



Utjecaj ekoloških čimbenika na klinički značajnu bakteriju *Acinetobacter baumannii* Seminar II

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Acinetobacter

- ▶ 57 imenovanih vrsta

Commonly found human pathogens

A. baumannii (genospecies 2)

A. nosocomialis (genospecies 13TU)

A. pittii (genospecies 3)

A. calcoaceticus (genospecies 1)

Uncommon organisms in clinical infections

A. baylyi

A. guillouiae

A. lwoffii

A. soli

A. beijerinckii

A. gyllenbergii

A. nectaris

A. tandoii

A. bereziniae

A. haemolyticus

A. parvus

A. tjernbergiae

A. boissieri

A. harbinensis

A. puyangensis

A. towneri

A. bouvetii

A. indicus

A. qingfengensis

A. ursingii

A. brisouii

A. johnsonii

A. radioresistens

A. venetianus

A. gernerii

A. junii

A. rudis

A. grimontii^a

A. kookii

A. schindleri

Review

Clinical relevance of the ESKAPE pathogens

Jack N Pendleton, Sean P Gorman & Brendan F Gilmore

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Abstract

In recent years, the Infectious Diseases Society of America has highlighted a faction of antibiotic-resistant bacteria (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Enterobacter* spp.) – acronymically dubbed ‘the ESKAPE pathogens’ – capable of ‘escaping’ the biocidal action of antibiotics and mutually representing new paradigms in pathogenesis, transmission and resistance. This review aims to consolidate clinically relevant background information on the ESKAPE pathogens and provide a contemporary summary of bacterial resistance, alongside pertinent microbiological considerations necessary to face the mounting threat of antimicrobial resistance.

Keywords: *Acinetobacter*, anti-acquired infection, *Klebsiella*,

Bad Bugs, No Drugs: No ESKAPE! An Update from the Infectious Diseases Society of America ^{FREE}

Helen W. Boucher ✉, George H. Talbot, John S. Bradley, John E. Edwards, David Gilbert, Louis B. Rice, Michael Scheld, Brad Spellberg, John Bartlett

