

# Impact of the COVID Pandemic in Susceptibility Patterns of Gram-Negative Organisms: A Report from the SENTRY Antimicrobial Surveillance Program

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## Introduction

- Studies documented the impact of the COVID pandemic on antimicrobial resistance at local and national levels.
- Reports have recorded the increased prescription of antimicrobial agents and the rise of antimicrobial resistance among several organism groups.
- This study evaluated susceptibility patterns of the main Gram-negative organisms/groups collected worldwide for the SENTRY Program during the COVID pandemic (2020–2021) and compared these patterns to those rates from the 3 previous years (2017–2019).

## Materials and Methods

- A total of 82,256 Gram-negative non-fastidious isolates were consecutively collected (1 isolate/episode).
- Only hospitals participating in all years were evaluated.
- Isolates were susceptibility tested by reference broth microdilution following the CLSI guidelines.
- Results were interpreted using CLSI criteria.
- Extended-spectrum β-lactamase (ESBL)-phenotype isolates were defined as those displaying MIC values >2 mg/L for one of the following agents: aztreonam, ceftriaxone, and ceftazidime.
- Carbapenem-resistant isolates were those resistant to meropenem and/or imipenem when applying CLSI criteria.
- Differences in percentages were investigated using the Chi-square test to determine statistical significance ( $p < 0.05$ ).

## Results

- Overall, ESBL phenotype rates increased among isolates recovered from skin and soft tissue infections (+8.9%; Figure 1) when 2017 rates were compared to 2021 rates (pre and post COVID, respectively).
  - ESBL rates were higher in Latin America for *E. coli* (+4.7%) and *P. mirabilis* (+5.3%) isolates when compared to overall isolates from these species (Figure 1).
  - ESBL phenotype rates increased among *K. pneumoniae* isolates from Europe (+4.3%) and Latin America (+11.2%; Figure 1).
- Carbapenem-resistant Enterobacterales (CRE) significantly increased from 2.6% in 2017 to 3.1% in 2021, mainly driven by an increase of 4.8% in Latin America (Figure 1).
  - Carbapenem-resistant *K. pneumoniae* (CR-KPN) increased 1.6% during the study period.
  - Rising CR-KPN rates were noted in Latin America (+5.0%) and among isolates collected from pneumonia in hospitalized patients (+4.3%) and skin and skin structure infections (+8.3%; Figure 1).
- Enterobacterales MDR rates increased in Latin America (+7.1%) with increases among *E. coli* (+4.3%) and *K. pneumoniae* (+10.4%).
- Carbapenem-resistant *A. baumannii-calcoaceticus* species complex (CRAB) increased in Latin America (+8.4%) and Europe (+4.3%) and among isolates from pneumonia in hospitalized patients (+5.8%), bloodstream (+12.4%), and intra-abdominal (+21.7%) infections (Figure 2).
- MDR rates among *A. baumannii-calcoaceticus* species complex isolates increased from 72.7% to 77.4%, with upward trends in Latin America (+6.4%) and Europe (+4.6%; Figure 2).
- MDR rates among *P. aeruginosa* isolates decreased for all infection types and regions during the study period (data not shown).
- All resistance rates for isolates from Asia-Pacific were the same or lower in 2020–2021 compared to 2017–2019 (data not shown).

