Risk factors for cross-transmission of carbapenem-resistant Enterobacteriacea (CRE): variables related to exposed patients, CRE-carriers and wards

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INTRODUCTION

- **Carriage** of CRE is **rising** worldwide[1]
- **Treatment** options for CRE infections are **limited**[2]
- **Attribute mortality** of infections is **high** (37%-50%)[3]
- CRE carriers often have **poor functional status**[4]
- CRE carriers are prone to hospital **readmissions**[5]
- Strict infection control measures are crucial to **limit the spread of CRE**[6,7]

CRE Cross-transmission

- **Cross- transmission:** physical movement or transfer of pathogenic bacteria from one person, object, or place to another
- **CRE cross-transmission case:** a patient exhibiting positive rectal (or clinical) culture after a roommate's (or a patient in another room handled with the same health care worker) identification as a new CRE case

OBJECTIVES

- **The study aim was to find the risk factors for cross-transmission of CRE post exposure?**
- **Dependent variable:** cross-transmission / no cross-transmission
- **Independent variables** related to the **CRE-carriers (transmitters)**
- **Independent variables** related to **exposed patients**
- **Independent variables** related to the **ward of exposure**

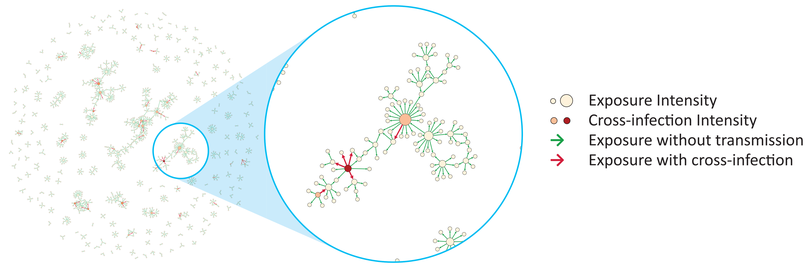
METHODS

- A **retrospective cohort** study conducted between **2007-2012**
- Study **population**: patients who were **inadvertently exposed to CRE-carriers** in the same room or were handeled with the same nursing personnel and were screened to determine cross-transmission
- Data was extracted from the **electronic health records** at Kaplan Medical Center
- Demographic variables, comorbidities, clinical status, antibiotic treatment, invasive procedures, longevity of exposure and specific wards were examined in an **univariate analysis**
- A **poissonic model** examined the hazard ratio **of transmission** from the CRE-carriers
- **Multivariable logistic model** for variables of the CRE-carriers (identified by the poissonic model), exposed patients and wards of exposure

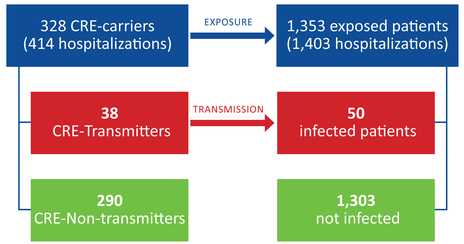
RESULTS

- In 1,403 hospitalizations of 1,353 patients an inadverent exposure to a CRE-carrier occurred
- 328 CRE-carriers exposed other patients in 414 hospitalizations
- 38 (11.6%) CRE-carriers transmitted CRE
- 50 (3.7%) exposed patients were infected
- The **CRE-carrier at risk** to transmit CRE used **antibiotics** in the prior 3 months, had CRE in **clinical** culture, had **chronic lung disease** and had **catheter on admission**
- The **exposed** patients **at risk** to become infected with CRE were **ventilated** and used **antibiotics** in the prior 3 months
- The **wards at risk** for cross transmission were **internal medicine** wards
- Exposure time of **≥6 days** was a risk factor

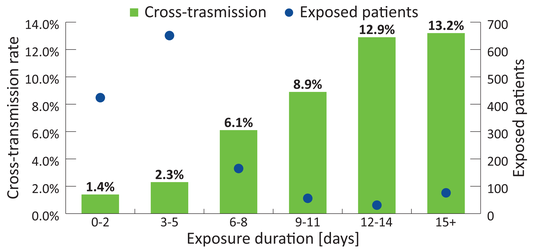
Figure 1: **Exposure network**
Network visualization of 1404 study exposures



Flowchart of the Study Population



Cross-transmission rates versus time of exposure



Multivariable logistic regression

	Variable	OR	*P value*
CRE-transmitters	CRE clinical culture (opposed to rectal culture)	2.34	0.008
	Catheter on admission	2.61	0.049
	Chronic lung disease	3.02	0.004
	Antibiotics on prior 3 months	2.83	0.003
Exposed patients	Ventilation	4.97	<0.001
	Antibiotics on prior 3 months	2.33	0.008
External parameters	≥6 days of exposure	3.88	<0.001
	Internal medicine ward	6.16	<0.001

CONCLUSIONS

- **The risk to be cross-infected with CRE is an integration of risk factors of the CRE-transmitter, the exposed patient, the ward of exposure and time of exposure**
- **Risk factors for CRE transmission can be defined and could be exploited for infection control policy**

References

[1] Nordmann P et al. *EID 2011*
[2] Van Duin D et al. *DMID 2013*
[3] Schwaber MJ et al. *AAC 2008*
[4] Marchaim D et al. *ICHE 2011*
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