Clin Infect Dis (2009) 48 (1): 1-12. DOI: <https://doi.org/10.1086/595011>

Published: 01 January 2009 Article history ▼

The WHO priority list

PRIORITY: CRITICAL

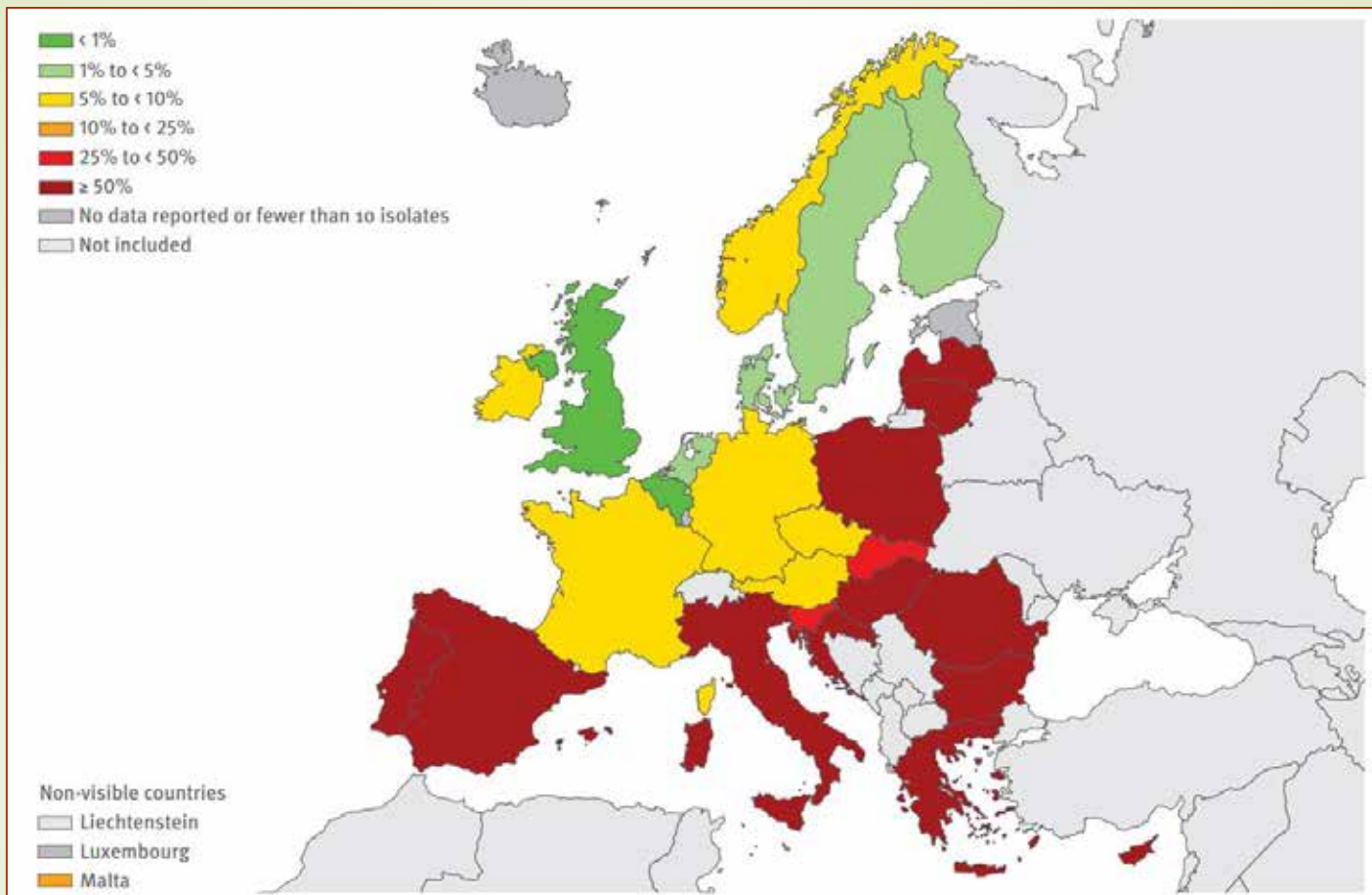
- ◆ **Acinetobacter baumannii**
carbapenem-resistant
- ◆ **Pseudomonas aeruginosa**
carbapenem-resistant
- ◆ **Enterobacteriaceae**
carbapenem-resistant,
ESBL-producing

PRIORITY 2: HIGH

- ◆ **Enterococcus faecium**
vancomycin-resistant
- ◆ **Staphylococcus aureus**
methicillin-resistant
vancomycin-intermediate
and resistant
- ◆ **Helicobacter pylori**
clarithromycin-resistant
- ◆ **Campylobacter spp.**
fluoroquinolone-resistant
- ◆ **Salmonellae**
fluoroquinolone-resistant
- ◆ **Neisseria gonorrhoeae**
cephalosporin-resistant
fluoroquinolone-resistant

PRIORITY 3: MEDIUM

- ◆ **Streptococcus pneumoniae**
penicillin-non-susceptible
- ◆ **Haemophilus influenzae**
ampicillin-resistant
- ◆ **Shigella spp.**
fluoroquinolone-resistant

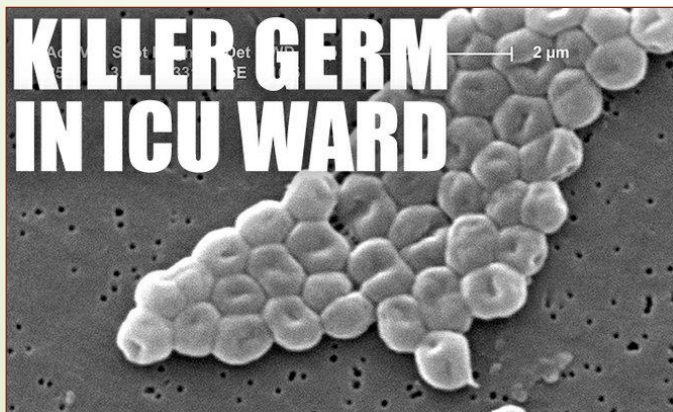


Postotak karpabenem-rezistentnih *Acinetobacter* spp. u 2015. (<https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/antimicrobial-resistance-europe-2015.pdf>)

Rezistencija *A. baumannii* na karpapenemske antibiotike u Hrvatskoj povećala se sa 10% u 2008. do 86% u 2016. godini (CAMS, 2017)