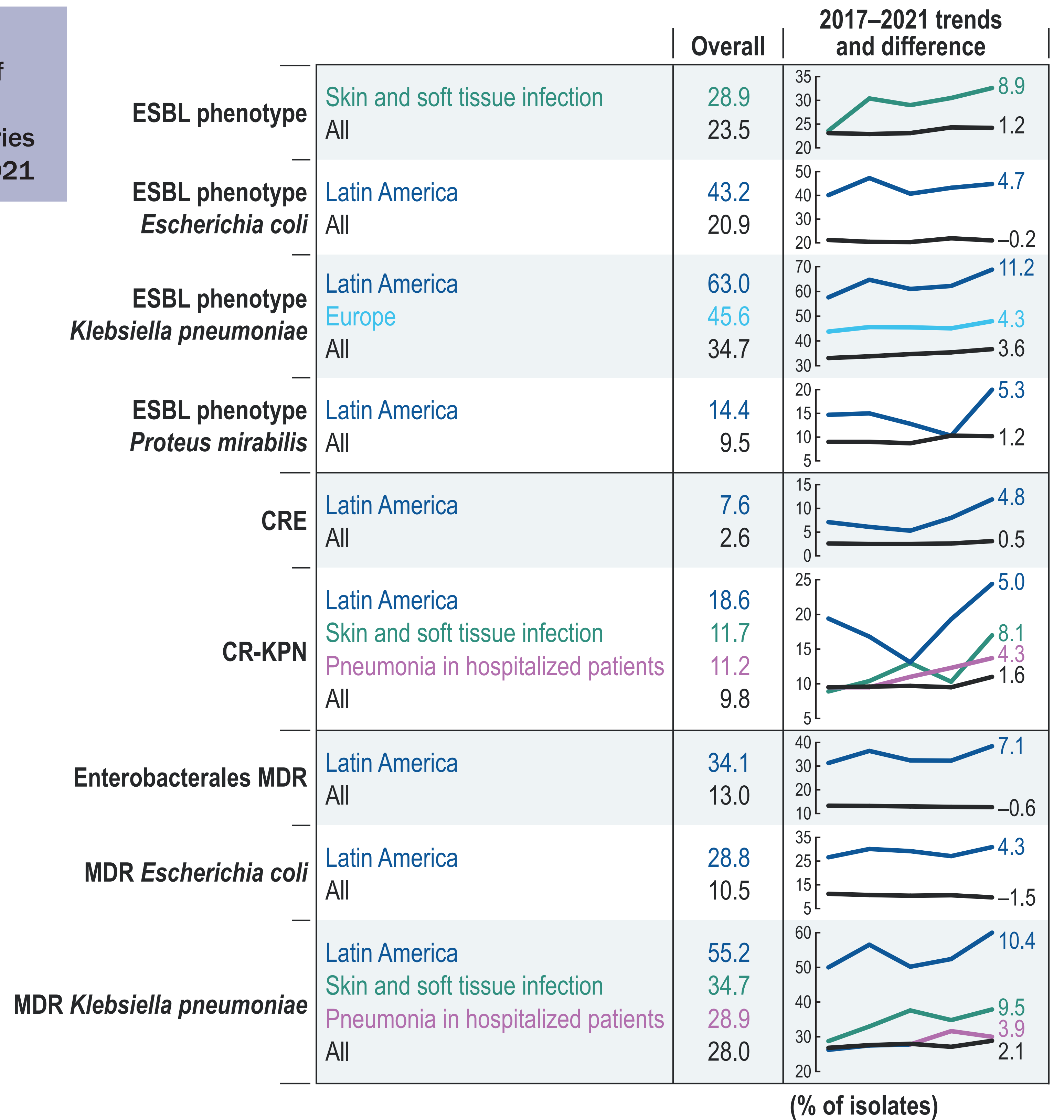
## Conclusions

- The COVID pandemic changed healthcare practices worldwide, including the use of antimicrobial agents.
- We used the SENTRY Program database to evaluate the impact of these changes on the antimicrobial susceptibility patterns of the main Gram-negative organism species.
- A dramatic increase in resistance was observed in Latin America and continuous monitoring is recommended in this region.

