INDONESIAN ANTIBIOTIC RESISTANCE REPORT 2024

PATHOGEN PATTERNS AND ANTIBIOGRAMS

Summary

Indonesian Society for Clinical Microbiology (ISCM)

2025

INDONESIAN ANTIBIOTIC RESISTANCE REPORT 2024
PATHOGEN PATTERNS AND ANTIBIOGRAMS
Summary

Contributors

Prof. Anis Karuniawati, dr., Sp.MK(K), Ph.D
Dr. dr. Wani Devita Gunardi, Sp.MK(K)
Dr. dr. Dewi Anggraini, Sp.MK(K)
dr. Dewi Santosaningsih, Ph.D, Sp.MK
Dr. dr. Leli Saptawati, Sp.MK(K)
dr. Cahyarini, Sp.MK(K)
dr. Pristiawan Navy Endraputra, M.Ked.Klin, Sp.MK
dr. Lusiya Ningsih, M.Ked.Klin, Sp.MK
dr. Thomas Robertus, Sp.MK
dr. Rosantia Sarassari, M.Ked.Klin, Sp.MK, Ph.D
dr. Luh Inta Prilandari, Sp.MK
dr. Evira Tiyakusuma, Sp.MK
dr. Wasista Hanung Pujangga, Sp.MK
dr. Yulanda Marta Lena, Sp.MK
dr. Puteri Lotusia Nurulummi
dr. Leopold Sampetua Hutabarat
M. Rayhan Fathur Rahman, S.Stat
Oksi Al Hadi, S.Stat

Indonesian Society for Clinical Microbiology (ISCM)
2025

Introduction

Antimicrobial Resistance (AMR) constitutes a serious global health challenge, prompting the World Health Organization (WHO) to launch the Global Action Plan, which has been followed up by numerous countries worldwide through the development of their respective National Action Plans (NAPs). Indonesia formulated its first multisectoral AMR NAP for the 2017–2019 period, covering human health, agriculture, livestock and animal health, fisheries, the environment, and human resources; this was succeeded by the AMR NAP for the 2020–2024 period. The AMR NAP for the 2025–2029 period is currently being formulated for proposal as a Presidential Regulation. Meanwhile, in 2024, the Ministry of Health of the Republic of Indonesia issued the National AMR Strategy, which aligns with the core package of interventions developed by WHO utilizing a people-centered approach. The National AMR Strategy consists of three foundations and four pillars; the second foundation is the collection of strategic information through surveillance and research, with the objective of Indonesia establishing representative AMR surveillance data at the national level.

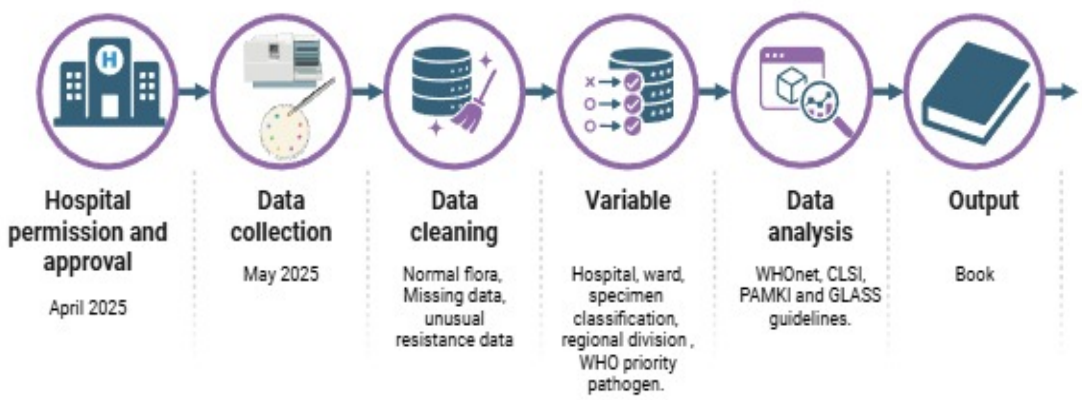


Figure 1. Flow of SINAR

The Government of the Republic of Indonesia, through the Ministry of Health, has participated in the WHO's international surveillance program, the Global Laboratory AMR Surveillance System (GLASS), since 2019. The Indonesian Association of Clinical Microbiologists (PAMKI), as a professional organization, plays a pivotal role in efforts to control antimicrobial resistance in Indonesia. The Indonesian Network on Antimicrobial Resistance (SINAR) is an AMR surveillance program conducted annually by PAMKI since 2021 (utilizing 2020 data), with results published in book format. Since 2024 (utilizing 2023 data), PAMKI has supported the Ministry of Health in compiling GLASS-AMR Indonesia data.

SINAR incorporates distinct data analyses and visualizations tailored to clinical requirements.

The 2025 AMR surveillance (utilizing 2024 data) analyzed 136,017 bacterial isolates from 139 hospitals across 24 provinces in Indonesia. Hospital classification adhered to the Ministry of Health Regulation No. 340 of 2010 regarding hospital classification. Hospitals were stratified into six regions—Sumatera, Java, Kalimantan, Sulawesi, Bali-Nusa Tenggara, and Papua-Maluku—based on geographic location and isolate volume. The analyzed ward categories included inpatient care, comprising intensive care units (ICU, PICU, NICU) and non-intensive care units (Non-ICU), as well as outpatient care units. Bacterial isolates were obtained from 10 clinical specimen types: blood, urine, feces, respiratory tract (sputum, bronchial specimens, tracheal aspirates), genital swabs, pleural fluid, cerebrospinal fluid, and joint fluid. Bacterial profiles and antimicrobial susceptibility patterns were analyzed based on specimen type, ward, hospital class, and region. The priority pathogens monitored in this surveillance align with the WHO Bacterial Priority Pathogen List 2024. Specifically, carbapenem-resistant *Acinetobacter baumannii*, third-generation cephalosporin-resistant and carbapenem-resistant *Enterobacterales* are classified as critical priority pathogens, while carbapenem-resistant *Pseudomonas aeruginosa* and methicillin-resistant *Staphylococcus aureus* (MRSA) are classified as high priority pathogens. WHO priority pathogens are reported alongside their respective antibiotic susceptibility patterns.