Acinetobacter baumannii

- Gram negativni kokobacil
- Nefermentativan, nesporogen, obligatni aerob
- Humani oportunistički patogen
- Infekcije većinom vezane uz bolnički okoliš
- Otpornost na komercijalne dezinficijense koji se uobičajeno koriste

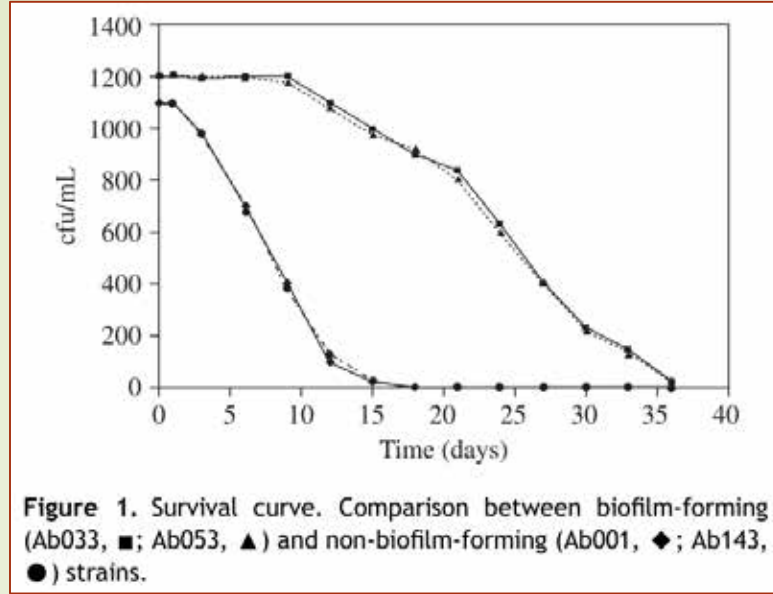


Klinički značajni *A. baumannii* u okolišu

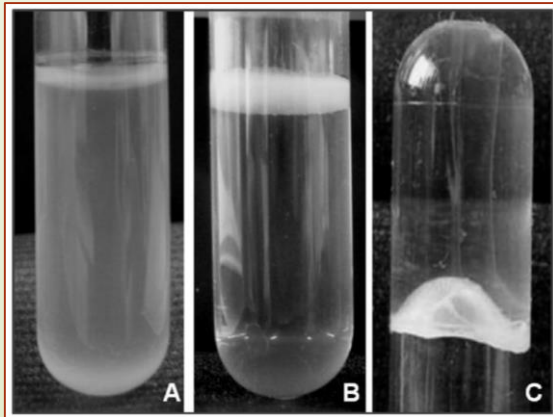
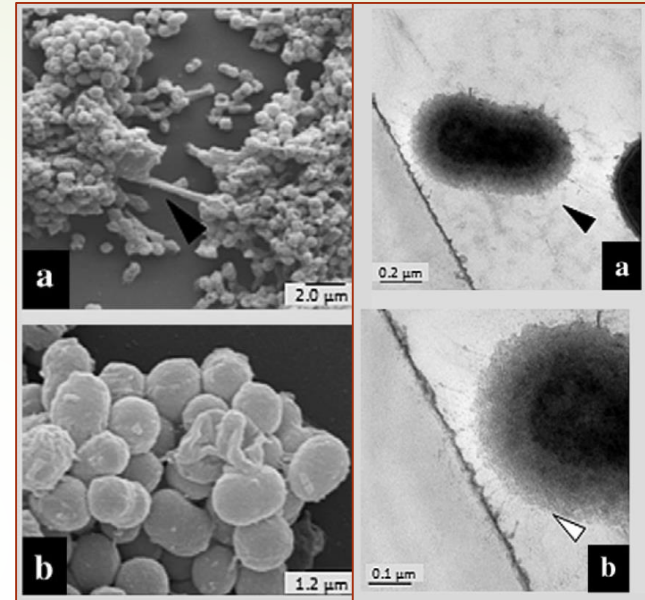
- Bolničke otpadne vode
- Uređaji za pročišćavanje otpadnih voda
- Prirodne vode (rijeka Sena i Sava)
- Tlo pod utjecajem ilegalno odbačenog krutog otpada



