National Institute of Health

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Correlation between the AMR and AMC: changes between 2016 and 2023 based on the national data in South Korea

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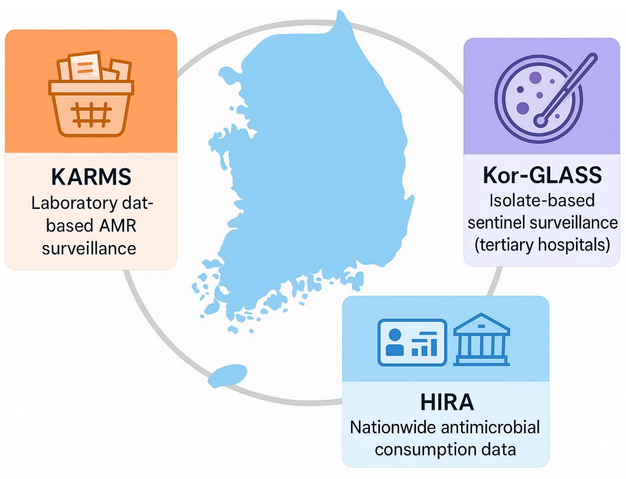
Background

Source: World Health Organization. *Causes of Antibiotic Resistance* [Infographic]. Retrieved from https://www.who.int/drugresistance

- Antimicrobial resistance (AMR) remains a major global health threat, exacerbated by inappropriate antimicrobial use (AMU) and healthcare system disparities.
- The emergence and spread of antimicrobial resistance (AMR) are driven by complex interactions between human, animal, and environmental factors.
- Inappropriate antimicrobial use (AMU), insufficient infection prevention, and the slow development of new antibiotics accelerate this global health crisis.
- Addressing AMR requires integrated surveillance systems and coordinated actions across healthcare levels to guide evidence-based stewardship.



- In South Korea, the **KARMS** and **Kor-GLASS** surveillance programs provide comprehensive national AMR data, while **HIRA** tracks antimicrobial consumption across all healthcare levels.

✓ **KARMS (Korea Antimicrobial Resistance Monitoring System):** A nationwide surveillance system that monitors antimicrobial resistance trends across community and hospital sectors in Korea.

✓ **Kor-GLASS (Korea Global Antimicrobial Resistance Surveillance System):** A sentinel-based national program aligned with WHO-GLASS, providing standardized laboratory data on key bacterial pathogens from major hospitals.

✓ **HIRA (Health Insurance Review and Assessment Service):** A national administrative database that tracks antimicrobial consumption through prescription claims across all healthcare settings.

- This study analyzed **ten-year (2014–2023)** national AMU and AMR data to identify long-term trajectories and pandemic-related deviations across pathogens and healthcare settings.

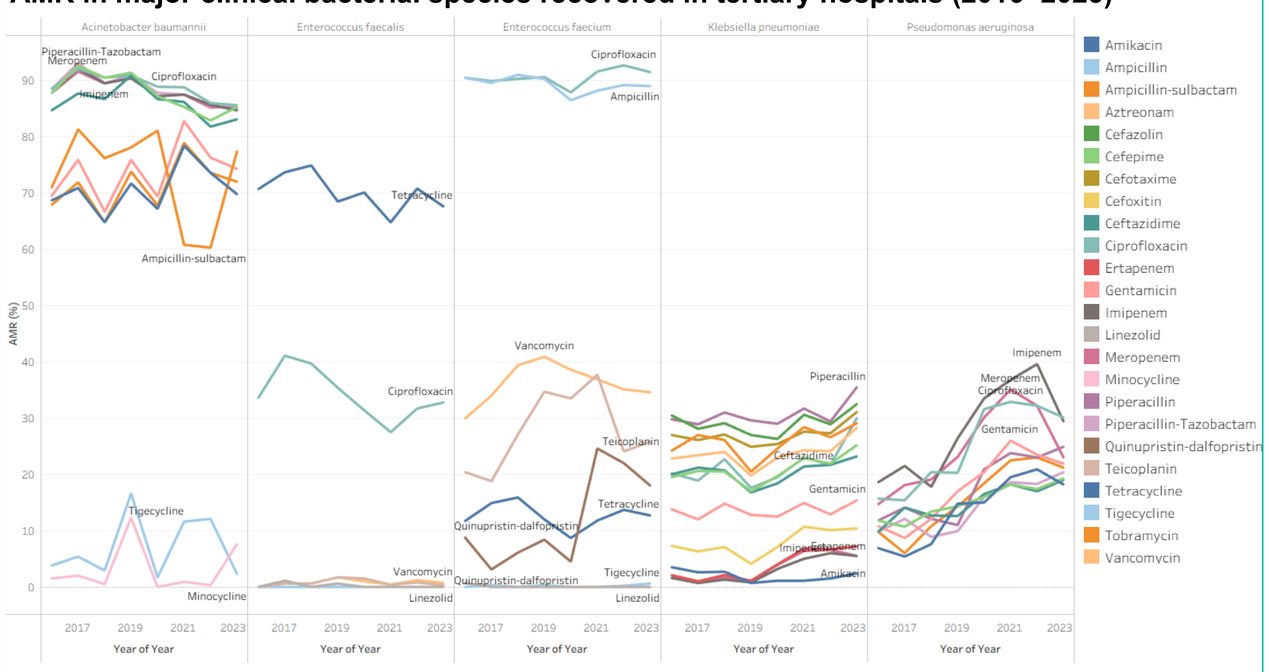
Data sources (2014-2023)	Analysis dimensions	Output and Interpretation
KARMS, Kor-GLASS (AMR) HIRA (AMU)	Temporal trends (pre/during/post pandemic) Pathogen-specific trajectories Hospital-type comparison	Long-term AMU-AMR trends Pandemic-related deviations Evidence for stewardship prioritization

