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Bloodstream Infections in Europe and United States: Aetiology and Antimicrobial Susceptibility Results from the SENTRY Antimicrobial Surveillance Program (2019–2021)

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Introduction

- The SENTRY Antimicrobial Surveillance Program monitors the frequency and antimicrobial susceptibility of bacteria causing bloodstream (BSI) and other infections in medical centres worldwide since 1997.
- We evaluated SENTRY results for BSI in Europe and the United States (USA).

Materials and Methods

- A total of 19,023 organisms were consecutively collected (1/patient) in 2019–2021 from 72 medical centres located in Western Europe (W-EU; *n*=8,031; 26 centres from 10 countries: Belgium, France, Germany, Ireland, Italy, Portugal, Spain, Sweden, Switzerland, and the United Kingdom), Eastern Europe (E-EU; *n*=1,963; 14 centres from 9 countries: Belarus, Czech Republic, Greece, Hungary, Israel, Romania, Russia, Slovenia, and Turkey), and USA (*n*=9,029; 32 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

- *S. aureus*, *E. coli*, *K. pneumoniae*, *E. faecalis*, and *P. aeruginosa* represented the top 5 organisms in all 3 regions and 63.5–69.6% of the collection (Figure 1).
- Gram-negative bacilli represented 59.8%, 68.7%, and 49.8% of organisms in W-EU, E-EU, and USA, respectively.
- *E. coli* susceptibility to ceftriaxone was lowest in E-EU (73.0%), followed by USA (81.0%) and W-EU (82.3%; Figure 2).
- Among *K. pneumoniae*, susceptibility to ceftriaxone and meropenem (Figure 2) was 65.9% and 89.7% in W-EU and only 36.2% and 74.9% in E-EU, respectively.
- Ceftazidime resistance among *E. cloacae* was similar in W-EU and E-EU and lowest in USA (Figure 2).
- Multidrug-resistant (MDR) phenotypes among Enterobacterales and *P. aeruginosa* and CRE phenotypes were markedly higher in E-EU than W-EU and USA (Figure 3).
- Ceftazidime-avibactam and meropenem-vaborbactam retained activity against Enterobacterales, with overall susceptibility rates of 99.2%–99.3%, but resistance to these agents was elevated among CRE, especially in E-EU and USA (Figure 4).
- Ceftazidime-avibactam (CAZ-AVI), ceftolozane-tazobactam (TOL-TAZ), and imipenem-relebactam (IMI-REL) remained highly active against *P. aeruginosa* from W-EU and USA, but less active in E-EU (Figure 5).
- The prevalence of methicillin-resistant *S. aureus* and vancomycin-resistant *E. faecium* phenotypes were higher in USA compared to W-EU and E-EU (Figure 6).
- KPC was the most common carbapenemase type among CRE isolates in W-EU and USA, whereas OXA-48 type predominated in E-EU (Figure 7).

Conclusions

- The frequency and susceptibility causing BSI varied considerably among W-EU, E-EU, and USA.
- Resistance rates among GNB were markedly higher in E-EU compared to W-EU and USA.
- Increased resistance to newer β-lactamase inhibitor combinations among CRE and *P. aeruginosa* from some regions is of great concern.

References

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Fuhrmeister AS, Jones RN, Sader HS, et al. (2019). Global surveillance of antimicrobial resistance: 20 years of experience with the SENTRY Program. OFID; 6(Supplement 1):S1-S102.

EUCAST (2023). Breakpoint tables for interpretation of MICs and zone diameters. Version 13.0, January 2023. Available at: https://www.eucast.org/clinical_breakpoints.

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Figure 1. Frequencies of organisms isolated from patients hospitalised with pneumonia

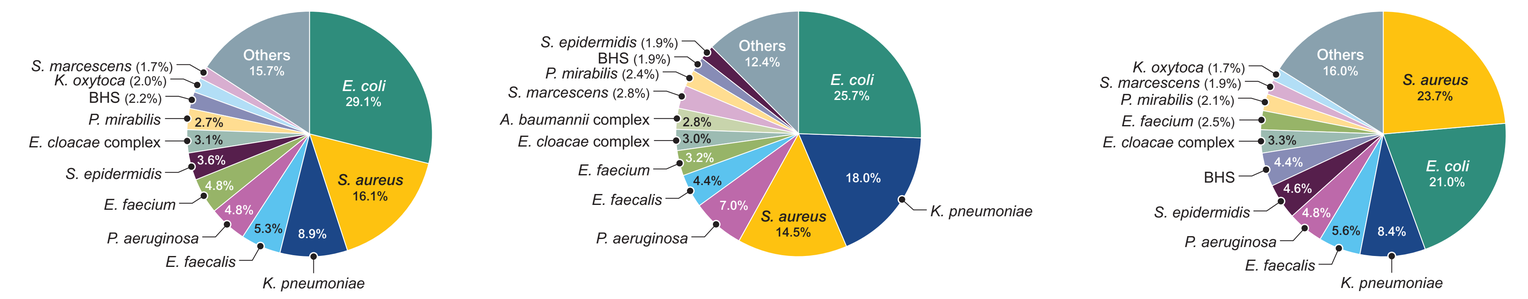
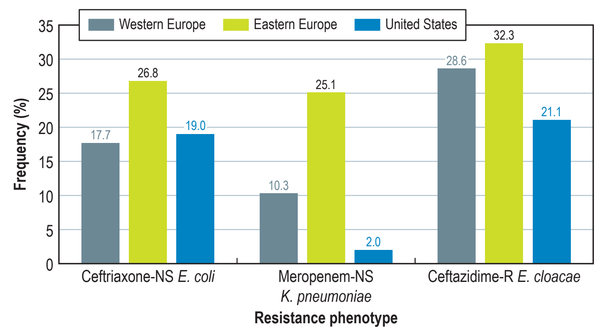
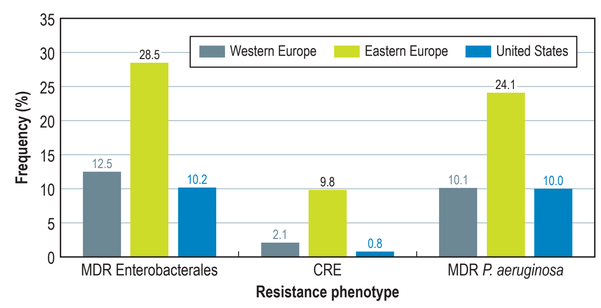


