

# Frequency of Occurrence and Antimicrobial Susceptibility of Bacteria Isolated from Patients Hospitalised with Bacterial Pneumonia in Western and Eastern Europe (SENTRY Program; 2021–2022)

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## Introduction

- The SENTRY Antimicrobial Surveillance Program monitors the frequency and antimicrobial susceptibility of organisms from various infection types worldwide since 1997.
- We evaluated the prevalence and antimicrobial susceptibility of bacteria isolated from patients hospitalised with pneumonia.

## Materials and Methods

- A total of 5,665 bacterial isolates were consecutively collected (1/patient) in 2021–2022 from 36 medical centres located Western Europe (W-EU; n=3,936; 23 centres from 10 countries: Belgium, France, Germany, Ireland, Italy, Portugal, Spain, Sweden, Switzerland, and the United Kingdom) and Eastern Europe/Mediterranean region (E-EU; n=1,729; 13 centres from 9 countries: Czech Republic, Greece, Hungary, Israel, Poland, Romania, Slovakia, Slovenia, and Turkey).
- Organisms were susceptibility tested at a monitoring laboratory by reference broth microdilution.
- Cefiderocol was only tested against carbapenem-resistant Enterobacterales (CRE) isolates.
- EUCAST breakpoints were applied.
- CRE isolates were subjected to whole genome sequencing (WGS).

## Results

- Gram-negative bacilli (GNB) represented 78.9% and 84.5% of organisms, while non-fermentative (NF) GNB represented 28.2% and 45.6% of organisms from W-EU and E-EU, respectively.
- P. aeruginosa* ranked first in W-EU (21.9%) and E-EU (24.2%), *A. baumannii* ranked second in E-EU (17.4%), and *S. maltophilia* ranked seventh in E-EU (3.1%) and eighth in W-EU (3.2%; Figure 1).
- S. aureus* was second in W-EU (17.6%) and fourth in E-EU (13.5%; Figure 1) and MRSA rates were higher in E-EU (20.1%) than W-EU (12.0%; Figure 2).
- Piperacillin-tazobactam and meropenem exhibited limited activity against *P. aeruginosa* from E-EU, with resistance rates of 27.2% (Figure 2) and 27.7% (Figure 3), respectively.
- P. aeruginosa* susceptibility to ceftazidime-avibactam and ceftolozane-tazobactam was 97.6% and 92.8% in W-EU and 92.8% and 90.2% in E-EU (Figure 3).
- Only 6.7% of *A. baumannii* isolates from E-EU were meropenem susceptible (Figure 2).
- Among *K. pneumoniae*, susceptibility to ceftriaxone and meropenem were 79.8% and 97.3% in W-EU and 43.7% and 73.3% in E-EU (data not shown).
- Among *E. coli*, susceptibility to ceftriaxone and levofloxacin were 86.3% and 84.8% in W-EU and 76.0% and 76.0% in E-EU (data not shown).
- CRE rates were significantly higher in E-EU (12.3%) compared to W-EU (1.0%;  $p < 0.001$ ) and CRE susceptibility to meropenem-vaborbactam was markedly higher in W-EU (84.2%; n=19) than E-EU (51.2%; n=80; Figures 4 and 5).
- The most active  $\beta$ -lactams against CRE were cefiderocol (89.5% susceptible [S]) and meropenem-vaborbactam (84.2%S) in W-EU and cefiderocol (81.2%) and ceftazidime-avibactam (68.8%) in E-EU (Figure 5).
- Although KPC was the most common carbapenemase type overall, it was observed in only around one-third of CRE isolates in W-EU (36.8%) and E-EU (37.5%; Figure 6).
- An MBL, mainly NDM type, was identified in 31.6% of CREs from W-EU and 31.3% of CREs from E-EU (Figure 6).
- The most active agents against CRE MBL producers (n=31) were cefiderocol (67.7%S), colistin (51.6%S), amikacin (38.7%S), and gentamicin (38.7%S; data not shown).

