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(RESEARCH ARTICLE)

ANTIMICROBIAL SUSCEPTIBILITY PROFILE OF *ACINETOBACTER BAUMANNII* ISOLATED FROM ICU AND NON-ICU PATIENTS AT NGOERAH HOSPITAL, BALI, INDONESIA: A RETROSPECTIVE STUDY IN 2025

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ABSTRACT

Background: *Acinetobacter baumannii* is a major healthcare-associated Gram-negative pathogen and an important contributor to antimicrobial resistance. Institution-specific susceptibility data are useful for antimicrobial stewardship and infection-control planning. This study characterized the antimicrobial susceptibility of *A. baumannii* isolates recovered from ICU and non-ICU patients at Ngoerah Hospital during 2025.

Methods: Laboratory records from January through December 2025 were reviewed retrospectively. Only one *A. baumannii* isolate was counted for each patient, with the earliest specimen retained when more than one record was present. ICU status included ICU Timur, ICU Barat, and ICU IGD. Routine identification and susceptibility results were analyzed according to the 2025 CLSI M100, 35th edition.

The analysis included 437 unique isolates: 101 from ICU locations and 336 from non-ICU locations. Sputum accounted for 206 isolates (47.1%), while wound-base specimens accounted for 172 (39.4%). ICU isolates had their greatest susceptibility to trimethoprim/sulfamethoxazole (67.0%), amikacin (66.0%), and tigecycline (46.0%). In the non-ICU group, the corresponding figures were 68.7% for amikacin, 64.8% for trimethoprim/sulfamethoxazole, and 52.8% for tigecycline. Meropenem susceptibility was 47.0% and 52.5% in ICU and non-ICU isolates, respectively. None of the antimicrobial comparisons reached statistical significance (all Fisher's exact $p>0.05$).

Conclusion: High levels of resistance were observed in both hospital locations. Because susceptibility did not differ significantly between ICU and non-ICU isolates, antimicrobial-resistance surveillance and stewardship should be implemented across the hospital rather than restricted to intensive care.

Keywords: *Acinetobacter baumannii*; Antimicrobial Susceptibility; Antimicrobial Resistance; Intensive Care Unit; Surveillance; Bali

1 INTRODUCTION

Acinetobacter baumannii is a clinically important Gram-negative opportunistic pathogen associated with healthcare-associated infections, particularly among critically ill and hospitalized patients. Its ability to persist in the hospital environment and acquire multiple resistance mechanisms has contributed to its global clinical importance [1-5].

Antimicrobial resistance in *A. baumannii* is driven by multiple mechanisms, including enzymatic inactivation, alterations in antimicrobial targets, reduced permeability, and active efflux. Carbapenem resistance is of particular concern because it substantially limits therapeutic options [2,5]. Intensive care units are recognized as settings with increased risk for multidrug-resistant *A. baumannii* due to high antimicrobial exposure, invasive procedures, prolonged hospitalization, and patient-to-patient transmission [4,5].

Routine antimicrobial susceptibility surveillance is therefore essential for understanding local resistance patterns and guiding empirical treatment and infection prevention strategies. Global surveillance frameworks also emphasize the importance of standardized laboratory data for monitoring antimicrobial resistance [6,7].

The present study aimed to describe the antimicrobial susceptibility profile of *A. baumannii* isolated from ICU and non-ICU patients at Ngoerah Hospital, Bali, Indonesia, during 2025, and to compare susceptibility between the two patient-location groups.

2 MATERIALS AND METHODS

2.1 Study design and setting

This retrospective laboratory-based study analyzed *A. baumannii* isolates recorded at Ngoerah Hospital, Denpasar, Bali, Indonesia, from January to December 2025.

2.2 Study population and isolate selection

Records identified as *A. baumannii* were extracted from the laboratory database. To avoid repeated representation of the same patient, one isolate per patient was retained. If a patient had multiple *A. baumannii* records, the isolate with the earliest specimen collection date was selected; laboratory identification was used as a tie-breaker when collection dates were identical. One record without a patient identifier was retained after confirmation that it represented a single patient.

2.3 Patient location classification

ICU was defined as ICU Timur, ICU Barat, or ICU IGD. All other patient locations were categorized as non-ICU.

2.4 Bacterial identification and antimicrobial susceptibility testing

A. baumannii identification and antimicrobial susceptibility results were obtained from the routine laboratory database. Susceptibility categories were recorded as susceptible (S), intermediate (I), or resistant (R). Eleven antimicrobial agents were included in the final analysis: amikacin, ceftazidime, ciprofloxacin, ceftriaxone, cefepime, gentamicin, meropenem, ampicillin/sulbactam, trimethoprim/sulfamethoxazole, tigecycline, and piperacillin/tazobactam. Interpretation followed Clinical and Laboratory Standards Institute M100, 35th edition (2025) [8].