Key findings

1. Increase in the number of participating hospitals, yet regional disparities persist.

In 2025 (utilizing 2024 data), a total of 139 hospitals across 24 provinces participated in SINAR. This figure represents an increase compared to previous years. Hospital participation from the Central and Eastern regions of Indonesia also demonstrated an increase. However, despite these year-on-year increases, regional disparities persist, and hospital representation remains dominated by Western Indonesia (Sumatera and Java).

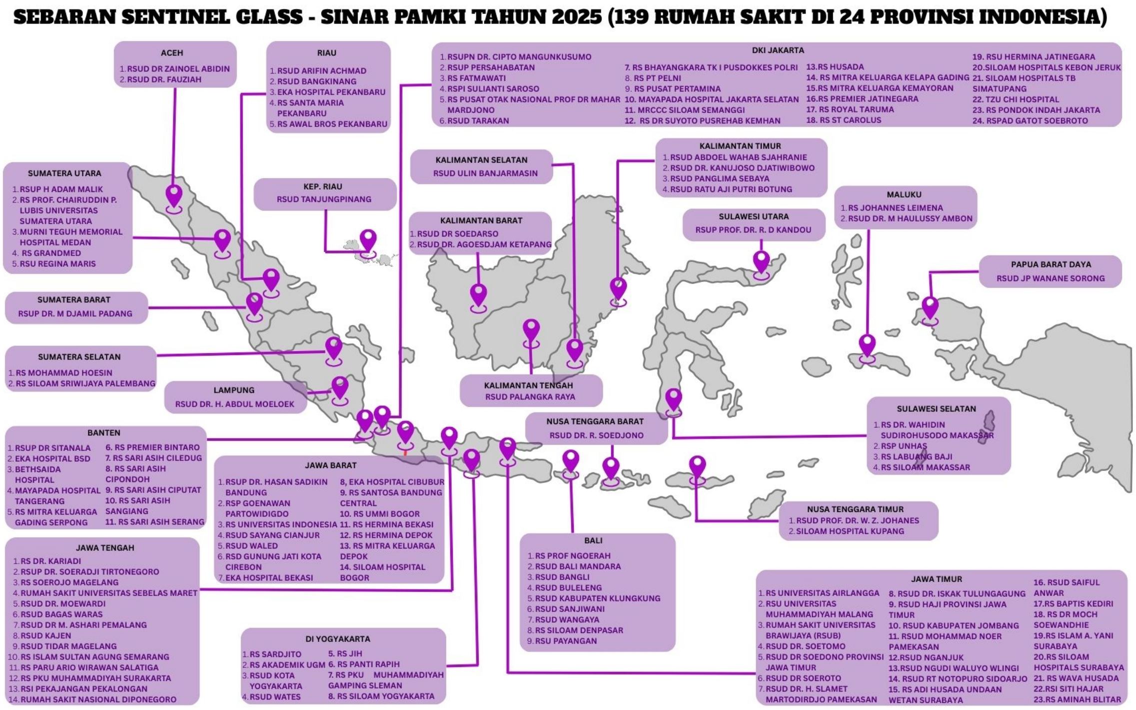
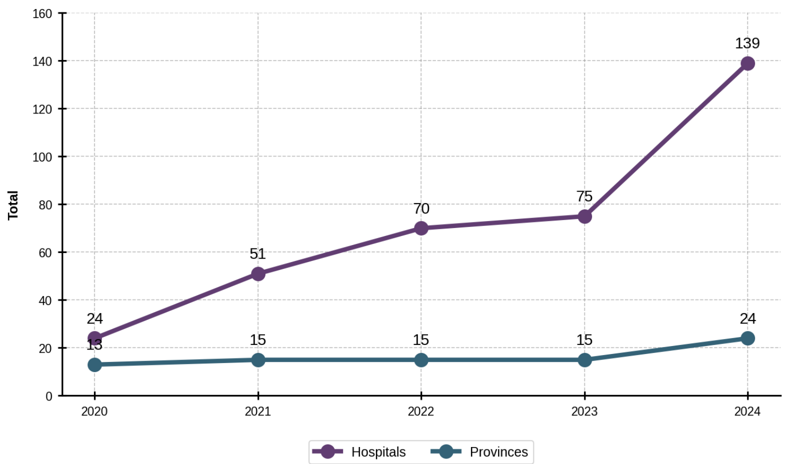
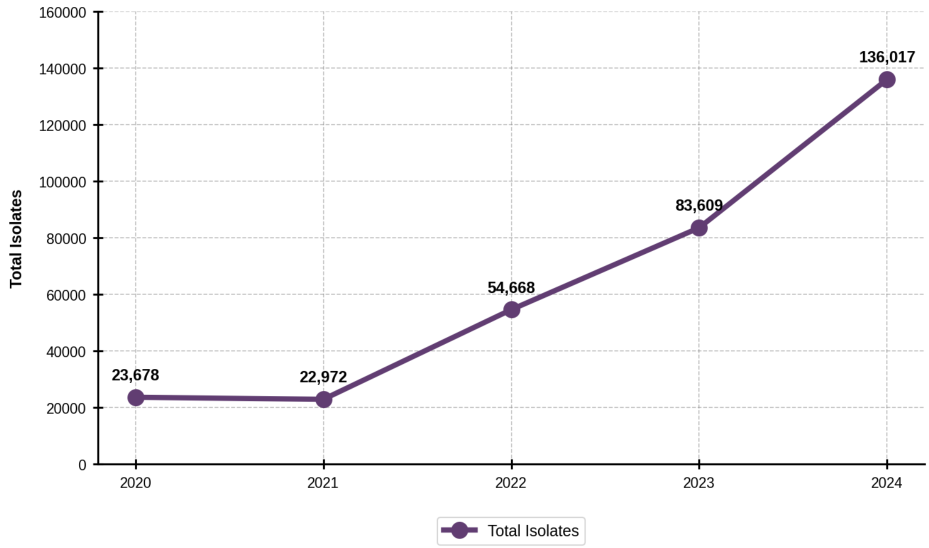