## Conclusions

- Rank order and antimicrobial susceptibility of bacteria isolated from patients hospitalised with pneumonia varied widely between W-EU and E-EU.
- Resistance rates among GNB were consistently higher in E-EU compared to W-EU.
- Multidrug-resistant NF-GNB represented an important cause of pneumonia in Europe, especially in E-EU.

Figure 1. Frequencies of organisms isolated from patients hospitalised with pneumonia in Western Europe (W-EU) and Eastern Europe (E-EU; 2021–2022)

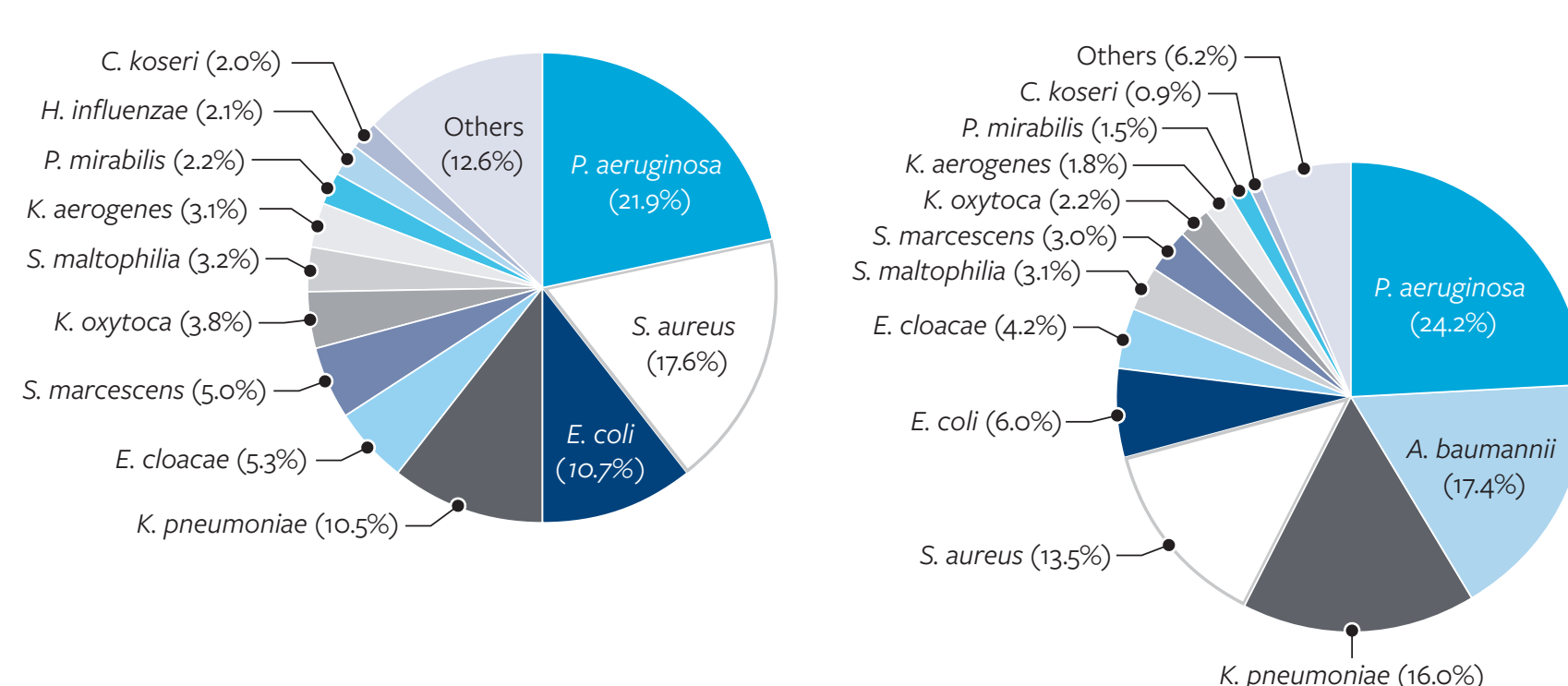
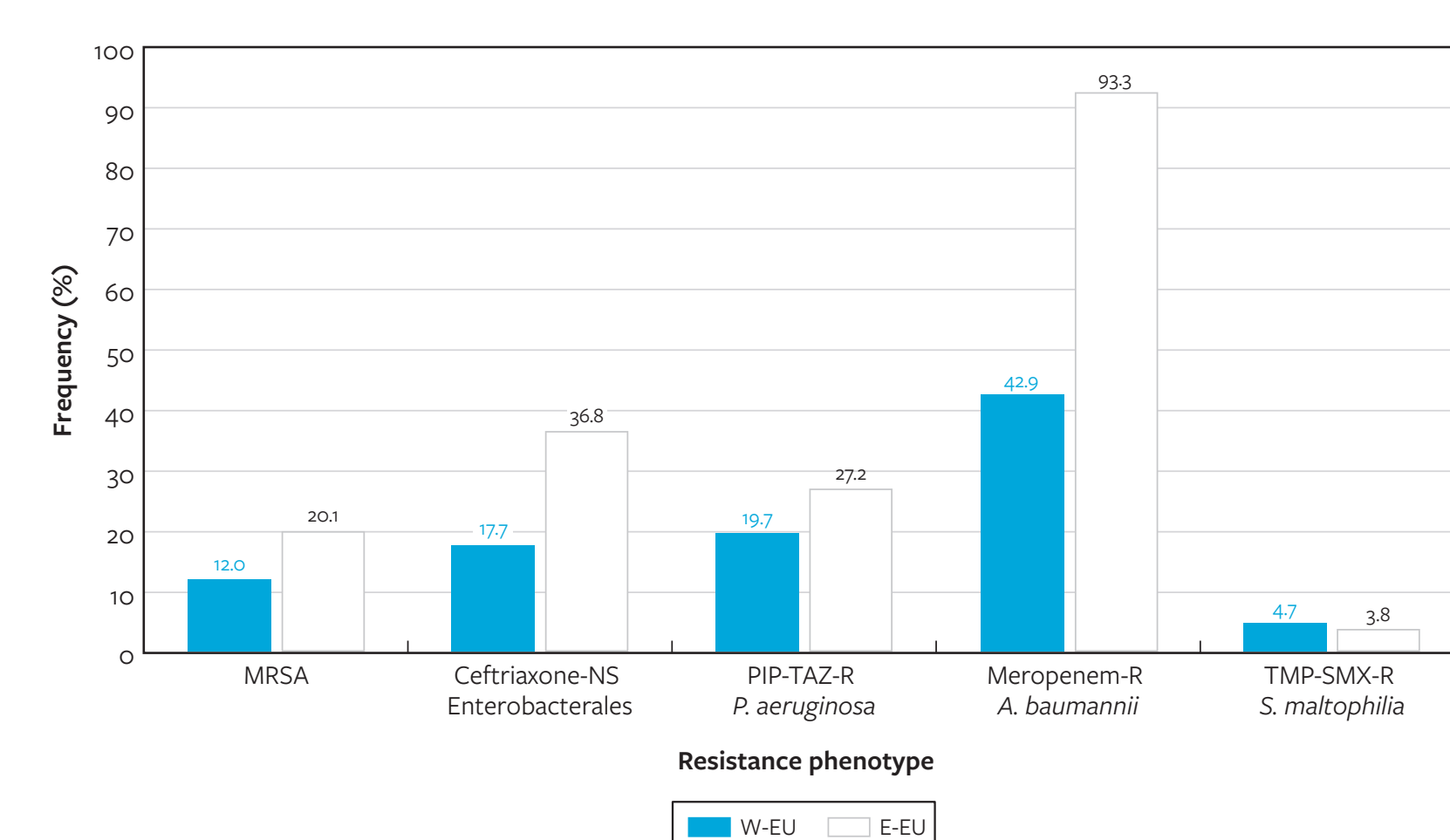
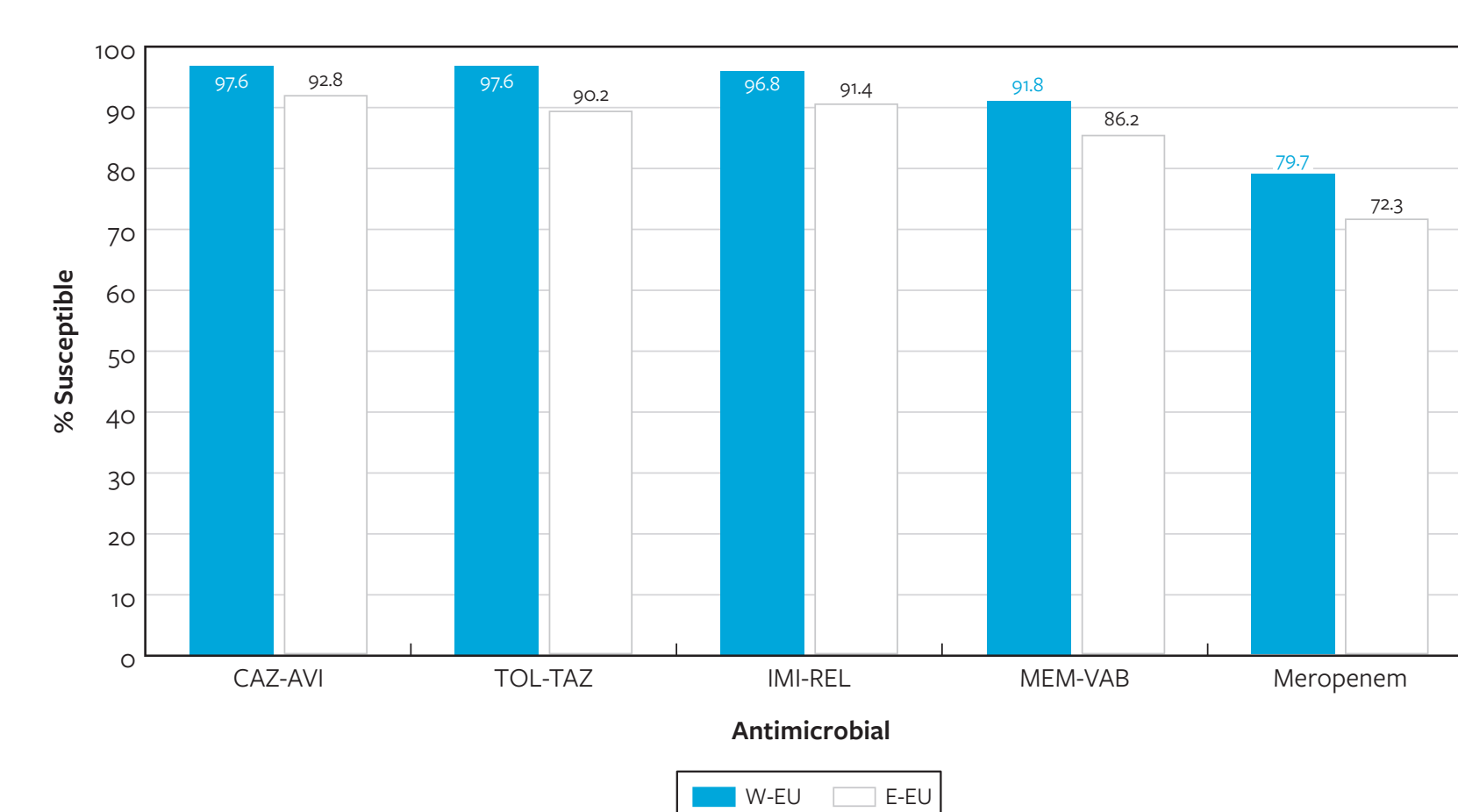


