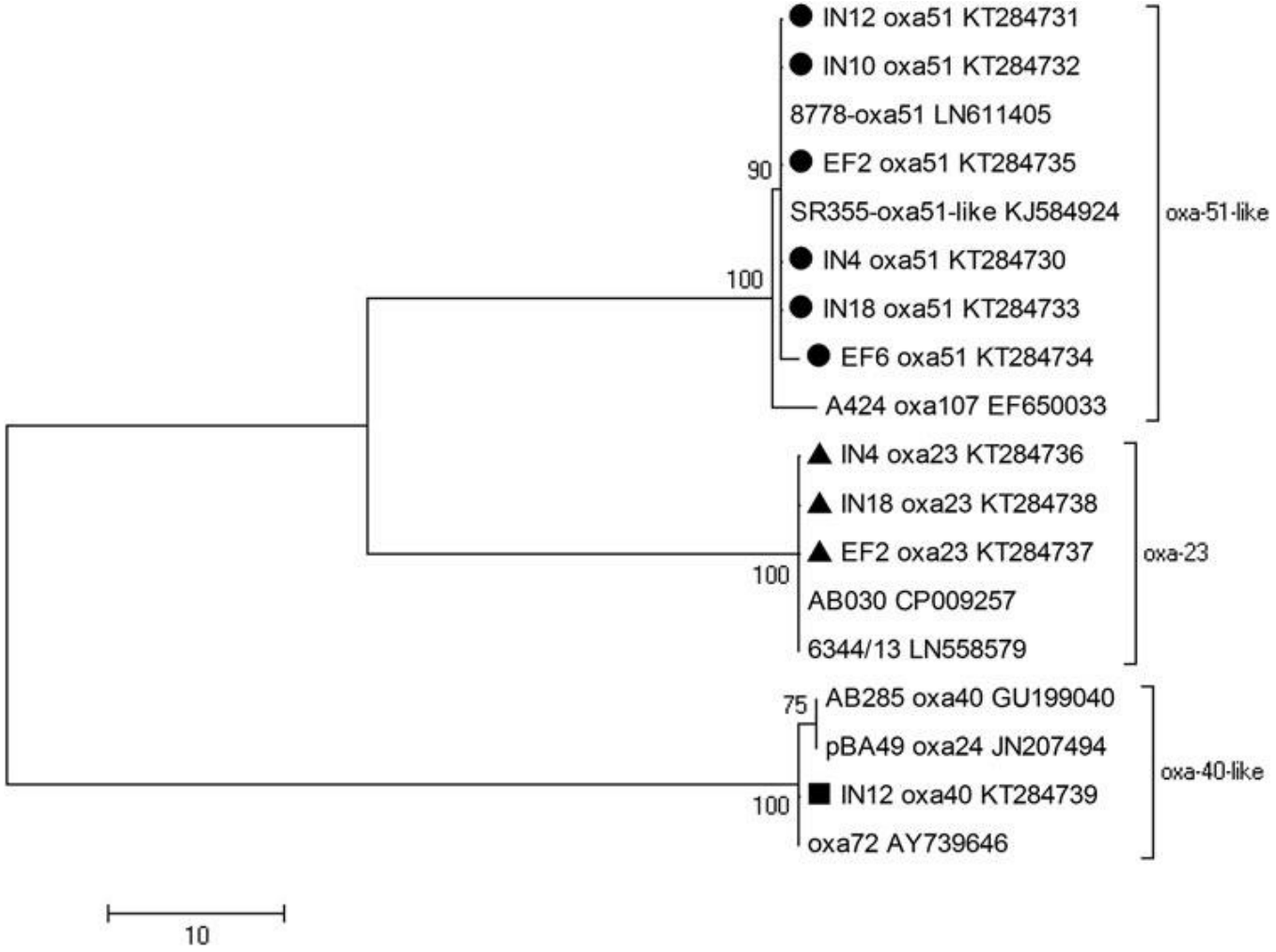
Point out

- 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 *rpo*B gene confirming molecular identification of *A. baumannii*



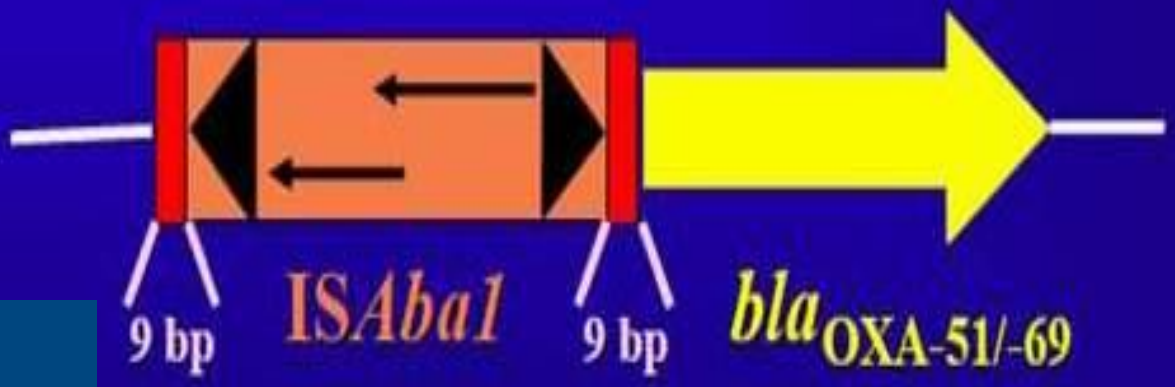
Goic-Barisic I, Hrenovic J et al. 2016

Strategies to Prevent Transmission

- Hand hygiene
- Isolation precautions
- Active surveillance for MDROs
- Decolonization of patients
- Environmental hygiene including hospital wastewater

