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Frequency of Occurrence and Antimicrobial Susceptibility of Bacteria Isolated from Patients Hospitalised with Pneumonia in Europe and United States: Results from the SENTRY Program (2019–2021)

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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 16,385 bacterial isolates were consecutively collected (1/patient) in 2019–2021 from 66 medical centres located Western Europe (W-EU; *n*=5,737; 23 centres; 10 countries), Eastern Europe and the Mediterranean (E-EU; *n*=2,245; 15 centres; 10 countries), and the United States (US; *n*=8,403; 28 centres).
- Organisms were susceptibility tested at a monitoring laboratory by reference broth microdilution.
- EUCAST breakpoints were applied.
- Carbapenem-resistant Enterobacterales (CRE) isolates were subjected to whole genome sequencing (WGS).

Results

- Gram-negative bacilli (GNB) represented 76.9%, 85.0%, and 72.5% of organisms, while non-fermentative (NF) GNB represented 27.2%, 44.9%, and 33.9% of organisms from W-EU, E-EU, and the US, respectively.
- *P. aeruginosa* ranked first in W-EU and E-EU and second in the US; *A. baumannii* ranked third in E-EU; and *S. maltophilia* ranked sixth in the US and E-EU and ninth in W-EU (Figure 1).
- MRSA rates were highest in the US (39.3%), followed by E-EU (29.0%) and W-EU (15.8%; Figure 2).
- *P. aeruginosa* resistance to piperacillin-tazobactam (Figure 2) and meropenem was similar in W-EU and the US and higher in E-EU.
- Susceptibility of Enterobacterales to ceftriaxone (Figure 2) and meropenem (Figure 3) was 78.2% and 98.9% in W-EU, 54.5% and 85.2% in E-EU, and 76.3% and 98.0% in the US, respectively.
- Only 9.6% of *A. baumannii* isolates from E-EU were meropenem susceptible compared to 59.3% in W-EU and 66.2% in the US (data not shown).
- Ceftazidime-avibactam (CAZ-AVI), ceftolozane-tazobactam (TOL-TAZ), and imipenem-relebactam (IMI-REL) remained highly active against *P. aeruginosa* from W-EU and the US, but were less active in E-EU (Figure 3).
- Overall, carbapenem-resistance rates among Enterobacterales species were markedly higher in E-EU (15.9%) compared to W-EU (1.4%) and the US (2.3%; Figure 4).
- Susceptibility of carbapenem-resistant Enterobacterales (CRE) to CAZ-AVI, IMI-REL, and meropenem-vaborbactam (MEM-VAB) was the highest in the US, followed by W-EU and E-EU (Figure 5).
- In the US, CRE rates increased from 1.7–1.8% in 2019–2020 to 3.3% in 2021; KPC predominated all 3 years, but metallo-β-lactamases (MBLs) emerged in 2020 and were observed in 10.5% and 9.5% of CREs in 2020 and 2021, respectively (Figures 6 and 7).
- KPC predominated among CRE isolates in W-EU and the US, whereas KPC, MBLs, and OXA-48–like carbapenemases showed similar frequencies in E-EU (Figure 7).

Conclusions

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

References

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Figure 1. Frequencies of organisms isolated from patients hospitalised with pneumonia (2019–2021)