Figure 2. Sentinel hospitals in GLASS-SINAR PAMKI 2025

The expansion in the number of sentinel hospitals was accompanied by a corresponding increase in the volume of bacterial isolates analyzed. In 2025, SINAR also extended its analysis to include fecal specimens and genital specimens for *Neisseria gonorrhoeae* (GO). However, the number of *Salmonella spp*. and *Shigella spp*. isolates recovered from fecal specimens were fewer than 30; consequently, no further analysis was performed. A similar observation was made regarding genital specimens for GO, where fewer than 30 *Neisseria gonorrhoeae* isolates were obtained. This indicates that fecal cultures and GO cultures are not widely performed.



Graph 1. Number of SINAR sentinel hospitals and provinces, 2020–2024



Graph 2. Number of bacterial isolates, 2020–2024

1. **The most frequent pathogens in clinical specimens were dominated by Gram-negative bacteria.**

Gram-negative bacteria dominated the bacterial isolates recovered from nearly all analyzed specimens. Resistance rates among both Gram-negative and Gram-positive bacterial isolates were notably high.

In blood specimens, the four most frequently isolated pathogens *were Staphylococcus aureus, Klebsiella pneumoniae, Escherichia coli,* and *Acinetobacter baumannii.* Among *Staphylococcus aureus* isolates, the percentage of MRSA was 37%. Among *Klebsiella pneumoniae* isolates, resistance to third-generation cephalosporins was 61%, while carbapenem resistance was 19%. Among *Escherichia coli* isolates, resistance to third-generation cephalosporins was 59%, while carbapenem resistance was 6%. Among *Acinetobacter baumannii* isolates, carbapenem resistance was 54%.

In respiratory specimens, the four most frequent pathogens causing lower respiratory tract infections *were Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa,* and *Escherichia coli.* Among *Klebsiella pneumoniae* isolates, resistance to third-generation cephalosporins was 42%, while carbapenem resistance was 14%. Among *Acinetobacter baumannii* isolates, carbapenem resistance was 54%. Among *Pseudomonas aeruginosa* isolates, carbapenem resistance was 24%. Among *Escherichia coli* isolates, resistance to third-generation cephalosporins was 59%, while carbapenem resistance was 6%.

Figure 3. Distribution of bacteria in clinical specimens

In urine specimens, the four most frequent pathogens causing urinary tract infections isolated were *Escherichia coli, Klebsiella pneumoniae, Enterococcus faecalis,* and *Pseudomonas aeruginosa.* Among *Escherichia coli* isolates, resistance to third-generation cephalosporins was 56%, while carbapenem resistance was 6%. Among *Klebsiella pneumoniae* isolates, resistance to third-generation cephalosporins was 60%, while carbapenem resistance was 16%. Among *Pseudomonas aeruginosa* isolates, carbapenem resistance was 26%.

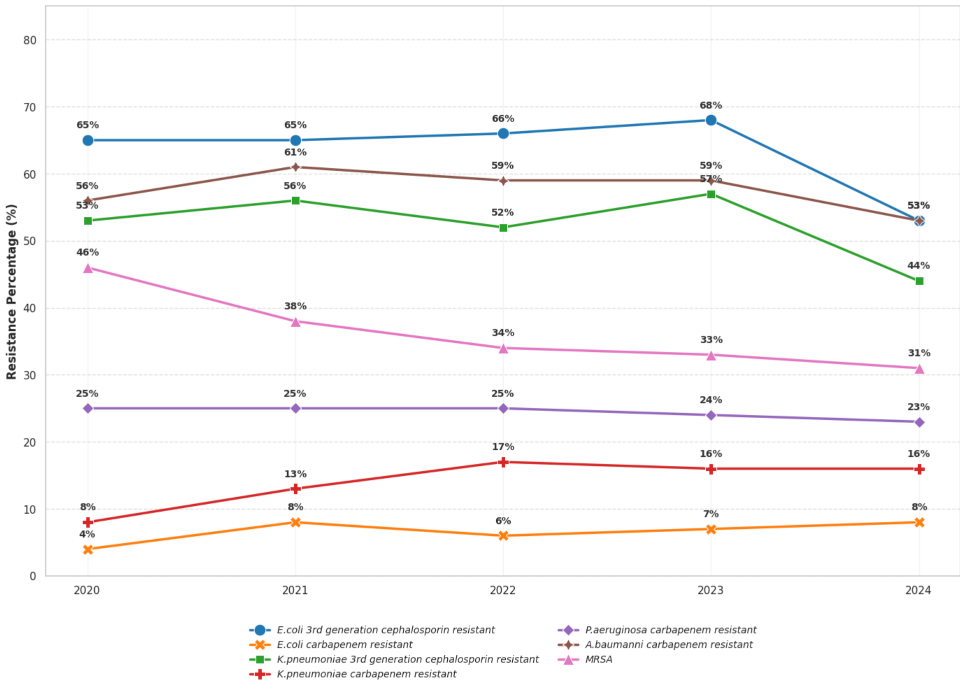
In cerebrospinal fluid specimens, the four most frequent pathogens causing central nervous system infections isolated *were Acinetobacter baumannii, Klebsiella pneumoniae, Escherichia coli,* and *Pseudomonas aeruginosa*. Among *Acinetobacter baumannii* isolates, carbapenem resistance was 59%. Among *Klebsiella pneumoniae* isolates, resistance to third-generation cephalosporins was 71%, while carbapenem resistance was 33%. Among *Escherichia coli* isolates, resistance to third-generation cephalosporins was 59%, while carbapenem resistance was 2%. Among *Pseudomonas aeruginosa* isolates, carbapenem resistance was 26%.