Methods

- **Data sources (2014–2023)**
- **AMR** data* obtained from KARMS and Kor-GLASS
  *AMR rates represented as **percentage of resistant isolates** per species per year.
- **AMC** data* derived from HIRA nationwide claims database.
  *AMC expressed as **defined daily doses (DDD) per 1,000 inhabitants per day (DID)**.
- Data were visualizedby using **Tableau Desktop (Prof. Ed. v.20252.25.0912.2314)**.

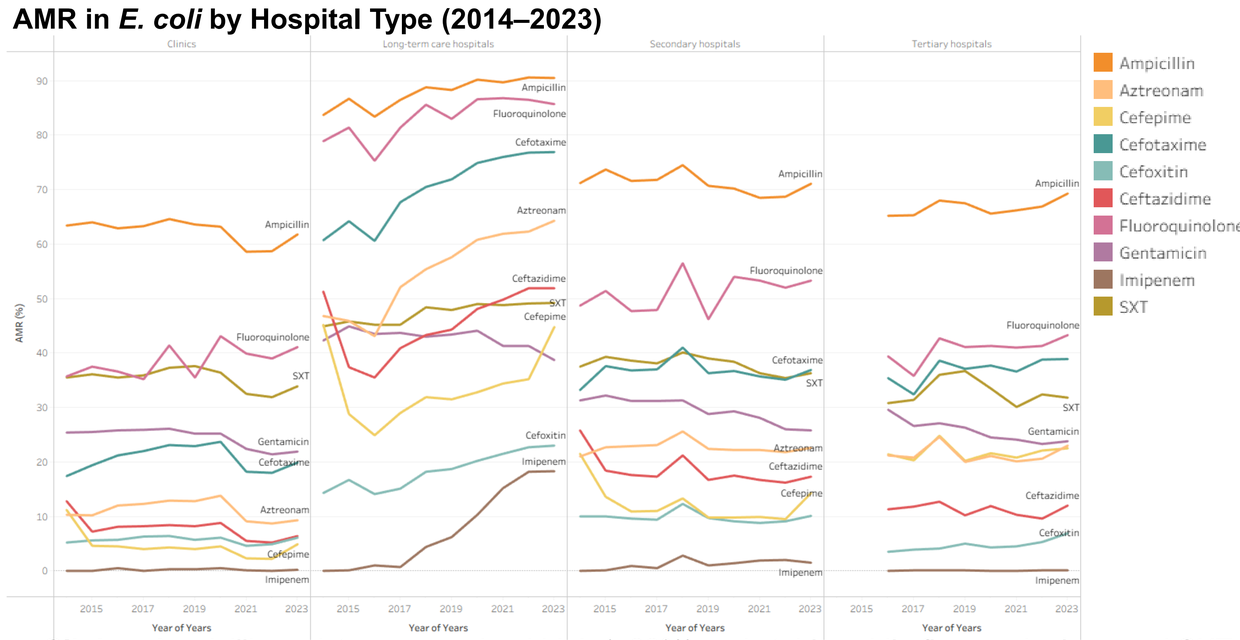
Results

AMR in major clinical bacterial species recovered in tertiary hospitals (2016–2023)