2.5 Statistical analysis

Categorical variables were summarized as frequencies and percentages. Susceptibility between ICU and non-ICU isolates was compared by categorizing results as susceptible versus non-susceptible (intermediate plus resistant). Fisher's exact test was used for the comparative analysis. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated, with ICU as the exposure group and non-ICU as the reference group. A two-sided p value <0.05 was considered statistically significant. Missing susceptibility results were excluded from the denominator for the corresponding antimicrobial analysis.

3 RESULTS

3.1 Distribution of *A. baumannii* isolates

A total of 437 unique *A. baumannii* isolates were included after applying the one-patient-one-isolate rule. Of these, 101 (23.1%) were obtained from ICU locations and 336 (76.9%) from non-ICU locations.

Table 1: Distribution of *A. baumannii* isolates by patient location.

Location	n	%
ICU	101	23.1
Non-ICU	336	76.9
Total	437	100.0

3.2 Specimen distribution

Sputum was the most frequent specimen, accounting for 206 isolates (47.1%), followed by wound-base specimens (172; 39.4%). Urine, tissue, pus, and blood accounted for the remaining isolates.

Table 2: Distribution of *A. baumannii* isolates by specimen type.

Specimen	n	%
Sputum	206	47.1
Wound base	172	39.4
Urine	36	8.2
Tissue	14	3.2
Pus	7	1.6
Blood	2	0.5
Total	437	100.0

3.3 Antimicrobial susceptibility profile

Table 3: Antimicrobial susceptibility profile of *A. baumannii* isolates from ICU and non-ICU patients.

Antimicrobial	ICU S (%)	ICU I (%)	ICU R (%)	Non-ICU S (%)	Non-ICU I (%)	Non-ICU R (%)
Amikacin	66.0	2.0	32.0	68.7	3.3	28.1
Ceftazidime	25.0	2.0	73.0	27.2	4.2	68.7
Ciprofloxacin	23.0	2.0	75.0	22.1	1.2	76.7
Ceftriaxone	2.0	25.0	73.0	5.1	24.2	70.7
Cefepime	27.0	0.0	73.0	27.5	1.2	71.3
Gentamicin	29.0	6.0	65.0	30.4	5.4	64.2
Meropenem	47.0	1.0	52.0	52.5	0.3	47.2
Ampicillin/sulbactam	35.0	8.0	57.0	43.3	11.9	44.8
Trimethoprim/sulfamethoxazole	67.0	0.0	33.0	64.8	0.0	35.2
Tigecycline	46.0	36.0	18.0	52.8	37.9	9.3
Piperacillin/tazobactam	26.0	1.0	73.0	28.8	1.8	69.4

The highest susceptibility among ICU isolates was observed for trimethoprim/sulfamethoxazole (67.0%), amikacin (66.0%), and tigecycline (46.0%). Among non-ICU isolates, the highest susceptibility was observed for amikacin (68.7%), trimethoprim/sulfamethoxazole (64.8%), and tigecycline (52.8%). Carbapenem susceptibility remained limited, with meropenem susceptibility of 47.0% in ICU and 52.5% in non-ICU isolates.

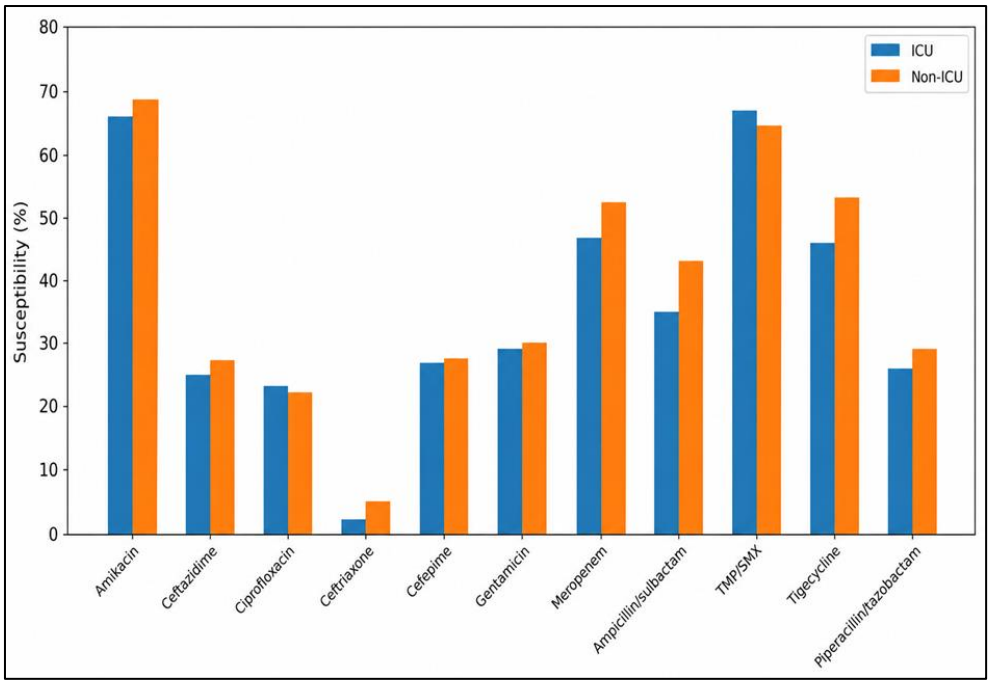

Figure 1: Antimicrobial susceptibility profile of *A. baumannii* isolates from ICU and non-ICU patients in 2025.