In pleural fluid specimens, the four most frequently isolated pathogens were *Klebsiella pneumoniae, Staphylococcus aureus, Pseudomonas aeruginosa,* and *Acinetobacter baumannii.* Among *Klebsiella pneumoniae* isolates, resistance to third-generation cephalosporins was 50%, while carbapenem resistance was 13%. Among *Staphylococcus aureus* isolates, the percentage of MRSA was 32%. Among *Pseudomonas aeruginosa* isolates, carbapenem resistance was 24%. Among *Acinetobacter baumannii* isolates, carbapenem resistance was 40%.

In joint fluid specimens, the most frequently isolated pathogen was *Staphylococcus aureus*, with an MRSA percentage of 44%.

2. Resistance trends tended to decline for the majority of priority pathogens in 2024.

WHO priority pathogens targeted by surveillance demonstrated a declining trend in 2024, with the exception of carbapenem-resistant *Klebsiella pneumoniae* and *Escherichia* coli. This downward trend may be attributed to the significant increase in the number of isolates compared to the previous year and may serve as an indicator of the success of the implemented Antimicrobial Resistance Program (PPRA). In 2021, the Ministry of Health issued the Guidelines on Antimicrobial Stewardship (PGA) for hospitals, which serve as the reference for implementation. Policies regarding the inclusion of the PPRA within Hospital Accreditation Standards and mandatory reporting via the online SIRS system require every hospital to implement the PPRA.



Graph 3. Trends in WHO priority pathogens, 2020–2024

3. The percentage of WHO priority pathogens tends to be higher in intensive care units.

Gram-negative bacteria were the most frequently isolated pathogens in both intensive care units (ICU, PICU, NICU) and non-intensive care units (Non-ICU).

In the ICU, resistance to third-generation cephalosporins among *Klebsiella pneumoniae* isolates was 48%, while carbapenem resistance was 22%. Among *Escherichia coli* isolates, resistance to third-generation cephalosporins was 61%, while carbapenem resistance was 12%. Carbapenem resistance among *Acinetobacter baumannii* and *Pseudomonas aeruginosa* isolates was 69% and 32%, respectively, and the prevalence of MRSA was 31%.

In the PICU, resistance to third-generation cephalosporins among *Klebsiella pneumoniae* isolates was 68%, while carbapenem resistance was 24%. Carbapenem resistance among *Acinetobacter baumannii* and *Pseudomonas aeruginosa* isolates was 72% and 27%, respectively. Among *Escherichia coli* isolates, resistance to third-generation cephalosporins was 63%, while carbapenem resistance was 9%.

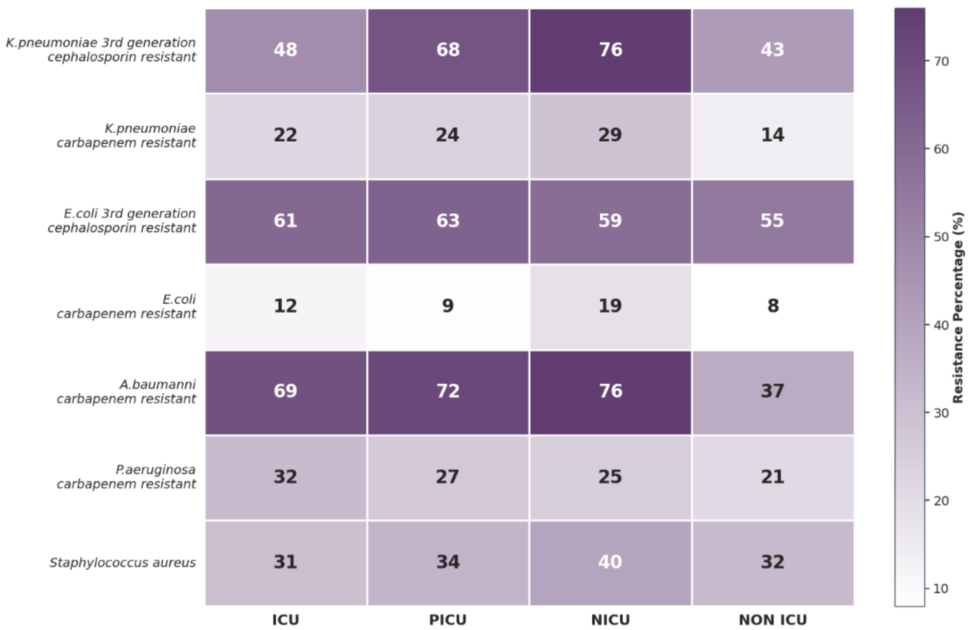


Figure 4. WHO priority pathogens in intensive and non-intensive care units

In the NICU, resistance to third-generation cephalosporins among *Klebsiella pneumoniae* isolates was 76%, while carbapenem resistance was 29%. Carbapenem resistance among *Acinetobacter baumannii* and *Pseudomonas aeruginosa* isolates was 76% and 25%, respectively. Among *Escherichia coli* isolates, resistance to third-generation cephalosporins was 59%, while carbapenem resistance was 19%.

In non-ICU settings, resistance to third-generation cephalosporins among *Klebsiella pneumoniae* isolates was 43%, while carbapenem resistance was 14%. Among *Escherichia coli* isolates, resistance to third-generation cephalosporins was 55%, while carbapenem resistance was 8%.

Carbapenem resistance among *Acinetobacter baumannii* and *Pseudomonas aeruginosa* isolates was 37% and 21%, respectively.

4. Comparison of resistance by region and hospital classification

The Sumatera region exhibited the highest percentages across nearly all WHO priority pathogens. Similarly, the Papua-Maluku region demonstrated high percentages for several WHO priority pathogens. This observation may be associated with the ratio of bacterial isolates to the population in these regions in 2024.