Figure 2. Prevalence of selected resistance phenotypes among key Enterobacterales species stratified by geographic region



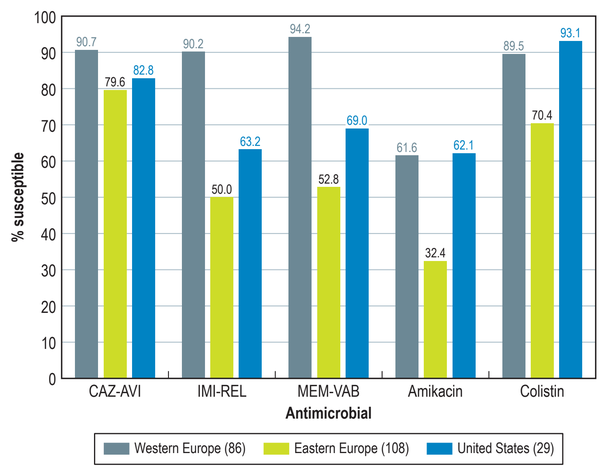
Abbreviations: NS, nonsusceptible; R, resistant.

Figure 3. Prevalence of selected resistance phenotypes among Gram-negative bacteria



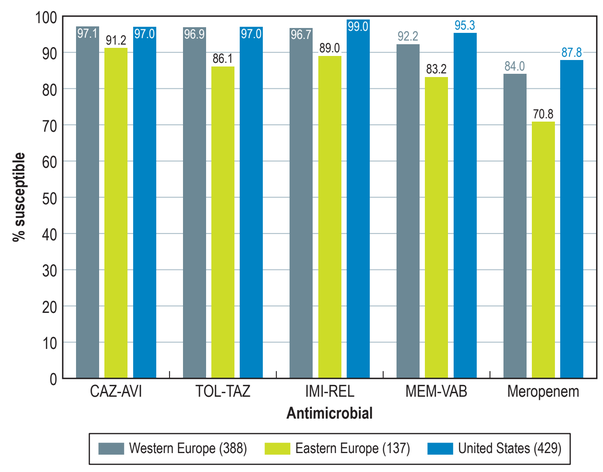
Abbreviations: MDR, multidrug-resistant; CRE, carbapenem-resistant Enterobacterales.

Figure 4. Antimicrobial susceptibility of carbapenem-resistant Enterobacterales



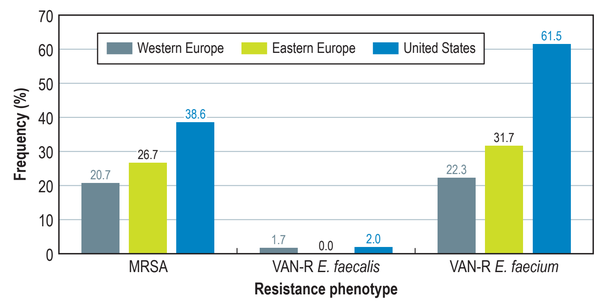
Abbreviations: CAZ-AVI, ceftazidime-avibactam; IMI-REL, imipenem-relebactam; MEM-VAB, meropenem-vaborbactam.

Figure 5. Antimicrobial susceptibility of *P. aeruginosa* stratified by region



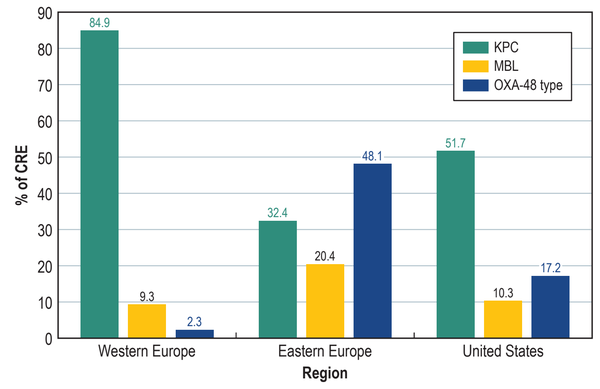
Abbreviations: CAZ-AVI, ceftazidime-avibactam; TOL-TAZ, ceftolozane-tazobactam; IMI-REL, imipenem-relebactam; MEM-VAB, meropenem-vaborbactam.

Figure 6. Prevalence of selected resistance phenotypes among Gram-positive organisms



Abbreviations: MRSA, methicillin-resistant *S. aureus*; VAN-R, vancomycin-resistant.

Figure 7. Frequency of carbapenemase types among carbapenem-resistant Enterobacterales



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

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