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Letter to the Editor

Age- and sex-stratified trends in carbapenem-resistant *Acinetobacter baumannii* and Enterobacterales: insights from MuGSI (2012–2022)

Sir,

Preventing healthcare-associated infections remains a top priority for the Centers for Disease Control and Prevention (CDC) and partners across public health and health care. This paper analyses the newly released dataset 'HAICViz_-_MuGSI_20250831.csv' (published 25th July 2025) to examine and visualize age- and sex-specific trends in two high-consequence antibiotic-resistant pathogens: carbapenem-resistant *Acinetobacter baumannii* (CRAB) and carbapenem-resistant Enterobacterales (CRE) [1]. Figures 1–3 summarize the principal findings.

The CDC's Emerging Infections Program (EIP) coordinates a national surveillance network focused on antimicrobial-resistant pathogens through the Multi-site Gram-negative Surveillance Initiative. This programme employs standardized, population-based surveillance across EIP sites, using uniform case definitions and systematic protocols to identify and report resistant infections. The resulting data inform evidence-based prevention policies nationwide.

CRAB and CRE represent urgent public health threats due to their limited treatment options, high mortality rates, and substantial clinical challenges. The World Health Organization has included both pathogens in its priority list of antimicrobial-resistant bacteria [3]. Recent research from Thacharodi *et al.* [2] highlighted the significance of CRAB as a nosocomial pathogen with concerning mortality rates and toxicity-limited treatment options. Lodise *et al.* [4] found that CRAB infections were associated with nearly two-fold higher mortality (20.5% vs 11.3%) compared with carbapenem-susceptible strains in US hospitals. Similarly, Akbari *et al.* [5] demonstrated that targeted infection prevention measures can significantly reduce the prevalence of CRAB and carbapenem-resistant *Klebsiella pneumoniae* in intensive care settings.

This analysis revealed distinct age and sex patterns in the epidemiology of these infections. Figure 1 (CRAB by age) and Figure 2 (CRE by age) show that, from 2012 to 2022, case rates increased with age, peaking in adults aged ≥ 80 years, where CRE exhibited pronounced spikes into the mid-60s

around 2016–2017, dipped in 2020, and rebounded to approximately 50 by 2022. Adults aged 65–79 years experienced a steady increase in CRE rates from the low teens at the start of the period to approximately 20 by 2021–2022; those aged 50–64 years saw gradual increases from approximately 4–5 to nearly 7 by 2022. CRAB rates were consistently lower across all age groups; in adults aged ≥ 80 years, they recovered after a mid-series decline to peak near 8 by 2022. Among those aged 65–79 years, CRAB rates fluctuated between 1 and 3; in those aged 50–64 years, around 1–2; and in adults aged < 50 years, below 1. Paediatric CRE rates in individuals aged 0–18 years remained minimal (≤ 1), with only slight upticks after 2018.

Figure 3 (sex trends) shows that from 2012 to 2015, CRAB and CRE rates remained low and stable for both sexes. In males, CRAB rates decreased from approximately 2.3 in 2012 to approximately 1.5 in 2015, while in females, rates remained just below 1. Over the same interval, CRE rates hovered around 2.4–2.5 in males, and increased from approximately 3.4 to 3.5 in females. In 2016, both infections surged: CRE rates increased to approximately 6.0 and nearly 9.8 in males and female, respectively, followed by declines through 2018 (to approximately 4.2 in males and approximately 6.4 in females), and subsequent increases to approximately 5.4 and 7.3, respectively, by 2022. CRAB rates continued a flat-to-declining trajectory until 2020, reaching approximately 0.9 in males and approximately 0.4 in females, then increased sharply in 2021–2022, ending at approximately 2.8 for males and 1.8 for females.

These age gradients likely reflect greater healthcare exposure among older adults, including more frequent hospitalizations, increased device use, higher cumulative antibiotic exposure, multi-morbidity and immunosenescence. The concentration of burden in older adults underscores the need for age-targeted strategies, such as enhanced infection prevention in acute and long-term care settings, geriatric-focused antimicrobial stewardship, and targeted screening protocols for high-risk admissions.

Sex differences may reflect variations in healthcare utilization patterns, anatomical and hormonal factors influencing susceptibility (particularly for urinary tract infections caused by Enterobacterales), and differences in comorbidity profiles. These findings suggest the importance of tailored prevention approaches, including reinforced catheter-associated urinary tract infection prevention in settings serving older females, and ensuring equitable access to diagnostics and stewardship programmes.

For transparency and reproducibility, the Python code used for analysis (hai2.py) is publicly available on GitHub [6].

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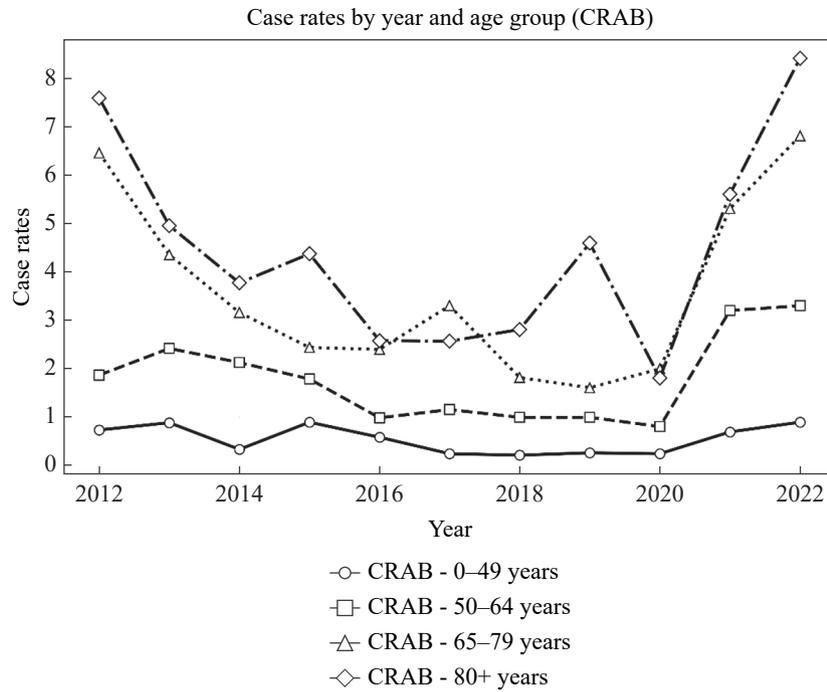