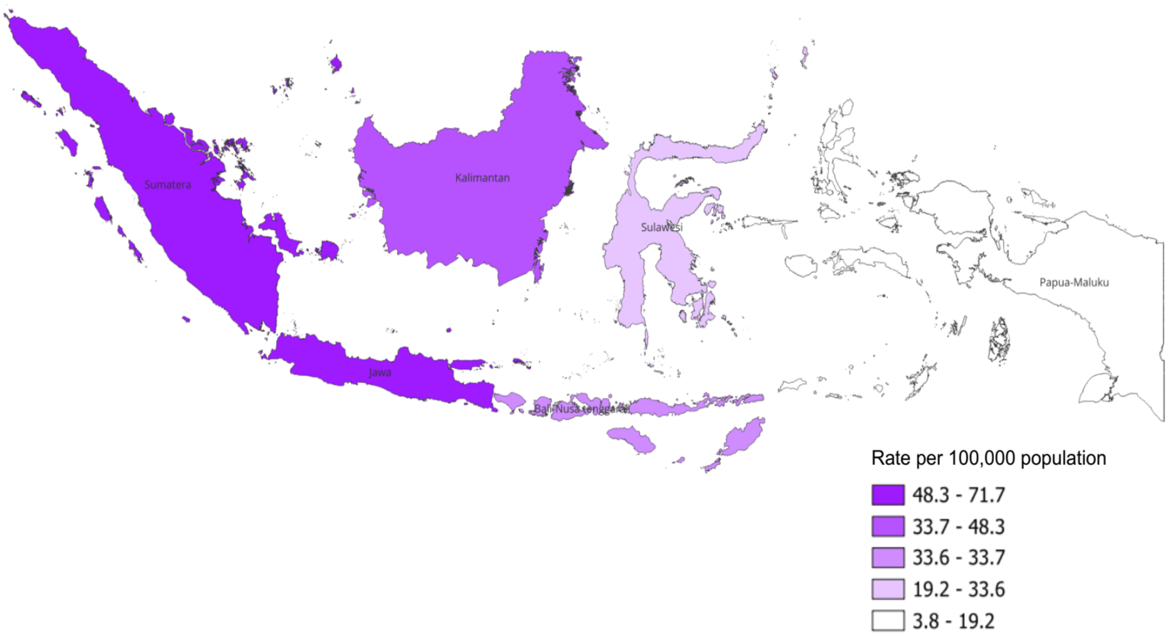


Figure 5. Bacterial isolate-to-population ratio by region

The number of isolates from the Sumatera region was 29,687, compared to a 2024 population of 61,515,800. The Java region exhibited the highest isolate-to-population ratio compared to other regions, with 112,522 isolates against a population of 156,927,800. Central Indonesian regions, specifically Kalimantan and Bali-Nusa Tenggara, had lower isolate-to-population ratios; however, Sulawesi demonstrated an even lower ratio compared to Kalimantan and Bali-Nusa Tenggara, despite having a larger population. The Eastern Indonesian region of Papua-Maluku recorded the lowest isolate-to-population ratio. This indicates that clinical microbiology services are not yet evenly distributed in the Papua-Maluku region.

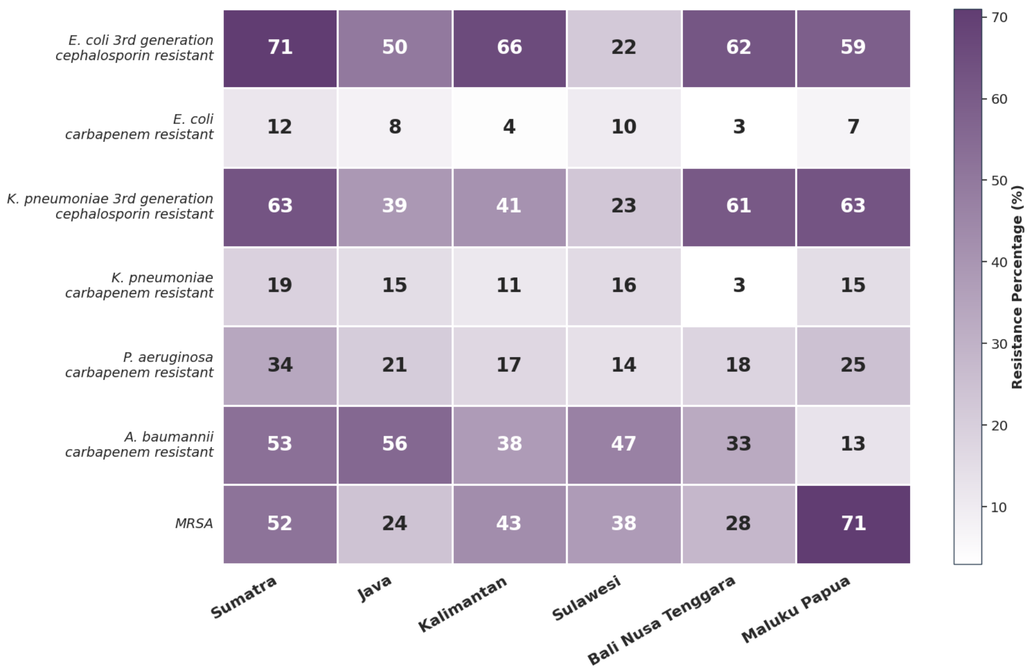
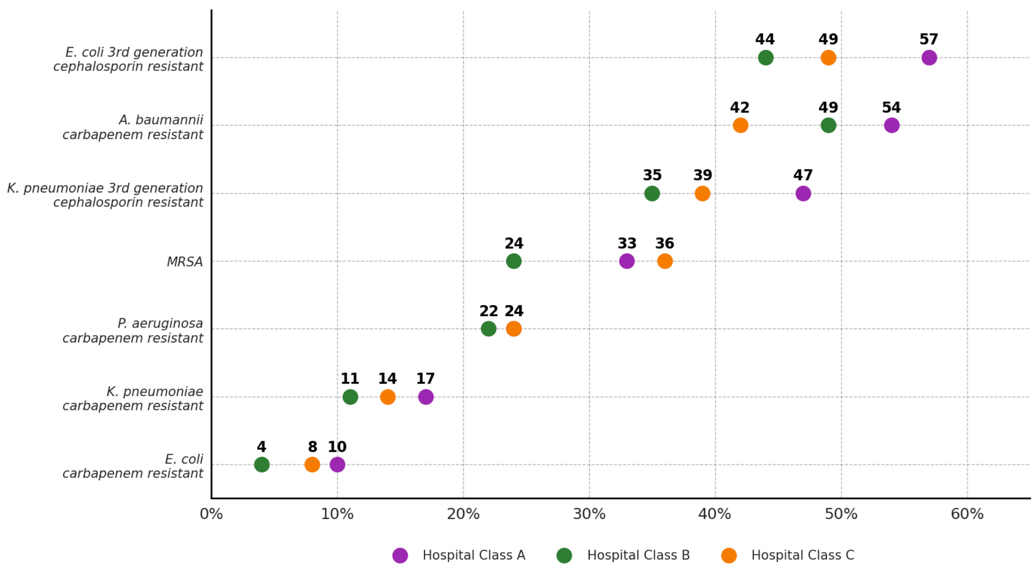