3.4 Comparison between ICU and non-ICU isolates

Antimicrobial	OR (95% CI)	Fisher p
Amikacin	0.886 (0.552–1.423)	0.626
Ceftazidime	0.894 (0.535–1.492)	0.701
Ciprofloxacin	1.054 (0.619–1.794)	0.891
Ceftriaxone	0.382 (0.087–1.681)	0.267
Cefepime	0.977 (0.591–1.615)	1.000
Gentamicin	0.933 (0.571–1.524)	0.805
Meropenem	0.801 (0.512–1.253)	0.363
Ampicillin/sulbactam	0.706 (0.444–1.122)	0.165
Trimethoprim/sulfamethoxazole	1.104 (0.688–1.772)	0.721
Tigecycline	0.760 (0.486–1.190)	0.255
Piperacillin/tazobactam	0.867 (0.523–1.439)	0.614

No antimicrobial demonstrated a statistically significant difference in susceptibility between ICU and non-ICU isolates. The smallest p-value was observed for ampicillin/sulbactam (p=0.165), followed by ceftriaxone (p=0.267) and tigecycline (p=0.255); all 95% CIs for the ORs included 1.

4 DISCUSSION

The 2025 laboratory data indicate a considerable resistance burden among *A. baumannii* recovered at this tertiary-care hospital. Reduced susceptibility was observed across several antimicrobial classes, most prominently among the cephalosporins, ciprofloxacin, and piperacillin/tazobactam. Such a broad phenotype is compatible with the capacity of *A. baumannii* to acquire and express multiple resistance mechanisms [2,5,9,10].

Meropenem remained active against fewer than two thirds of isolates in either location, with susceptibility of 47.0% in ICU and 52.5% in non-ICU isolates. The numerical difference did not reach statistical significance. Thus, the available data do not support viewing carbapenem non-susceptibility as an ICU-specific problem; it appears to be present throughout the hospital population represented in the laboratory database.

An important finding was the consistency of the susceptibility patterns between locations. Although ICU admission is associated with recognized risk factors for multidrug-resistant *A. baumannii*, such as prolonged hospitalization, invasive devices, and antimicrobial exposure [4,5], resistance can also circulate in non-ICU areas. Hospital-wide transmission and antimicrobial selection pressure may therefore contribute to a resistance pattern that is not confined to intensive care [7,9,10].

Among the agents evaluated, amikacin and trimethoprim/sulfamethoxazole had the most favorable susceptibility proportions, while tigecycline had a substantial intermediate category. These laboratory findings describe phenotype rather than establish treatment choices for individual patients. Clinical use of an antimicrobial must additionally consider the infection site, disease severity, drug exposure, and patient-specific characteristics, together with the applicable susceptibility standard [8].

Several limitations should be considered. The study used retrospective data from a single institution, limiting external generalizability. Laboratory records alone also did not allow reliable separation of clinical infection from colonization. Information on individual risk factors, previous antimicrobial exposure, hospitalization duration, mechanical ventilation, and clinical outcomes was unavailable. In addition, the analysis was phenotypic and did not determine the genetic mechanisms responsible for resistance.

5 CONCLUSION

A. baumannii isolates recovered at Ngoerah Hospital during 2025 showed substantial resistance across both ICU and non-ICU settings. Meropenem susceptibility was 47.0% in ICU and 52.5% in non-ICU isolates. No statistically significant difference in susceptibility was identified between the two locations for any of the 11 antimicrobials analyzed. These findings support continued hospital-wide antimicrobial resistance surveillance, infection-prevention measures, and antimicrobial stewardship. Molecular studies are warranted to further define the resistance mechanisms underlying these phenotypes.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of ethical approval

This retrospective laboratory-based study received ethical exemption from the relevant institutional ethics authority. Ethical Exemption Number: PS.02.03/D.XVI.17.4/0006/2026.

Statement of informed consent

Informed consent was not required because this was a retrospective laboratory-based study using routinely collected laboratory data and received ethical exemption from the relevant institutional ethics authority.

Authors' Contributions

- IIP: study conception, data analysis, interpretation, and manuscript preparation.
- NNDF: supervision, methodological guidance, interpretation, and critical revision of the manuscript. Both authors approved the final manuscript.

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