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## I. Introduction

The REVERSE (pREvention and management tools for rEducing antibiotic Resistance in high prevalence Settings) is a multi-center Horizon 2020-project in four European countries. The overall aim is to evaluate the effectiveness of interventions combining infection prevention control and antibiotic stewardship on reducing healthcare-associated infections due to multidrug-resistant microorganisms.

Three point prevalence surveys on rectal carriage of multidrug-resistant Gram-negative bacteria are planned. This abstract summarizes the results of the first round before implementing interventions.

## II. Methodology

Twenty-four hospitals from Italy, Spain, Greece and Romania each collected 250 rectal swabs and sent them to the medical microbiology at UMC Utrecht, Netherlands.

Samples were collected from patients in intensive care, haemato-oncology, internal medicine and surgery. Gender, age and length of hospital stay were recorded.

Samples were cultured on ESBL/CRE selective plates for 2 days to select phenotypic resistant strains. Strains were typed by MALDI-TOF and tested by Carbapenem-Inactivation Method (CIM) to identify carbapenem-resistant *Enterobacterales* (CRE) and carbapenem-resistant *Pseudomonas aeruginosa* (CRPA).

All CIM-positive isolates and all *Acinetobacter baumannii* isolates will be tested by NGS for clonal relatedness and resistance gene identification.

## III. Results

- A total of 5590 rectal swabs were tested. Overall prevalences of CRE and CRPA were 10.0 and 2.5%, respectively. *Acinetobacter baumannii* was found in 2.9% of the samples. The prevalence varied between the different countries (table 1).

Table 1. Prevalence of CRE, CRPA and *Acinetobacter baumannii* per participating country

	Spain	Italy	Romania	Greece	Total
nr of samples	1434	1394	1340	1422	5590
nr of samples with one or more CIM pos <i>Enterobacterales</i> (CRE)	56 (3.9%)	84 (6.0%)	173 (12.9%)	244 (17.2%)	557 (10.0%)
nr of samples <i>Acinetobacter baumannii</i>	2 (0.1%)	13 (0.9%)	47 (3.5%)	98 (6.9%)	160 (2.9%)
nr of samples CIM pos <i>Pseudomonas aeruginosa</i> (CRPA)	24 (1.7%)	10 (0.7%)	26 (1.9%)	81 (5.7%)	141 (2.5%)

Coloured cells are above average

- Most CRE were *Klebsiella pneumoniae*, *Escherichia coli*, *Enterobacter sp.* and *Citrobacter sp.* Some CIM-positive species like *Citrobacter*, *Proteus* or *Morganella* clustered within certain hospitals (table 2).

Table 2: CIM-positive species plus *Acinetobacter baumannii*

CIM positive species (plus <i>Acinetobacter</i> )	Spain	Italy	Romania	Greece	Total
<i>Acinetobacter baumannii/calcoaceticus compl.</i>	2 (0.1%)	13 (0.9%)	47 (3.5%)	98 (6.9%)	160
<i>Pseudomonas aeruginosa</i>	24 (1.7%)	10 (0.7%)	24 (1.8%)	81 (5.7%)	139
<i>Klebsiella pneumoniae</i>	16 (1.1%)	53 (3.8%)	139 (10.4%)	213 (15%)	421
<i>Citrobacter sp.</i>	15 (1.0%)	7 (0.5%)	5 (0.4%)	5 (0.4%)	32
<i>Enterobacter sp.</i>	19 (1.3%)	5 (0.4%)	16 (1.2%)	12 (0.8%)	52
<i>E. coli</i>	9 (0.6%)	22 (1.6%)	29 (2.2%)	29 (2.0%)	89
<i>Klebsiella sp.</i>	3 (0.2%)	4 (0.3%)	3 (0.2%)	10 (0.7%)	20
<i>Proteus sp.</i>	1 (0.1%)	2 (0.1%)	4 (0.3%)	3 (0.2%)	10
<i>Morganella morganii</i>	0	3 (0.2%)	0	2 (0.1%)	5
<i>Providencia stuartii</i>	0	0	4 (0.3%)	3 (0.2%)	7
<i>Raoultella sp.</i>	0	0	1 (0.1%)	2 (0.1%)	3
<i>Acinetobacter sp.</i>	0	1 (0.1%)	0	0	1

Coloured cells are above average

## III. Results

Samples were obtained from internal medicine (52%), surgery (27%), intensive care (11%) and haemato-oncology (11%).

Prevalence of CRE, CRPA and *Acinetobacter baumannii* was highest in intensive care (32.0%), followed by internal medicine (17.0%), surgery (13.2%) and haemato-oncology (9.6%).