Figure 2. Prevalence of selected resistance phenotypes among organisms isolates from patients hospitalised with pneumonia stratified by region (2021–2022)



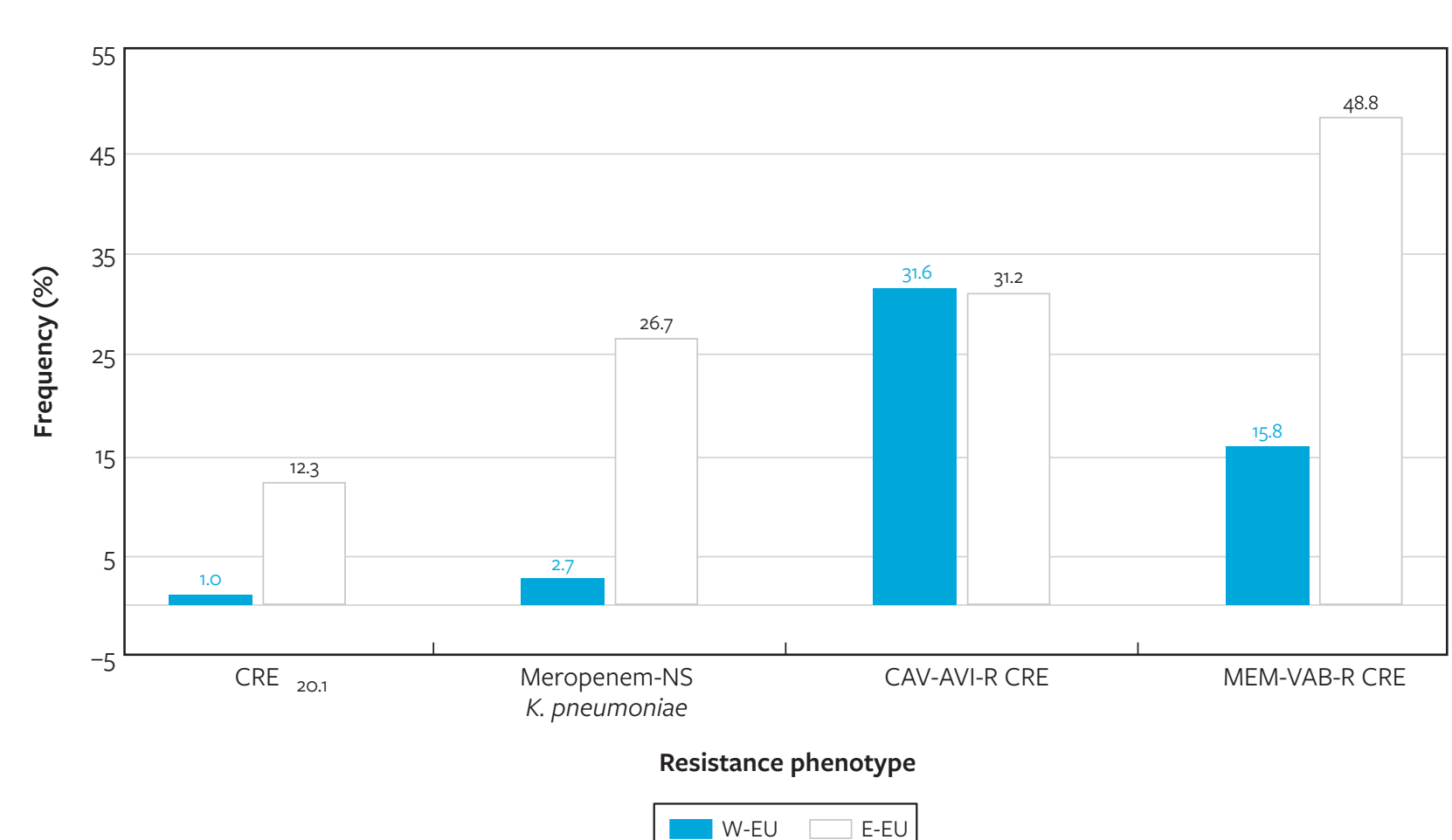
Abbreviations: W-EU, Western Europe; E-EU, Eastern Europe; MRSA, methicillin-resistant *S. aureus*; NS, nonsusceptible; PIP-TAZ, piperacillin-tazobactam; R, resistant.