Figure 6. Percentage of WHO priority pathogens by region

Class A hospitals exhibited higher percentages among several WHO priority pathogens; this may be attributed to the higher complexity of healthcare services.



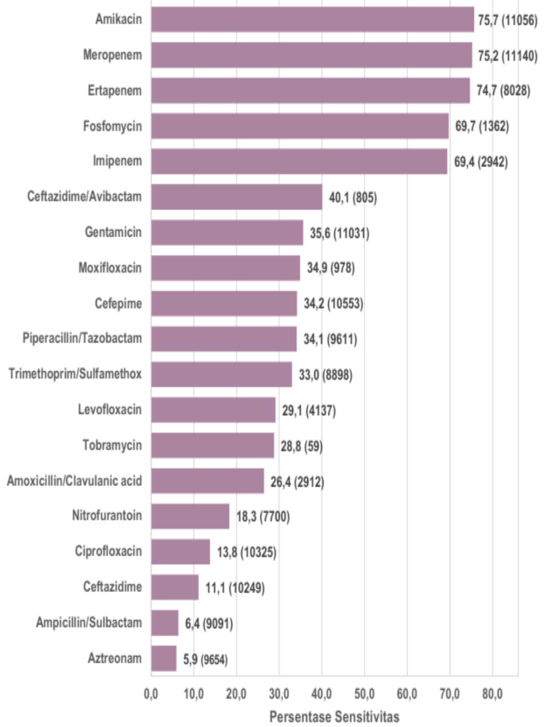
Graph 4. Percentage of WHO priority pathogens by hospital class

5. Treatment options for priority pathogens are extremely limited.

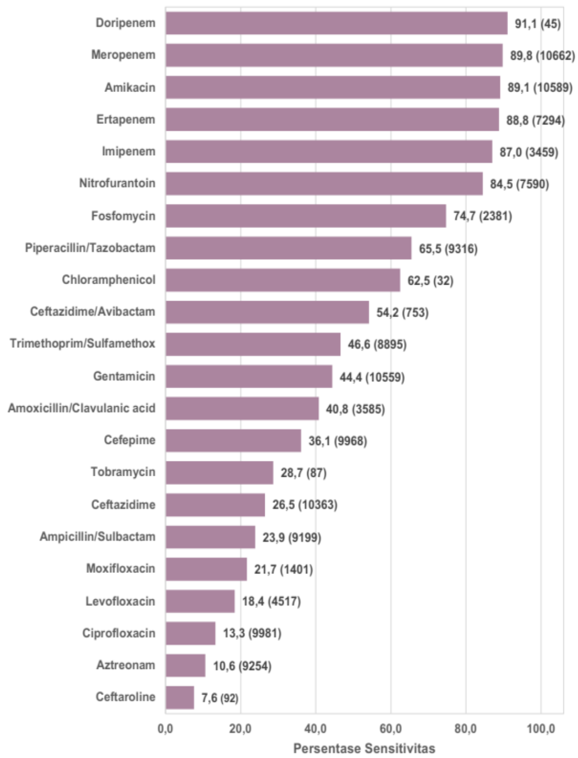
Among *Klebsiella pneumoniae* and *Escherichia coli* isolates resistant to third-generation cephalosporins, carbapenems, and amikacin demonstrated the highest susceptibility rates among the antibiotics tested. Consequently, carbapenems and amikacin may be considered as therapeutic options for infections caused by third-generation cephalosporin-resistant Gram-negative bacteria.

For MRSA isolates, vancomycin, linezolid, minocycline, and doxycycline exhibited favorable susceptibility profiles; thus, they may be considered as treatment options for MRSA, contingent upon the site of infection.

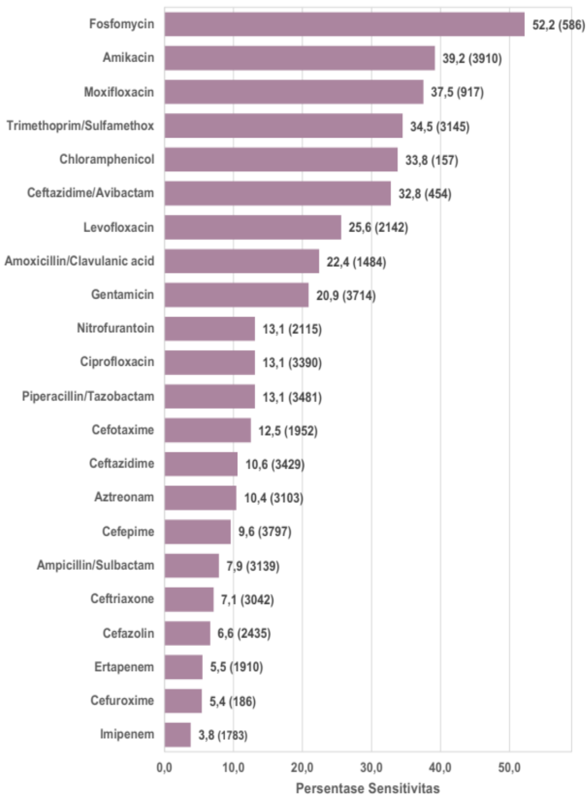
However, antibiotic options for carbapenem-resistant Gram-negative bacteria are severely limited. Novel agents recommended for the treatment of carbapenem-resistant bacteria—such as ceftazidime-avibactam, cefiderocol, ceftolozane-tazobactam, imipenem-cilastatin-relebactam, and meropenem-vaborbactam—are not yet available in Indonesia, or are prohibitively expensive where available.