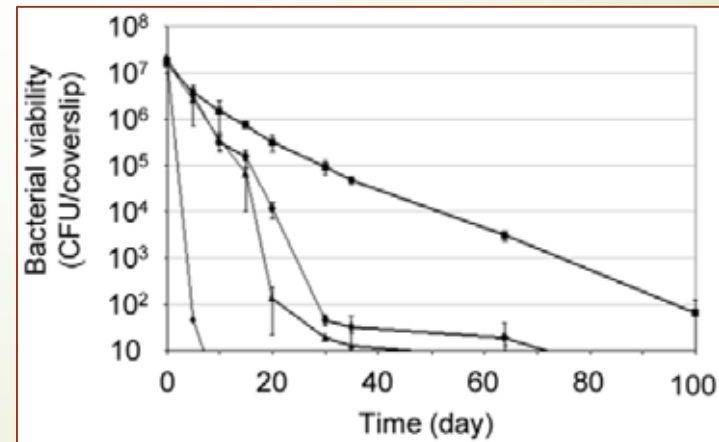
Faktori virulencije – biofilm, pelikula



Espinal i sur. (2012)

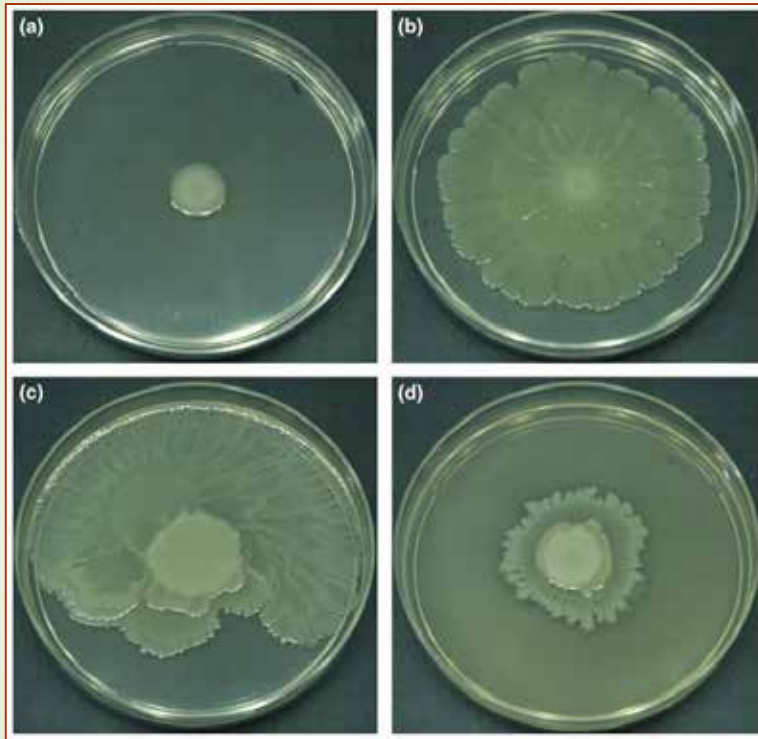


Nait Chabane i sur. (2014)

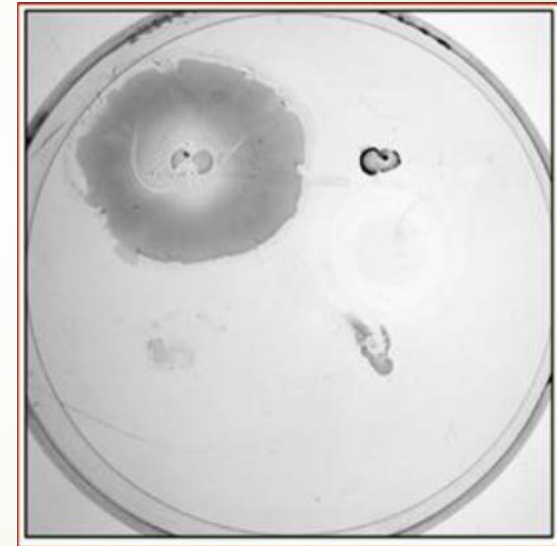


Antunes i sur. (2011)