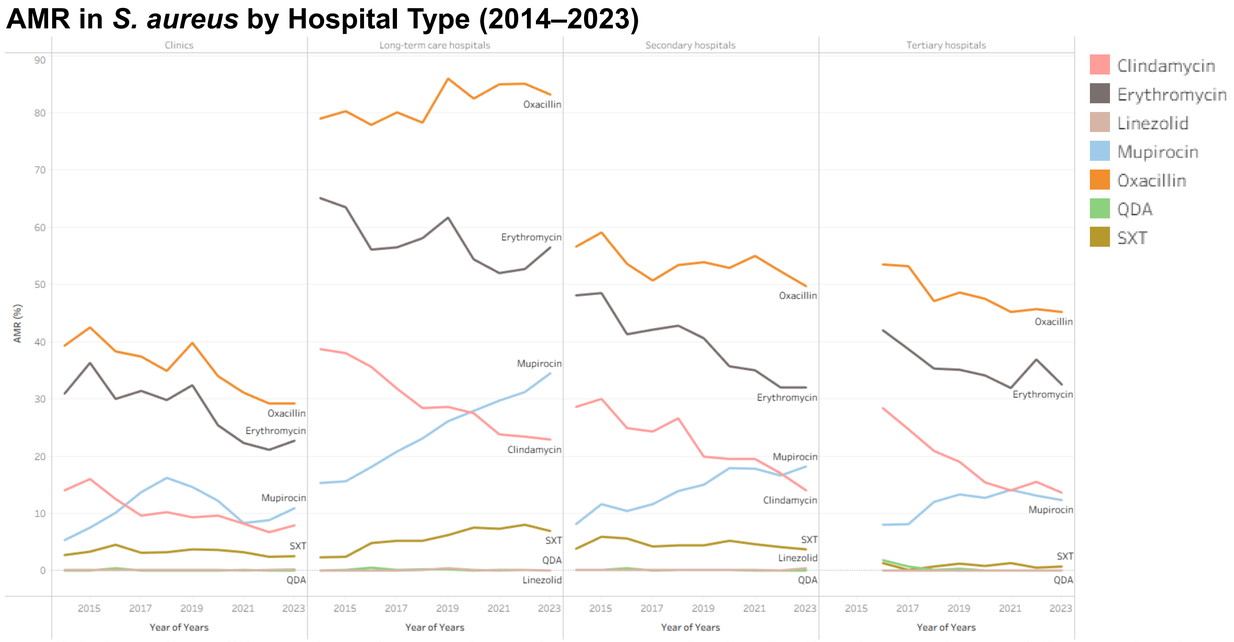
- ***Acinetobacter baumannii***: Resistance to major agents including imipenem, meropenem, and piperacillin–tazobactam remained consistently high (>80%) across years.
- ***Enterococcus faecalis***: Maintained moderate tetracycline resistance (~60–70%) but preserved full susceptibility to vancomycin and linezolid.
- ***Enterococcus faecium***: Showed persistently high resistance to ampicillin and ciprofloxacin (>80%) with a slight post-2020 decline in glycopeptide resistance.
- ***Klebsiella pneumoniae***: Demonstrated a gradual rise in β-lactam, aminoglycoside, and carbapenem resistance, particularly after 2020.
- ***Pseudomonas aeruginosa***: Exhibited increasing resistance to carbapenems and fluoroquinolones, indicating progressive multidrug resistance.