Figure 3. Antimicrobial susceptibility of *P. aeruginosa* isolated from patients hospitalised with pneumonia stratified by European region



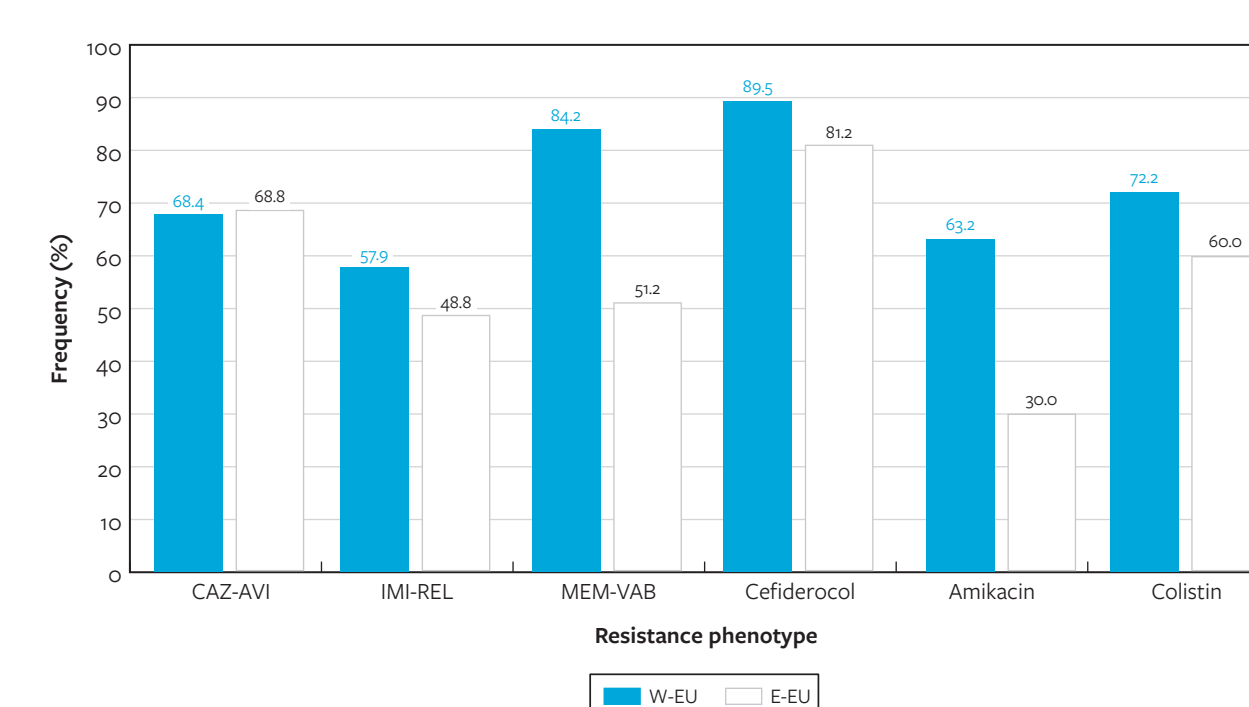
Abbreviations: W-EU, Western Europe; E-EU, Eastern Europe; CAZ-AVI, ceftazidime-avibactam; TOL-TAZ, ceftolozane-tazobactam; IMI-REL, imipenem-relebactam; MEM-VAB, meropenem-vaborbactam.

Figure 4. Prevalence of selected resistance phenotypes among Enterobacterales isolated from patients hospitalised with pneumonia stratified by region (2021–2022)