The role of IS*Aba1* in expression of OXA carbapenemase genes in *Acinetobacter baumannii*

Jane F. Turton[1], M. Elaina Ward[2], Neil Woodford[2], Mary E. Kaufmann[1], Rachel Pike[2], David M. Livermore[2] & Tyrone L. Pitt[1]

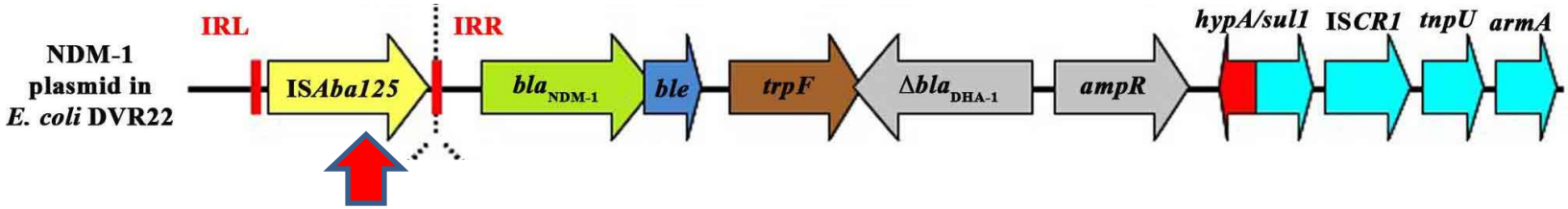


JOURNAL OF CLINICAL MICROBIOLOGY, Oct. 2009, p. 3348–3349 Vol. 47, No. 10
0095-1137/09/$08.000 doi:10.1128/JCM.02394-08

Occurrence of OXA-107 and IS*Aba*1 in Carbapenem-Resistant Isolates of *Acinetobacter baumannii* from Croatia

Ivana Goic-Barisic,1* Branka Bedenic,2 Marija Tonkic,1 Anita Novak,1 Stjepan Katic,2 Smilja Kalenic,2 Volga Punda-Polic,1 and Kevin J. Towner3

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

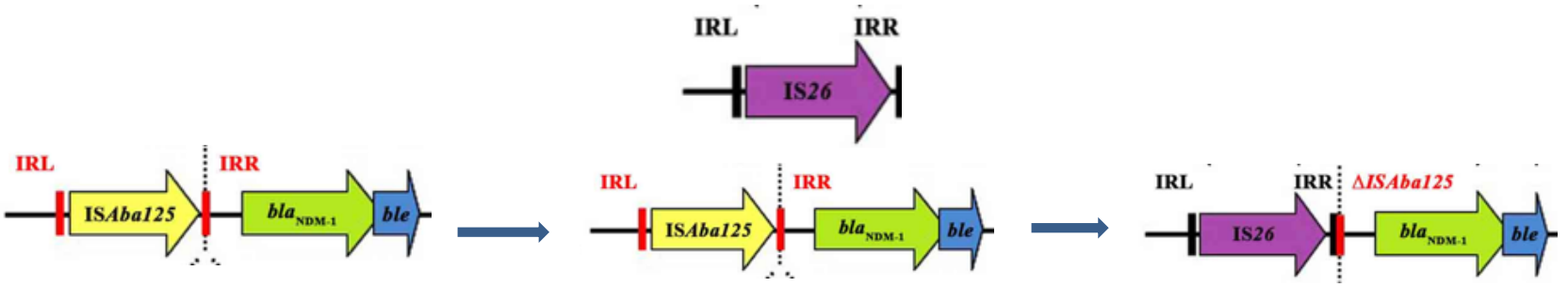


IS*Aba125*upstream of NDM-1
IS*Aba125*is an IS specific from *Acinetobacter*spp.

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

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

Acinetobacter **Enterobacteriaceae** **Enterobacteriaceae**



Luo Y et al. Environ Sci Technol Lett 2014

Vila J. 2016 EUROPE – NORDIC – U.S. SYMPOSIUM Stockholm, Sweden

Multidrug resistant *Acinetobacter baumannii* inside and outside hospital setting

Thank you

- Croatian science foundation – project 252556

Natural habitat of clinically important *Acinetobacter baumannii* (NATURACI)

Jasna Hrenović **Ana Kovačić**

Martina Šeruga Musić **Marija Tonkić**

Blaženka Hunjak