

# Multicenter Evaluation of the Acuitas AMR Gene Panel for Detection of an Extended Panel of Antimicrobial Resistance Genes among Bacterial Isolates

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## Background

- Antimicrobial resistance (AMR) is a serious public health threat.
- Clinical labs detect AMR by phenotypic antimicrobial susceptibility testing (AST).
- Rapid diagnostic tools are needed for AMR.
- Acuitas<sup>®</sup> AMR Gene Panel is a rapid molecular test that detects several AMR genes from cultured isolates of 26 common bacterial pathogens. The AMR genes render non-susceptibility to 9 classes of antimicrobials including, aminoglycosides, carbapenems, cephalosporins, fluoroquinolones, polymyxins, penicillins, sulfonamides, trimethoprim and vancomycin.
- Acuitas AMR Gene Panel was evaluated in a multicenter study.

## Methods

Across four clinical sites, we evaluated 1,249 retrospective clinical stock isolates and 89 prospective clinical isolates consisting primarily of *E. coli*, *K. pneumoniae*, *P. mirabilis*, *P. aeruginosa* and *E. faecalis*. Acuitas AMR Gene Panel results were compared with genome sequencing, organism identification (bioMérieux Vitek2/ MALDI-TOF MS) and phenotypic AST (Beckman Coulter MicroScan system/reference broth microdilution).

## Results for Reported Organisms and AMR Gene Assays

Positive percent agreement (PPA) was 94 to 100% for detection of AMR genes. Negative percent agreement (NPA) was 97 to 100%. Positive predictive values (PPV) were 80 to 100% for correlation between AMR gene detection and phenotypic non-susceptibility across aminoglycosides (gentamicin, tobramycin, amikacin), beta-lactamase/beta-lactamase inhibitors (amoxicillin/clavulanate, ampicillin/sulbactam, piperacillin/tazobactam), beta-lactams (ampicillin, cefuroxime, ceftriaxone, ceftazidime, cefepime), carbapenems (ertapenem, imipenem, meropenem), trimethoprim/sulfamethoxazole, fluoroquinolones (ciprofloxacin, levofloxacin), polymyxins (colistin) and vancomycin.

## Conclusions

OpGen's Acuitas AMR Gene Panel is an accurate method for detecting a broad array of AMR genes from bacterial isolates and could be used to help guide infection control and antimicrobial stewardship practices. Correlation of AMR gene detection with phenotypic non-susceptibility varied by gene, organism and antimicrobial agent. The Acuitas AMR Gene Panel is pending 510(k) clearance and is not for diagnostic use.

Organism	Reported AMR Gene Assays
<i>Citrobacter freundii</i> complex <sup>1</sup>	CTX-M-1, CTX-M-9, IMP, KPC, NDM, OXA-1, OXA-48, TEM, VIM
<i>Citrobacter koseri</i>	KPC, OXA-48
<i>Enterobacter cloacae</i> complex <sup>2</sup>	CTX-M-1, CTX-M-2, CTX-M-9, IMP, KPC, NDM, OXA-1, OXA-48, SHV, TEM, VIM
<i>Enterococcus faecalis</i>	vanA
<i>Escherichia coli</i>	aac(3)-II(a-d), aac(3)-IV, aac(6')-Ib/Ib-cr, ant(2'')-Ia, CMY-2, CMY-41, CTX-M-1, CTX-M-2, CTX-M-9, dfrA5, dfrA17, gyraseA Mutant, KPC, MCR-1, OXA-1, OXA-9, SHV, sul1, sul2, TEM, VIM
<i>Klebsiella pneumoniae</i>	aac(3)-II(a-d), aac(3)-IV, aac(6')-Ib/Ib-cr, aadA3/A8, aph(4)-Ia, CMY-2, CMY-41, CTX-M-1, CTX-M-9, dfrA5, dfrA17, DHA, IMP, KPC, NDM, OXA-1, OXA-9, OXA-48, rmtB/rmtF, sul1, sul2, TEM, VIM
<i>Klebsiella quasipneumoniae</i>	CTX-M-1, CTX-M-9, IMP, KPC, NDM, OXA-48, VIM
<i>Klebsiella</i> spp. <sup>3</sup>	CTX-M-1, CTX-M-2, CTX-M-9, IMP, KPC, NDM, OXA-48, VIM
<i>Morganella morganii</i>	CTX-M-1, KPC, NDM, OXA-48
<i>Proteus mirabilis</i>	aac(3)-II(a-d), aac(3)-IV, aac(6')-Ib/Ib-cr, ant(2'')-Ia, aph(4)-Ia, armA, CMY-2, CMY-41, CTX-M-1, CTX-M-2, CTX-M-9, dfrA5, dfrA17, IMP, KPC, NDM, OXA-1, OXA-9, OXA-48, sul2, TEM, VEB, VIM
<i>Providencia rettgeri</i>	NDM, VIM
<i>Providencia stuartii</i>	NDM, VIM
<i>Pseudomonas aeruginosa</i>	aac(3)-II(a-d), aac(6')-Ib/Ib-cr, ant(2'')-Ia, CTX-M-1, CTX-M-2, gyraseA Mutant, KPC, NDM, OXA-1, OXA-48, PER, SHV, TEM, VEB, VIM
<i>Raoultella ornithinolytica</i>	IMP, KPC, NDM, OXA-48
<i>Raoultella planticola</i>	KPC, VIM
<i>Serratia marcescens</i>	CTX-M-1, CTX-M-2, CTX-M-9, IMP, KPC, NDM, OXA-1, OXA-48, TEM, VIM

1. *Citrobacter freundii* complex = *C. freundii*, *C. braakii*, *C. werkmanii* and *C. youngae*.

2. *Enterobacter cloacae* complex = *E. asburiae*, *E. cloacae*, *E. hormaechei*, *E. kobei* and *E. ludwigii*.

3. *Klebsiella* spp. = *K. aerogenes*, *K. michiganensis*, *K. oxytoca* and *K. variicola*.

## Results primarily from *E. coli*, *K. pneumoniae*, *P. mirabilis*, *P. aeruginosa* and *E. faecalis*

AMR Gene Assay	PPA	NPA	AMR Gene Assay	PPA	NPA	AMR Gene Assay	PPA	NPA	AMR Gene Assay	PPA	NPA
aac(3)-II(a-d)	98	99	CTX-M-1	97	99	KPC	97	100	SHV	100	100
aac(3)-IV	94	100	CTX-M-2	100	100	MCR-1	94	100	Sul1	99	97
aac(6')-Ib/Ib-cr	98	99	CTX-M-9	99	100	NDM	97	100	Sul2	98	97
aadA3/A8	99	97	DFR	99	99	OXA-1	97	99	TEM	99	98
ant(2'')-Ia	99	99	DHA	100	100	OXA-9	100	100	vanA	100	100
aph(4)-Ia	98	100	<i>E. coli</i> gyrA Mutant	98	99	OXA-48	94	99	VEB	100	99
armA	100	100	<i>P. aeruginosa</i> gyrA Mutant	95	99	PER	99	100	VIM	98	100
CMY	98	100	IMP	100	100	RMT	97	100			

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