Faktori virulencije - površinska pokretljivost rojenjem i trzanjem



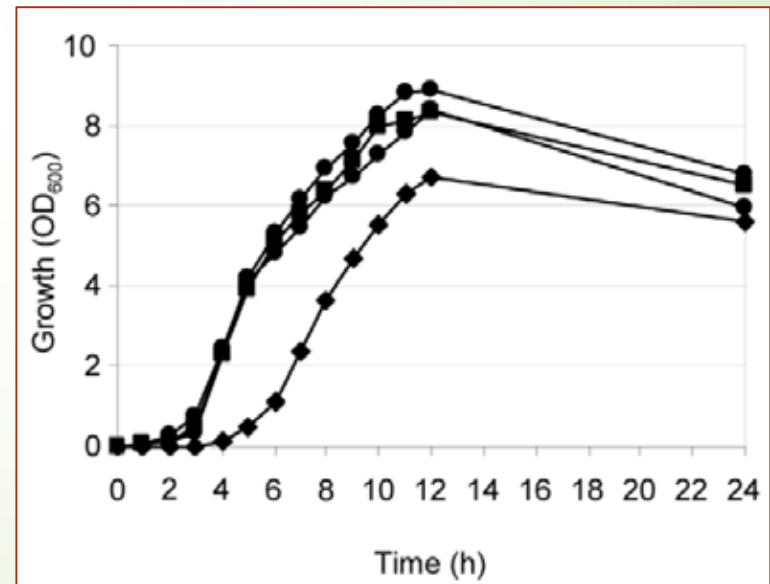
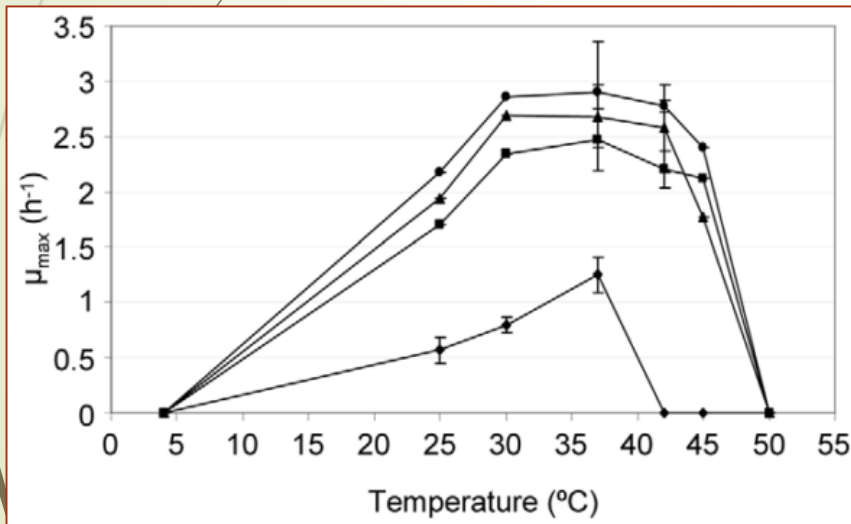
McConnell i sur. (2013)



Antunes i sur. (2011)

Ekološki čimbenici

- ▶ *A. baumannii* raste na temperaturama 25 – 45 °C, optimum 37 °C (Antunes i sur. 2011)





American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

Major biologic characteristics of *Acinetobacter baumannii* isolates from hospital environmental and patients' respiratory tract sources

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- Obeidat i sur. (2014) – preživljavanje *A. baumannii* u destiliranoj, vodovodnoj vodi i fiziološkoj otopini do 23 dana na sobnoj temperaturi i pH 4,5-8
- *A. baumannii* raste na 37, 42, 45 °C, nema rasta na 4 i 48 °C



Cilj

- ▶ Odrediti faktore virulencije *A. baumannii*:
 - ▶ formiranje biofilma, pelikule, površinska pokretljivost trzanjem i rojenjem
 - ▶ utjecaj prirodnog zeolitnog tufa na ekspresiju faktora virulencije
- ▶ Odrediti utjecaj ekoloških čimbenika na preživljavanje *A. baumannii*:
 - ▶ temperatura, vrijednost pH, koncentracija otopljenog kisika, dostupnost nutrijenata, preživljavanje u morskoj vodi, isušivanje, kompeticija s drugim mikroorganizmima
- ▶ Postoji li potencijal za kolonizaciju slatkovodnih riba s klinički značajnim *A. baumannii* što predstavlja jedan od potencijalnih načina širenja ovog patogena