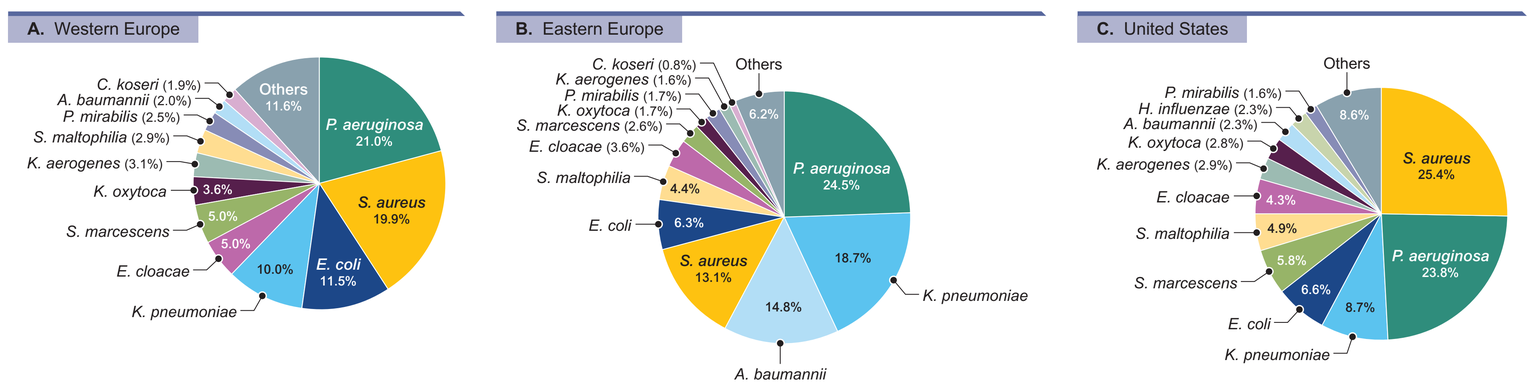
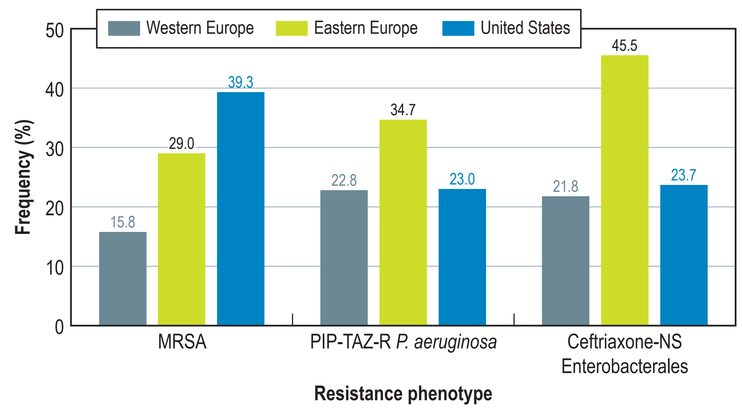
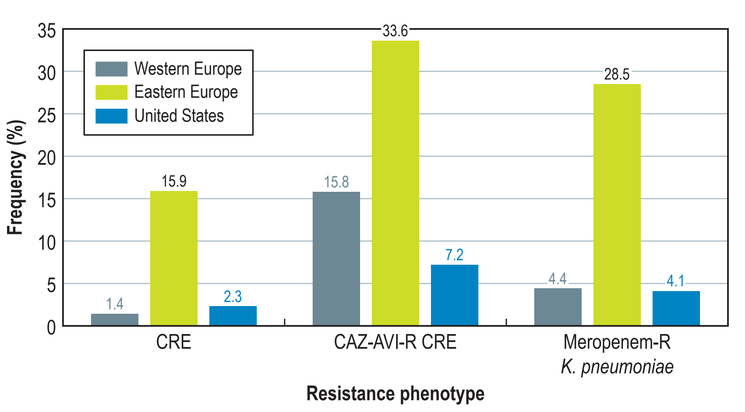


Figure 2. Prevalence of selected resistance phenotypes stratified by region (2019–2021)



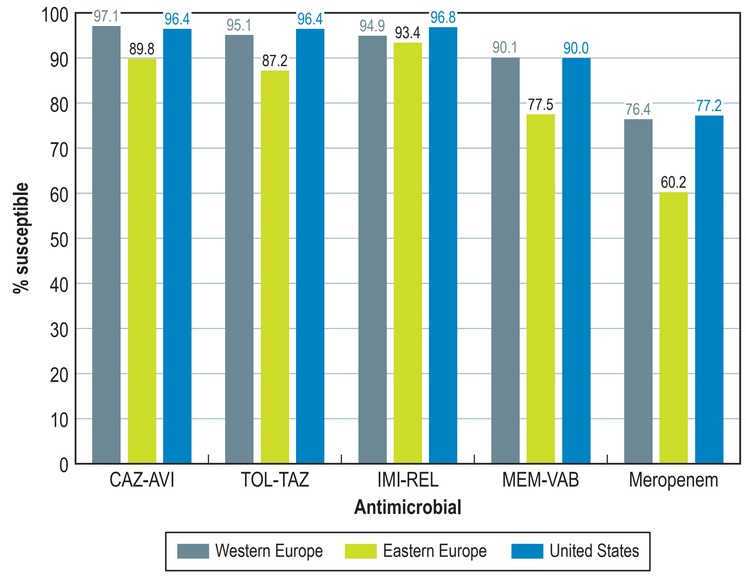
Abbreviations: MRSA, methicillin-resistant *S. aureus*; PIP-TAZ-R, piperacillin-tazobactam–resistant; NS, nonsusceptible.