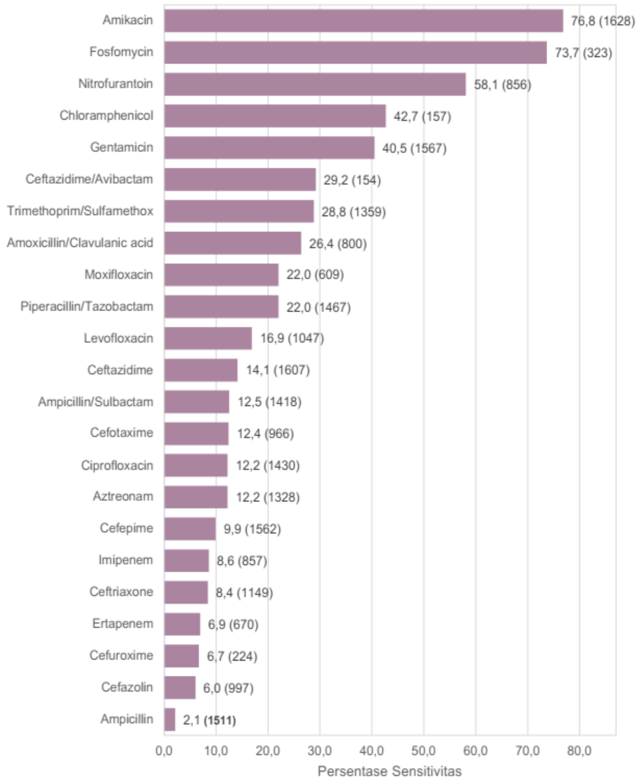
Graph 5. Antibiotic susceptibility pattern of third-generation cephalosporin-resistant *Klebsiella pneumoniae*



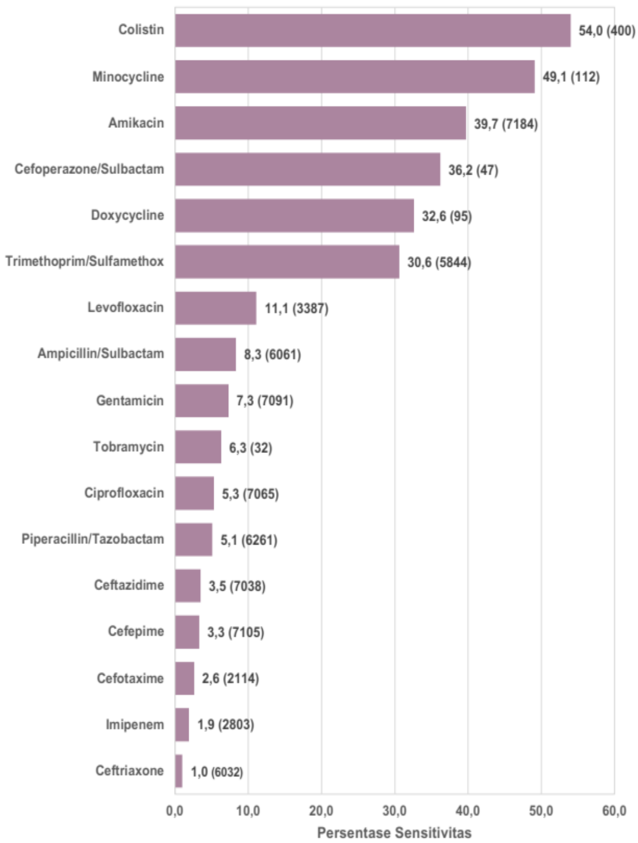
Graph 6. Antibiotic susceptibility pattern of third-generation cephalosporin-resistant *Escherichia coli*



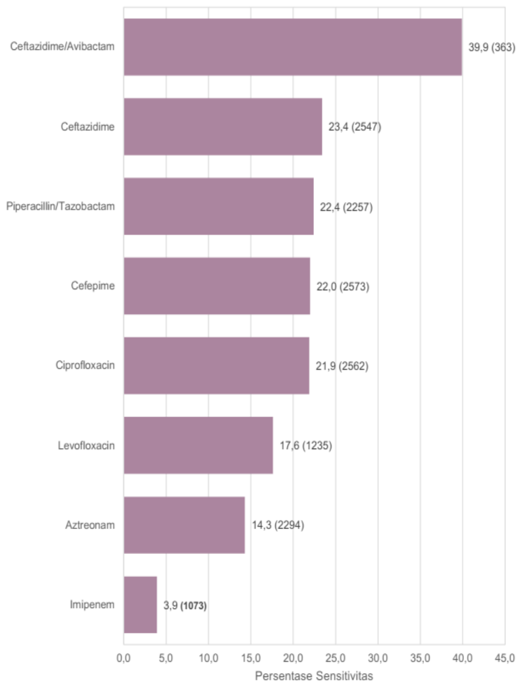
Graph 7. Antibiotic susceptibility pattern of carbapenem-resistant *Klebsiella pneumoniae*