Hipoteza



- ▶ Klinički značajni *A. baumannii* iz okoliša posjeduju izražene faktore virulencije te mogu preživjeti izvjesno vrijeme u različitim uvjetima u okolišu
- ▶ Prirodni zeolitni tuf utječe na smanjenje faktora virulencije
- ▶ Potencijal za kolonizaciju slatkovodnih riba postoji



Materijal i metode

- 25 okolišnih i 1 klinički izolat
- Profil antibiotske osjetljivosti: Vitek 2 sustav, E-test, mikrodilucija u bujonu
- Podjela izolata u kategorije prema Magiorakos i sur. (2012) u kategorije:
 - S - senzitivna na sve testirane antibiotike
 - MDR - multiplo-rezistentan
 - XDR - prošireno-rezistentan
 - PDR - sveopće-rezistentan



Faktori virulencije

- Stvaranje biofilma – Kaliterna i sur. (2015)
- Stvaranje pelikule – Nait Chabane i sur. (2014)
- Površinska pokretljivost trzanjem i rojenjem – Antunes i sur. (2011)
- Ponoviti eksperimente s dodatkom 1 i 10% prirodnog zeolitnog tufa
- Hidrofobnost – BATH test (Rosenberg i sur. 1980)

Prirodni zeoliti

- ▶ Odlični nosači bakterija zbog svoje netoksičnosti, porozne strukture, velike površine, dostupnosti
- ▶ Kamenolom u Donjem Jesenju, <0.122mm
- ▶ Postotak redukcije faktora virulencije i intenzitet imobilizacije *A. baumannii*

Colloids and Surfaces B: Biointerfaces 88 (2011) 208–214



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Selective immobilization of *Acinetobacter junii* on the natural zeolitized tuff in municipal wastewater

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ABSTRACT

The immobilization of desired bacteria onto material was usually performed in synthetic media. The aim of this study was to test the immobilization of phosphate (P)-accumulating bacteria *Acinetobacter junii* onto natural zeolitized tuff (NZ) in the raw or sterilized municipal wastewater containing the common



Ekološki čimbenici

- Preživljavanje 4 okolišna i 1 kliničkog izolata odabrani prema profilu antibiotske osjetljivosti kroz 50 dana
- 2 tipa hranjivih medija – komercijalno dostupna izvorska voda i voda obogaćena nutrijentima (razrijeđeni Nutrient broth)
- Temperatura: -20, 4, 22, 35, 44, 50, 63 °C
- Vrijednost pH: 2, 5, 7, 10, 12 pri 22 °C
- Koncentracija otopljenog kisika: 0, 50, 100% pri 22 °C
- Otpornost na isušivanje pratit će se u tlu različite vlažnosti pri 22 °C
- Preživljavanje u sterilnoj morskoj vodi pri 22 °C

Ekološki čimbenici

- Kompeticija *A. baumannii* s *Escherichia coli* i *Enterococcus faecium* pratit će se do pojave dominacije jedne bakterije
- Ispaša kolnjaka (koljeno Rotifera) na kulturi *A. baumannii*



Kolonizacija riba

- Kolonizacijski potencijal na slatkovodnim ribama *Poecilia reticulata*
- Ribe će biti stavljene u tri zatvorena aerirana sustava s prirodnom izvorskom vodom s tri različite koncentracije *A. baumannii* na sobnoj temperaturi
- Koncentracija *A. baumannii* u vodi i u ribama kroz vrijeme do nestanka bakterija iz sustava ili uginuća riba
- Ishođena je dopusnica etičkog povjerenstva





Statistička analiza

- Broj bakterija – log CFU/mL (Colony Forming Unit)
- Faktori virulencije
 - Postotak redukcije faktora virulencije i intenzitet imobilizacije *A. baumannii*
- Preživljavanje
 - Postotak preživljavanja
 - Redukcija log CFU
- Microsoft Excel 2016 i Statistica 13.3 računalni programi



Očekivani doprinos

- ▶ Posjeduju li klinički značajni okolišni izolati *A. baumannii* iste faktore virulencije kao i bolnički izolati
- ▶ Spoznaje o tome koji ekološki čimbenici i u kojoj mjeri uvjetuju preživljavanje *A. baumannii* u okolišu
- ▶ Predviđanje ponašanja *A. baumannii* u bolničkom i izvanbolničkom okružju
- ▶ Podloga za daljnja istraživanja usmjerena na remedijaciju okoliša zagađenog s *A. baumannii*

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Hvala na pažnji!