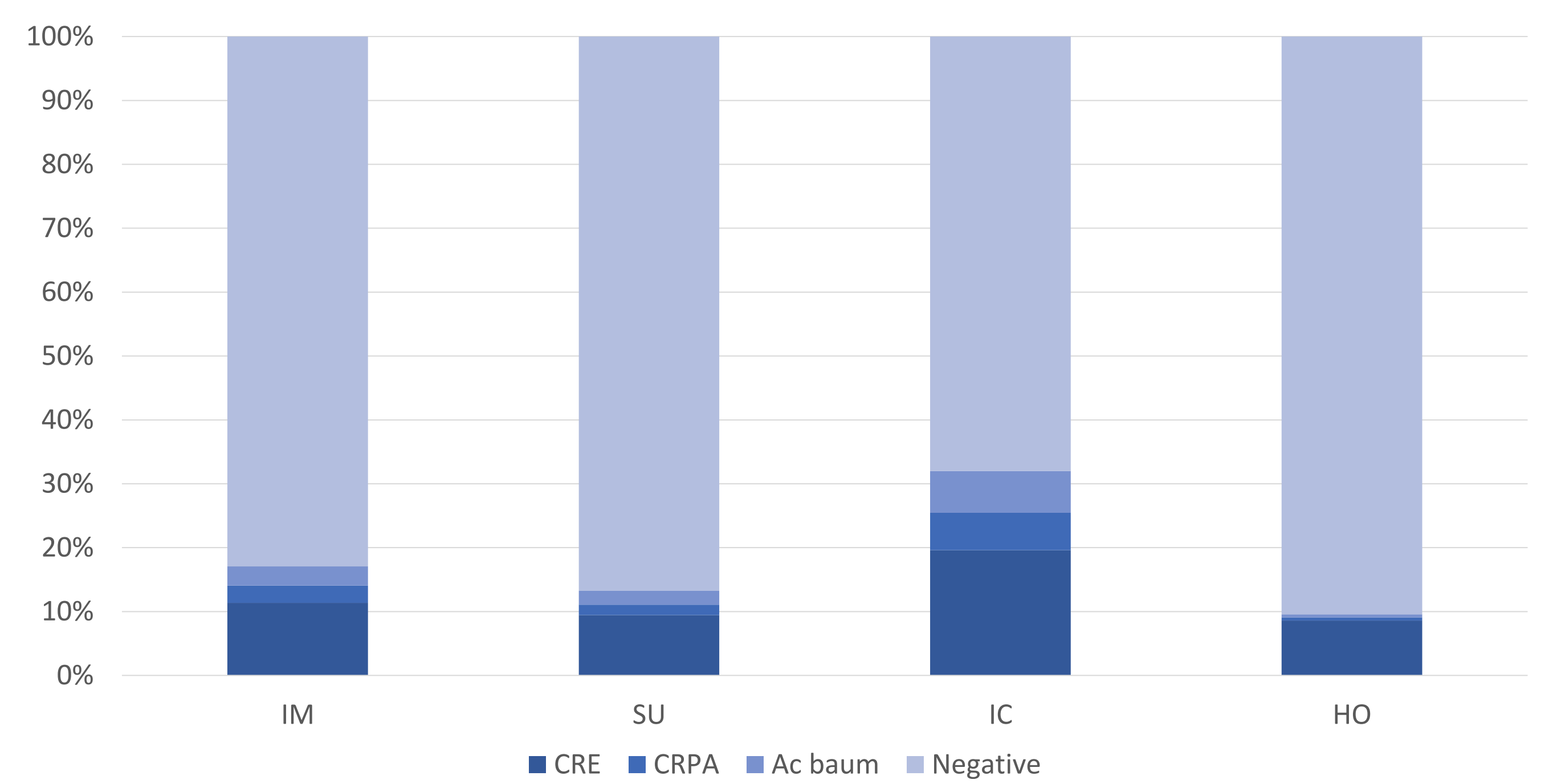


Figure 2: Prevalence of CRE, CRPA and *Acinetobacter baumannii* in the wards

The length of the hospital stay was related to the percentage positive for CRE, CRPA and *Acinetobacter baumannii*. This was independent of the country.

	CRE pos samples	CRPA pos samples	Ac baum pos samples	CIM neg samples	sum
<b>GR</b>	244	81	98	1100	1523
>3d stay	206 (19.1%)	75 (7.0%)	84 (7.8%)	711 (66.1%)	1076
<3d stay	38 (8.5%)	6 (1.3%)	14 (3.1%)	389 (87.0%)	447
<b>IT</b>	84	10	13	1290	1397
>3d stay	71 (6.7%)	6 (0.6%)	12 (1.1%)	968 (91.6%)	1057
<3d stay	13 (3.8%)	4 (1.2%)	1 (0.3%)	322 (94.7%)	340
<b>RM</b>	173	26	47	1137	1383
>3d stay	160 (16.7%)	25 (2.6%)	45 (4.7%)	726 (75.9%)	956
<3d stay	13 (3.0%)	1 (0.2%)	2 (0.5%)	411 (96.3%)	427
<b>SP</b>	56	24	2	1343	1425
>3d stay	47 (4.6%)	20 (2.0%)	2 (0.2%)	950 (93.2%)	1019
<3d stay	9 (2.2%)	4 (1.0%)	0	393 (96.8%)	406
<b>total</b>	557	141	160	4870	5728*

\*Some samples were Ac.b. and CRE or CRPA pos.

Figure 3: Relation length of stay and percentage positive for CRE, CRPA and *Acinetobacter baumannii*

## IV. Conclusions

- The overall prevalence of carriage of CRE, CRPA and CRAB varied significantly across hospitals in European countries.
- In the wards investigated (hemato-oncology, intensive care, surgery and internal medicine), prevalence was highest in the intensive care units.
- Higher prevalence was related to longer stay in the hospital.
- The prevalence survey will be repeated after implementation of infection prevention measures and antibiotic stewardship.

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## REVERSE Consortium



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