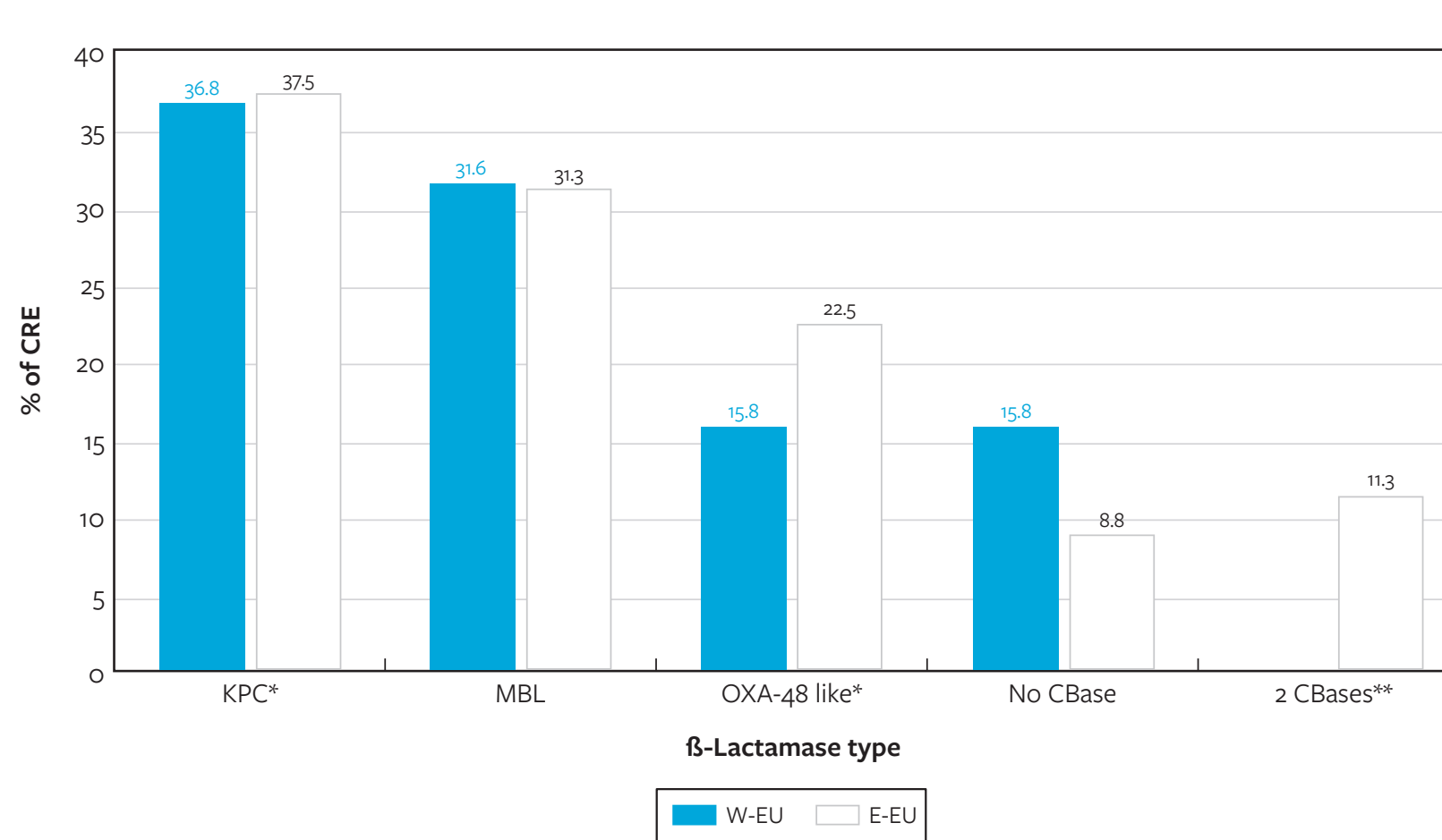
Abbreviations: W-EU, Western Europe; E-EU, Eastern Europe; CRE, carbapenem-resistant Enterobacterales; NS, nonsusceptible; CAZ-AVI, ceftazidime-avibactam; R, resistant; MEM-VAB, meropenem-vaborbactam.

Figure 5. Antimicrobial susceptibility of carbapenem-resistant Enterobacterales stratified by region



Abbreviation: CAZ-AVI, ceftazidime-avibactam; IMI-REL, imipenem-relebactam; MEM-VAB, meropenem-vaborbactam; W-EU, Western Europe; E-EU, Eastern Europe.

Figure 6. Frequency of carbapenemase types among carbapenem-resistant Enterobacterales (CRE) stratified by region



\* Excludes MBL co-producers.  
\*\* Five isolates had a KPC-2 and an NDM-1, 1 isolate had a KPC-3 and an NDM-1, and 3 isolates had an OXA-48 and an NDM-1.  
Abbreviations: KPC, *Klebsiella pneumoniae* carbapenemase; MBL, metallo- $\beta$ -lactamase; OXA, oxacillinase; CBase, carbapenemase.

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