## Acknowledgements

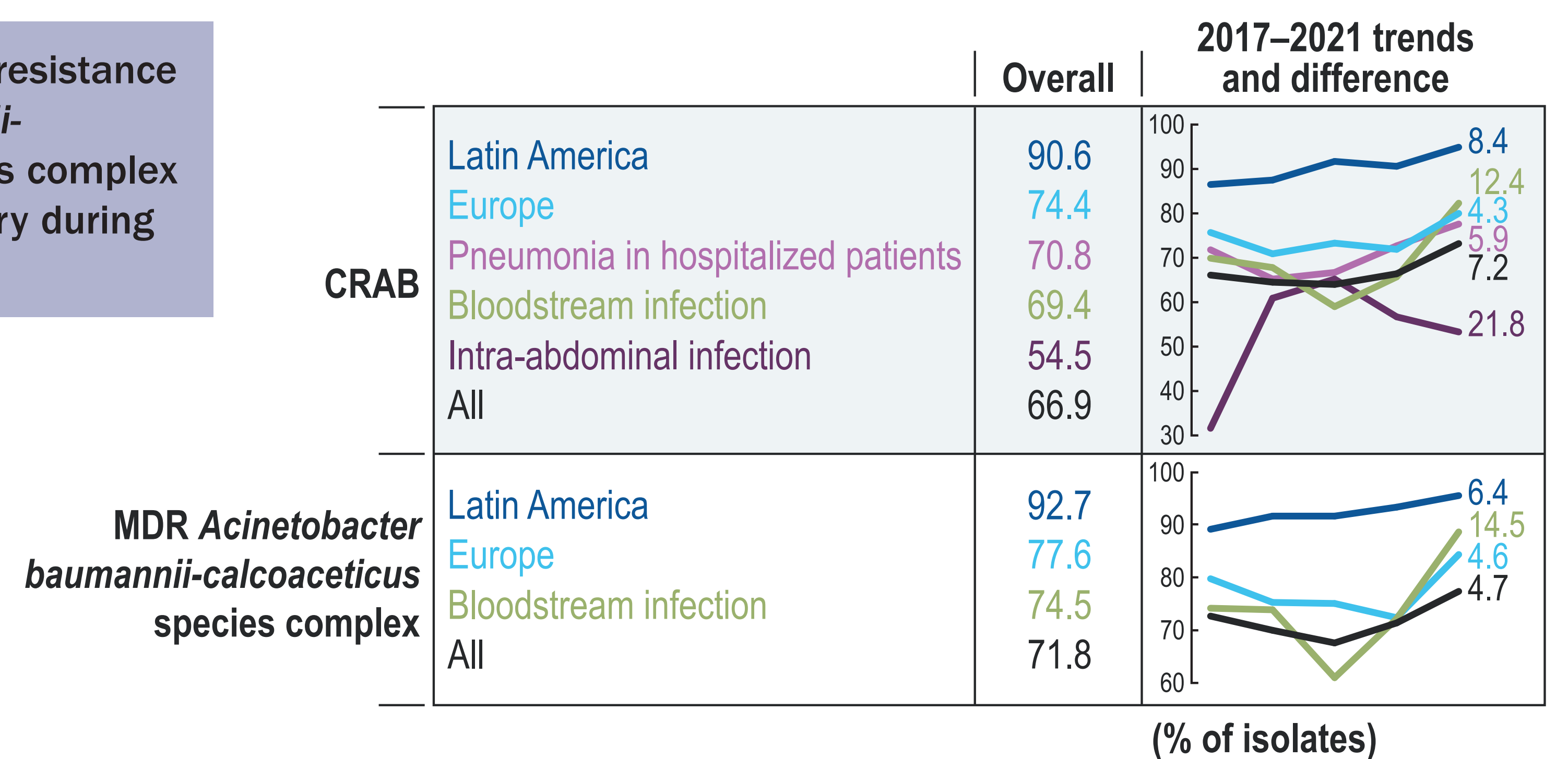
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**Figure 1. Increasing rates of Enterobacterales resistance categories during 2017 to 2021**



Abbreviations: ESBL, extended-spectrum β-lactamase; MDR, multi-drug resistant; CRE, carbapenem-resistant Enterobacterales; CR-KPN, carbapenem-resistant *Klebsiella pneumoniae*

**Figure 2. Increasing resistance rates of *A. baumannii-calcoaceticus* species complex by resistance category during 2017 to 2021**



Abbreviations: CRAB, carbapenem-resistant *A. baumannii-calcoaceticus* species complex; MDR, multi-drug resistant

## References

Baggs J, Rose AN, McCarthy NL, Wolford H, Srinivasan A, Jernigan JA, Reddy SC. Antibiotic-Resistant Infections Among Inpatients with Coronavirus Disease 2019 (COVID-19) in US Hospitals. *Clin Infect Dis.* 2022;75(Suppl 2):S294-S297.

Rose AN, Baggs J, Wolford H, Neuhauser MM, Srinivasan A, Gundlapalli AV, Reddy S, Kompaniyets L, Pennington AF, Grigg C, Kabbani S. Trends in Antibiotic Use in United States Hospitals During the Coronavirus Disease 2019 Pandemic. *Open Forum Infect Dis.* 2021;8(6):ofab236.

Clinical and Laboratory Standards Institute (2018). M07Ed11. Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically. Wayne, PA.

Clinical and Laboratory Standards Institute (2022). M100Ed32. Performance Standards for Antimicrobial Susceptibility Testing. Wayne, PA.

Centers for Disease Control (2022). COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022. Atlanta, GA. <https://dx.doi.org/10.15620/cdc:117915>

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