Figure 4. Prevalence of selected resistance phenotypes stratified by region (2019–2021)



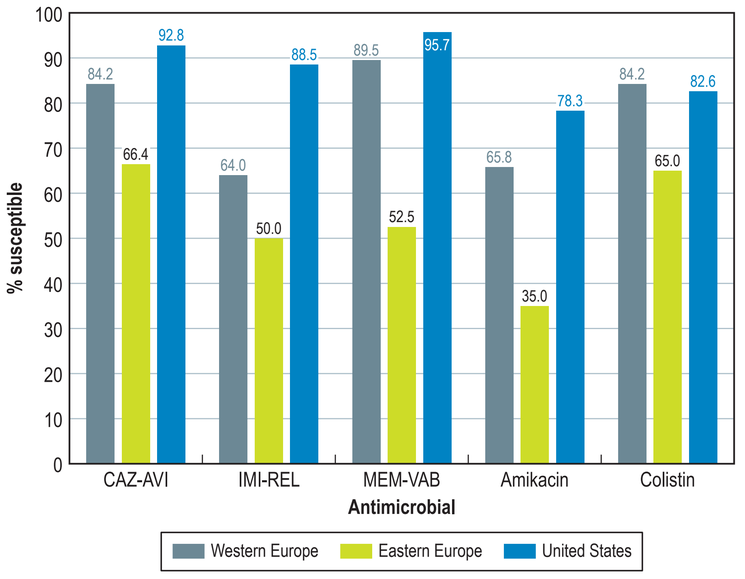
Abbreviations: CRE, carbapenem-resistant Enterobacterales; CAZ-AVI, ceftazidime-avibactam; R, resistant.

Figure 3. Antimicrobial susceptibility of *P. aeruginosa* stratified by region



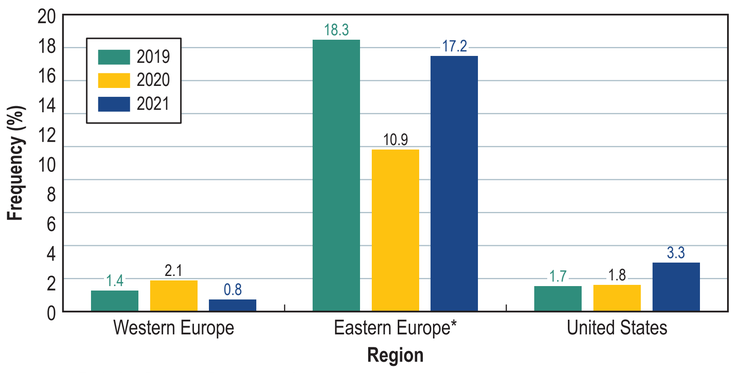
Abbreviations: CAZ-AVI, ceftazidime-avibactam; TOL-TAZ, ceftolozane-tazobactam; IMI-REL, imipenem-relebactam; MEM-VAB, meropenem-vaborbactam.

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



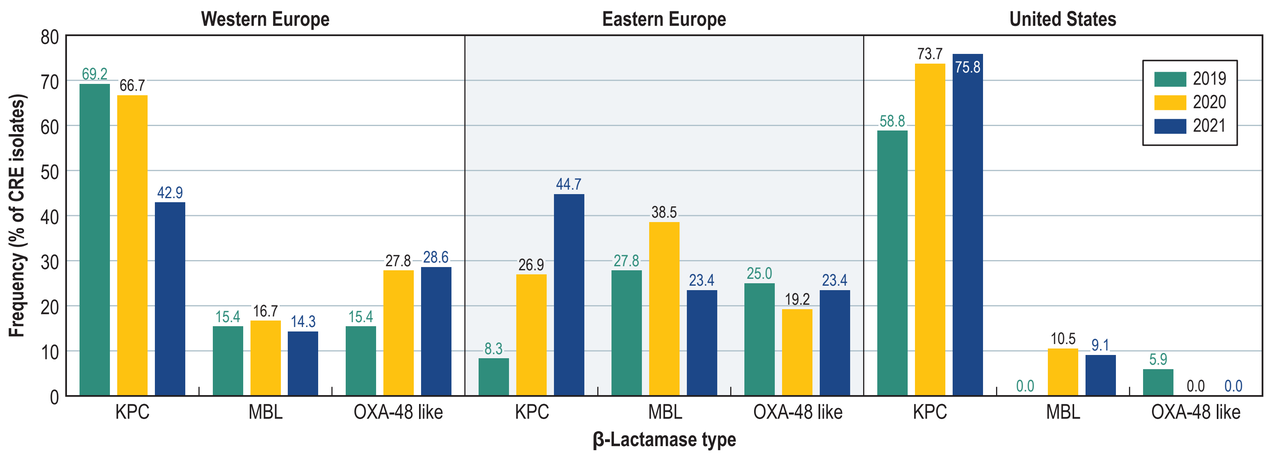
Abbreviations: CAZ-AVI, ceftazidime-avibactam; IMI-REL, imipenem-relebactam; MEM-VAB, meropenem-vaborbactam.

Figure 6. Yearly prevalence of carbapenem-resistant Enterobacterales stratified by region



*Excludes Belarus, Russia and Israel.

Figure 7. Yearly frequency of carbapenemase types among carbapenem-resistant Enterobacterales (CRE) stratified by region



Abbreviations: KPC, *Klebsiella pneumoniae* carbapenamase; MBL, metallo-β-lactamase; OXA, oxacillinase.