Figure 1. Trends in carbapenem-resistant *Acinetobacter baumannii* (CRAB) by age.

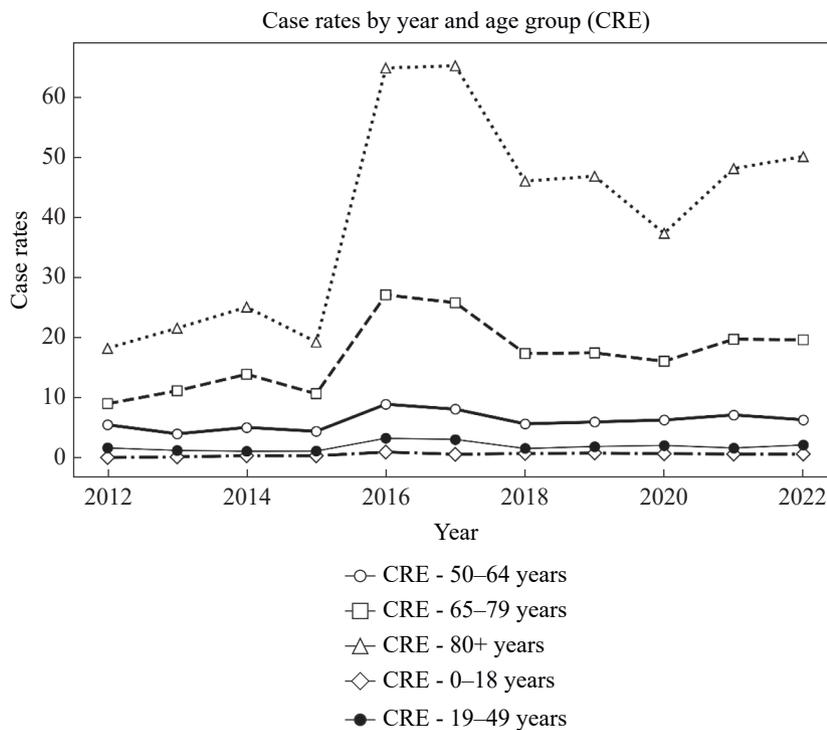


Figure 2. Trends in carbapenem-resistant Enterobacterales (CRE) by age.

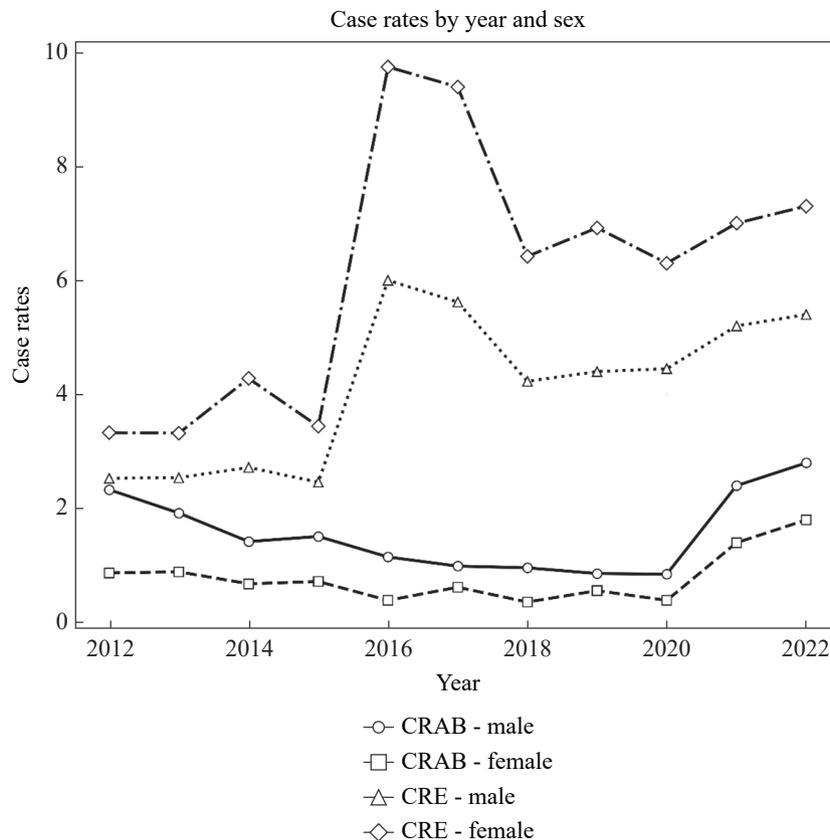


Figure 3. Trends in carbapenem-resistant *Acinetobacter baumannii* (CRAB) and carbapenem-resistant Enterobacterales (CRE) by sex.

Conflict of interest statement

None declared.

Funding sources

None.

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