AMR in *E. coli* by Hospital Type (2014–2023)



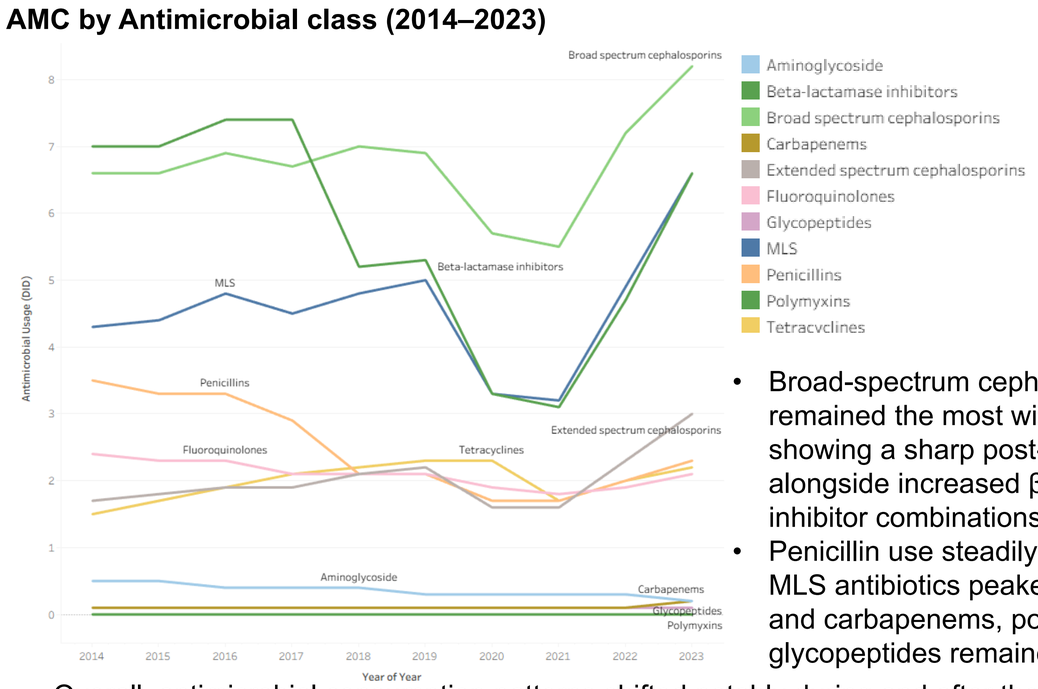
- **Clinics:** Ampicillin resistance remained high (~60%) and stable, while fluoroquinolone and SXT resistance fluctuated moderately without clear decline.
- **Long-term care hospitals:** Showed the **highest and most rapidly increasing resistance** to multiple β-lactams and fluoroquinolones, with imipenem resistance emerging after 2019.
- **Secondary hospitals:** Maintained **intermediate resistance levels**, with mild year-to-year variation but no sustained improvement across drug classes.
- **Tertiary hospitals:** Displayed **relatively lower resistance** compared to other hospital types, though fluoroquinolone and cephalosporin resistance showed gradual upward trends after 2020.

AMR in *S. aureus* by Hospital Type (2014–2023)



- **Clinics:** Oxacillin and erythromycin resistance gradually declined over time, while mupirocin and clindamycin resistance fluctuated at low to moderate levels.
- **Long-term care hospitals:** Maintained the **highest oxacillin resistance (>80%)**, with rising mupirocin resistance and variable macrolide-lincosamide resistance patterns.
- **Secondary hospitals:** Showed a **moderate downward trend** in oxacillin and erythromycin resistance, while mupirocin and clindamycin resistance remained relatively stable.
- **Tertiary hospitals:** Demonstrated **the lowest resistance levels overall**, with consistent declines in oxacillin, erythromycin, and clindamycin resistance across the study period.

AMC by Antimicrobial class (2014–2023)



- Broad-spectrum cephalosporins remained the most widely used class, showing a sharp post-2021 rebound alongside increased β-lactamase inhibitor combinations.
- Penicillin use steadily declined, while MLS antibiotics peaked around 2018 and carbapenems, polymyxins, and glycopeptides remained stable.
- Overall, antimicrobial consumption patterns shifted notably during and after the pandemic, reflecting changes in prescribing and infection management practices.

Conclusion

- Despite variable antimicrobial use, resistance among major Gram-negative pathogens remained high or increased after the pandemic.
- Long-term care hospitals showed the highest resistance levels, while tertiary hospitals maintained relatively lower rates, reflecting differences in stewardship capacity.
- The post-pandemic rebound in β-lactam and cephalosporin use paralleled rising carbapenem resistance, underscoring renewed selective pressure.
- Continuous AMU–AMR monitoring across healthcare settings is essential to sustain effective antimicrobial stewardship in the post-pandemic era.
- Integrated national surveillance of AMU and AMR across healthcare settings is crucial to identify emerging risks and guide targeted stewardship interventions in the post-pandemic era.

Acknowledgements

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