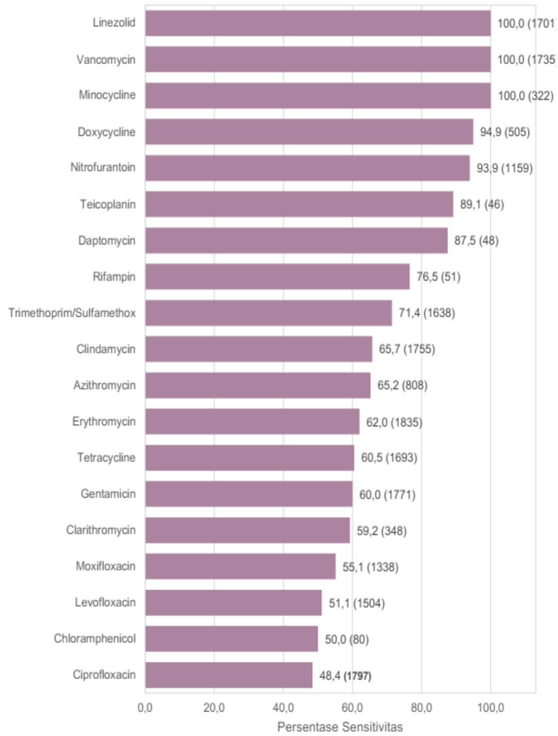
Graph 8. Antibiotic susceptibility pattern of carbapenem-resistant *Escherichia coli*



Graph 9. Antibiotic susceptibility pattern of carbapenem-resistant *Acinetobacter baumannii*



Graph 10. Antibiotic susceptibility pattern of carbapenem-resistant *Pseudomonas aeruginosa*



Graph 11. Antibiotic susceptibility pattern of MRSA

Recommendations

To address the disparities in AMR surveillance within the central and Eastern regions of Indonesia, an expansion of clinical microbiology laboratories in these areas is required. The capacity of clinical microbiology laboratories to perform culture examinations and antimicrobial susceptibility testing must be enhanced to ensure the quality of healthcare services for infectious diseases, as well as the integrity of surveillance data. Concurrently, the quality of existing clinical microbiology examinations must be continuously improved through the implementation of quality assurance measures and the expansion of service capabilities, including the cultivation of fastidious bacteria and anaerobes.

Regarding the low volume of fecal and genital *Neisseria gonorrhoeae* isolates—totaling fewer than 30 nationwide—it is necessary to enhance the capability of clinical microbiology laboratories to isolate gastrointestinal pathogens from fecal specimens and *Neisseria gonorrhoeae* from genital specimens. One measure to address this issue is the establishment of a laboratory referral system.

Under the current AMR surveillance system, distinguishing between community-acquired and hospital-acquired infections presents a challenge, as not all hospitals maintain comprehensive data. Differentiating between community and hospital sources of infection is crucial to ensure that recommendations for empiric therapy based on local pathogen patterns are accurate and appropriate.

Antibiotic therapeutic options for treating infections caused by WHO priority pathogens, particularly carbapenem-resistant Gram-negative bacteria, are severely limited and unevenly distributed across regions. It is recommended that the Government of Indonesia enhance access to novel antibiotics effective against multidrug-resistant bacteria.

References

1. *Global antibiotic resistance surveillance report 2025: WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS)*. Geneva: World Health Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO.
2. *Global antibiotic resistance surveillance report 2025: WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS) - Summary. Geneva: World Health Organization*; 2025. https://doi. org/10.2471/B09585. Licence: CC BY-NC-SA 3.0 IGO.
3. Kementerian Kesehatan Republik Indonesia, 2025, Keputusan Direktur Jenderal Kesehatan Lanjutan No. HK.02.02/D/3610/2025 Tentang Pedoman Penyusunan Antibiogram di Rumah Sakit.
4. Kementerian Kesehatan Republik Indonesia, 2025, Strategi Nasional Pengendalian Resistensi Antimikroba Sektor Kesehatan 2025-2029.
5. *Clinical and Laboratory Standards Institute 2025, M-100 Performance standards for antimicrobial susceptibility testing; 33rd edition*.
6. Badan Pusat Statistik, 2024, Penduduk, laju pertumbuhan penduduk, distribusi persentase penduduk, kepadatan penduduk, rasio jenis kelamin penduduk menurut Provinsi tahun 2024. Downloaded from bps.go.id.
7. *World Health Organization 2024. WHO bacterial priority pathogen list*, 2024.
8. Perhimpunan Dokter Spesialis Mikrobiologi (PAMKI). 2024. Pola Patogen dan Antibiogram di Indonesia Tahun 2023. Downloaded from https://sinar.pamki.or.id.
9. Perhimpunan Dokter Spesialis Mikrobiologi (PAMKI). 2023. Pola Patogen dan Antibiogram di Indonesia Tahun 2022. Downloaded from https://sinar.pamki.or.id.
10. Perhimpunan Dokter Spesialis Mikrobiologi (PAMKI). 2022. Surveilans resistensi antibiotik Rumah Sakit di Iindonesia Tahun 2021. Downloaded from https://sinar.pamki.or.id.
11. *Clinical and Laboratory Standards Institute (CLSI): Analysis and Presentation of Cumulative Antimicrobial Susceptibility Test Data; Approved Guideline M39* Tahun 2022
12. Perhimpunan Dokter Spesialis Mikrobiologi Klinik Indonesi (PAMKI). Surveilans Resistensi Antibiotik Rumah Sakit Kelas A dan B di Indonesia tahun 2020. Jakarta: Deep Publish; 2021.
13. Kementerian Koordinator Bidang Pembangunan Manusia dan Kebudayaan Republik Indonesia, 2021, Rencana Aksi Nasional Pengendalian Resistensi Antimikroba 2020-2024.

14. Soebandrio A, Saptawati L, Prasetyo DS, Rahmiati, Puspandari N, Pedoman Nasional Penyusunan Antibiogram PAMKI, Jakarta: Fakultas Kedokteran Universitas Sebelas Maret, 2020.
15. Isenberg HR, *Essential Procedures for Clinical Microbiology, second edition,* Washington, DC: *American Society for Microbiology,* 2016.
16. *World Health Organization. (2015). Global Antimicrobial Resistance Surveillance System: Manual for Early Implementation.*
17. *American Society of Microbiology 2014, Microbiology Mentoring Package: Culture reading. Clinical and Laboratory Standards Institute 2014, Analysis and Presentation of Cumulative Antimicrobial Susceptibility Test Data; Approved Guideline-Fourth Edition.*