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Evaluation of the VITEK®2 XL Antimicrobial Susceptibility Testing for Non-fermenter Gram-Negative Bacilli: The Importance of Continuing to Monitor Antimicrobial Susceptibility Testing (AST) Systems

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Introduction

- *Pseudomonas aeruginosa* (PSA), *Acinetobacter calcoaceticus-baumannii* complex (ACB), and *Stenotrophomonas maltophilia* (SM) are difficult-to-treat pathogens that substantially contribute to mortality rates.
- Accurate susceptibility testing is crucial to guide antimicrobial therapy and to improve clinical outcomes.
- Therefore, automated susceptibility testing (AST) systems such as VITEK 2 should be monitored against contemporaneous clinical isolates.
- This study compared VITEK 2 AST to the broth microdilution method for reporting susceptibility results against a challenge set of non-fermenter Gram-negative bacilli (NF-GNB) isolates.

Methods

- A challenge set of 159 NF-GNB collected between 2019–2021 from 43 medical centers located in 28 US states in 9 Census Divisions was included (Figure 1).
- Organisms include PSA (62 isolates; including 22 carbapenem-resistant [CR] and 18 cefepime [CEP]-R), ACB (64; 20 CR and 16 CEP-R), and SM (33; 10 trimethoprim-sulfamethoxazole [TS]-R; Figure 2).
- Isolates were identified by MALDI-TOF MS and susceptibility tested by VITEK 2 (using AST-N802+XN15 cards) and CLSI broth microdilution method.
- A total of 1,672 isolate/antimicrobial combinations were evaluated for essential (EA) and categorical (CA) agreements and error rates, following the CLSI M52 guideline.
- FDA-approved VITEK 2 breakpoints were applied to both methods to mimic clinical laboratory practices.

Results

- Overall, VITEK 2 EA and CA rates were 91.7% and 87.9%, respectively.
- Additionally, EA/CA rates were 93.1%/87.6%, 90.6%/88.0%, and 89.9%/88.9% for *P. aeruginosa*, *A. calcoaceticus-baumannii* complex, and *S. maltophilia*, respectively (Figure 3).
- The EA and CA rates for each antimicrobial and organism combination are displayed in Table 1.

P. aeruginosa

- All antimicrobials showed >90% EA against *P. aeruginosa*, except amikacin, imipenem, and ciprofloxacin.
- CA rates >90% were noted for amikacin, ceftolozane-tazobactam, ciprofloxacin, levofloxacin, tobramycin, and gentamicin against *P. aeruginosa*.
- VITEK 2 CA rates for all other antimicrobials tested against *P. aeruginosa* ranged from 75.8% to 88.7%.

***A. calcoaceticus-baumannii* complex**

- All antimicrobials but ampicillin-sulbactam, piperacillin-tazobactam, cefepime, and ceftazidime exhibited EA and CA rates >90% against ACB.

S. maltophilia

- Minocycline and trimethoprim-sulfamethoxazole showed >90% EA and CA rates against *S. maltophilia*, but rates were lower for levofloxacin (78.8%/75.8%).

Conclusions

- The collection of NF-GNB pathogens tested in this study have been designated serious threats, so accurate antimicrobial susceptibility results are critical for treatment.
- VITEK 2 EA and CA rates were >90% for most antimicrobials tested against this challenging collection of NF-GNB; however, some poor correlations were observed.
- β-lactam agents showed categorical rates <88.7% against *P. aeruginosa* (75% of discordances were minor errors).
- Carbapenems showed elevated EA and CA rates (>96%) against *A. baumannii*, while EA/CA rates were low for cephalosporins (cefepime and ceftazidime).
- Trimethoprim-sulfamethoxazole and minocycline exhibited good EA and CA rates (>93%) against *S. maltophilia*.

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Figure 1. Origin of the 159 non-fermenter Gram-negative bacilli isolates included in the study

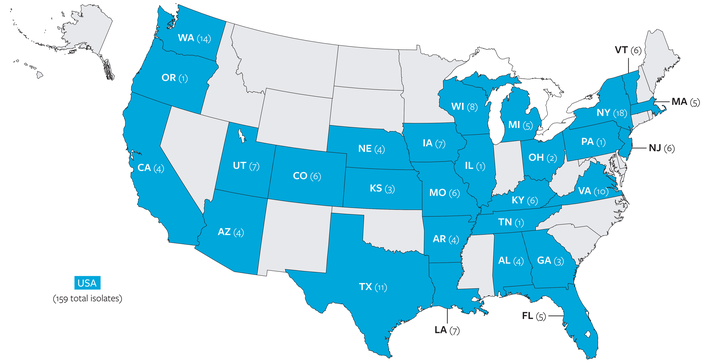


Figure 2. Distribution of non-fermenter Gram-negative bacilli and resistant subgroups

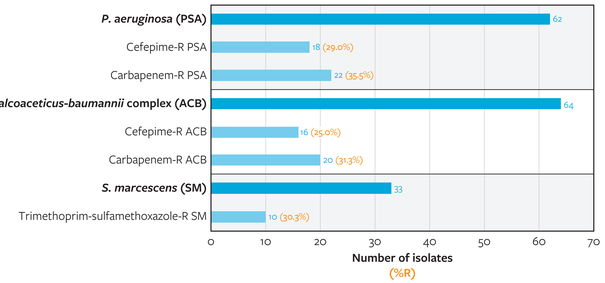
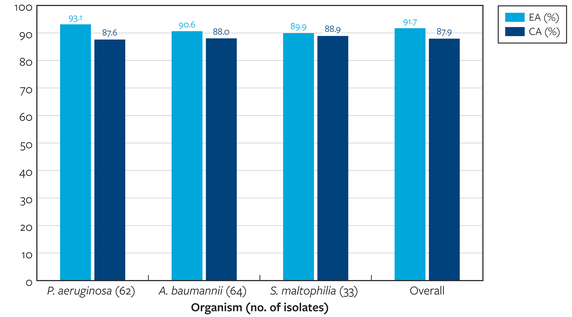


Table 1. VITEK 2 EA and CA rates compared to broth microdilution for non-fermenter Gram-negative bacilli

	Organism (no. isolates)					
	P. aeruginosa (62)		*A. baumannii-calcoaceticus* complex (64)		*S. maltophilia* (33)	
Antimicrobial	EA (%)	CA (%)	EA (%)	CA (%)	EA (%)	CA (%)
Amikacin	88.7	91.9	—	—	—	—
Ampicillin-sulbactam	—	—	62.5	65.6	—	—
Aztreonam	—	—	—	—	—	—
Piperacillin-tazobactam	93.5	79.0	84.1	82.5	—	—
Ceftazidime-avibactam	98.4	88.7	—	—	—	—
Ceftolozane-tazobactam	93.5	93.5	—	—	—	—
Cefepime	91.9	75.8	73.0	55.6	—	—
Ceftazidime	95.2	83.9	89.1	78.1	—	—
Imipenem	82.3	87.1	96.9	98.4	—	—
Meropenem	98.4	83.6	100.0	98.4	—	—
Ciprofloxacin	87.1	90.3	95.3	95.3	—	—
Levofloxacin	93.5	90.3	98.4	96.9	78.8	75.8
Tobramycin	95.2	90.3	95.3	100.0	—	—
Gentamicin	100.0	96.8	95.3	92.2	—	—
Minocycline	—	—	96.9	92.2	97.0	93.9
Trimethoprim-sulfamethoxazole	—	—	100.0	100.0	90.9	97.0

*"—", not tested.

Figure 3. Overall VITEK 2 EA and CA rates compared to broth microdilution against non-fermenter Gram-negative bacilli



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