



Health System

**Antimicrobial  
Susceptibility  
Summary  
2016**

**Clinical Microbiology  
Department of Pathology & Laboratory Medicine**



# **Antimicrobial Susceptibility Summary**

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Department of Pathology and  
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**UCLA Health System**

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# Preface

This booklet contains up-to-date information to assist the clinician in making decisions concerning antimicrobial therapy and testing:

These tables summarize susceptibility data obtained for organisms isolated in the UCLA Clinical Microbiology Laboratory in 2015.

**Percent Susceptible Data (Tables 1-13)**

**Emerging Resistance Trends at UCLA (Tables 14-18)**

**Antimicrobial Testing and Reporting Policies (Tables 28–29)**

In order to provide the most meaningful information, the laboratory is selective in reporting antimicrobial susceptibility results.

Reporting guidelines are based on:

1. Identity of the organism
2. Body site of culture
3. Overall antibiogram of the organism
4. Therapeutically relevant antimicrobials
5. Formulary status of the antimicrobial

Non-formulary drugs are not routinely reported and controlled formulary agents (Table 27) are reported only in the appropriate setting: e.g. amikacin and tobramycin if resistant to gentamicin. Results of all relevant drugs tested, including those not reported, are available upon request.

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# Guidelines for Interpretation of Minimal Inhibitory Concentrations (MICs)

MICs are interpreted as susceptible, intermediate, resistant, non-susceptible or susceptible dose dependent according to Clinical and Laboratory Standards Institute (CLSI) guidelines. When deciding whether the interpretation is meaningful, one should consider the antimicrobial pharmacokinetics, taking into account dosage and route of administration, the infecting organism and site of infection, and previous clinical experience.

For additional information, please call the antimicrobial testing laboratory, or Antimicrobial Stewardship hotline.

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Frequently called numbers\*:

Antimicrobial Stewardship Hotline.....	310-267-7567
Antimicrobial Testing Laboratory.....	310-794-2760
Drug Information Center.....	310-267-8522
Infection Control (SMH-UCLA).....	424-259-4454
Infection Control (RRUMC).....	310-794-0187
Infectious Diseases (Adult).....	310-825-7225
Infectious Diseases (Pediatric).....	310-825-5235
Infectious Disease Pharmacist (page 92528).....	310-267-8510
Microbiology Fellow on-call.....	page 90103

\* If calling within UCLA system, dial the last 5 digits of the phone number.

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RRUMC – Ronald Reagan UCLA Medical Center  
 SMH-UCLA – Santa Monica Hospital-UCLA

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**Table 1. RRUMC: Adults (>21 y.o.) Five Most Common Gram-negative Bacteria – Non-Urine Isolates, % Susceptible**

Organism	Location	No. Isolates	Penicillins			Cephalosporins				Carbapenems			Aminoglycosides			Fluoro-quinolone	Other	
			Ampicillin	Ampicillin-sulbactam	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone <sup>1</sup>	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Trimethoprim-sulfamethoxazole	Colistin
<i>Enterobacter cloacae</i>	OP	74	R <sup>2</sup>	R	95	R	99	— <sup>3,4</sup>	— <sup>4</sup>	99	99	99	99	99	99	97	92	81
	IP	33	R	R	76	R	85	— <sup>4</sup>	— <sup>4</sup>	88	97	97	94	94	94	94	88	79
	ICU	64	R	R	67	R	88	— <sup>4</sup>	— <sup>4</sup>	95	98	98	97	97	97	98	91	78
<i>Escherichia coli</i>	OP	246	47	55	94	67	91	89	86	99	99	99	82	85	62	59	99	99
	IP	106	33	43	90	49	75	71	65	97	99	99	73	72	45	43	99	99
	ICU	92	20	31	77	33	69	67	65	95	99	99	71	71	46	46	99	99
<i>Klebsiella pneumoniae</i>	OP	105	R	78	94	78	91	88	86	97	97	97	94	91	91	91	75	98
	IP	84	R	58	80	56	75	74	70	85	85	87	80	75	74	69	98	98
	ICU	111	R	68	83	68	83	81	80	91	92	91	88	86	82	77	95	95
<i>Proteus mirabilis</i>	OP	71	73	87	99	34	93	96	89	99	76	99	85	93	72	72	R	R
	IP	17 <sup>5</sup>	71	88	99	24	94	99	88	99	53	99	88	94	53	71	R	R
	ICU	18 <sup>5</sup>	78	78	99	44	99	99	99	99	67	99	89	89	61	61	R	R
<i>Pseudomonas aeruginosa</i>	OP	308	R	R	90	R	90	91	R	R	83	89	95	90	80	R	R	98
	IP	96	R	R	77	R	84	83	R	R	71	78	95	93	63	R	R	99
	ICU	114	R	R	72	R	78	82	R	R	61	68	92	90	93	R	R	99

OP, outpatient (includes EMC); IP, inpatient (excludes ICU); ICU, intensive care unit

<sup>1</sup> Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae*.

<sup>2</sup> R = intrinsic resistance (inherent or innate antimicrobial resistance).

<sup>3</sup> — = Not routinely tested and/or not applicable.

<sup>4</sup> 3<sup>rd</sup> generation cephalosporins should not be used for serious infections.

<sup>5</sup> Calculated from fewer than the standard recommendation of 30 isolates.



**Table 2. RRUMC: Adults (>21 y.o.) Gram-negative Bacteria – Non-Urine Isolates, % Susceptible**

Organism	No. Isolates	Penicillins			Cephalosporins				Carbapenems			Aminoglycosides			Fluoro-quinolone	Other	
		Ampicillin	Ampicillin-subactam	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone <sup>1</sup>	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Trimethoprim-sulfamethoxazole	Colistin
<i>Citrobacter freundii</i>	40	R <sup>2</sup>	R	88	R	93	— <sup>3,4</sup>	90	93	95	99	83	93	85	73	99	
<i>Enterobacter aerogenes</i>	63	R	R	79	R	95	— <sup>4</sup>	98	95	99	99	99	99	98	98	99	
<i>Enterobacter cloacae</i>	172	R	R	81	R	92	— <sup>4</sup>	95	99	99	99	98	98	97	91	79	
<i>Escherichia coli</i>	441	41	50	92	59	84	83	79	98	99	99	79	81	58	55	99	
<i>Klebsiella oxytoca</i>	102	R	66	91	31	95	92	98	99	99	99	95	97	96	91	99	
<i>Klebsiella pneumoniae</i>	299	R	72	88	71	86	84	93	93	93	94	90	87	85	76	98	
<i>Morganella morganii</i>	29 <sup>5</sup>	R	R	97	R	99	— <sup>4</sup>	99	—	99	99	76	90	69	66	R	
<i>Proteus mirabilis</i>	117	74	87	99	34	95	97	99	—	99	99	87	93	71	70	R	
<i>Serratia marcescens</i>	99	R	R	98	R	99	— <sup>4</sup>	99	97	99	99	99	99	93	99	R	
<i>Acinetobacter baumannii</i>	49	R	69	49	R	63	61	R	74	71	74	65	69	63	67	94	
<i>Pseudomonas aeruginosa</i>	498	R	R	87	R	89	90	R	80	86	95	92	96	78	R	99	
<i>Stenotrophomonas maltophilia</i>	53	R	R	R	R	—	32	R	R	R	R	R	R	—	94	45	
<i>Burkholderia cepacia complex</i>	12 <sup>5</sup>	R	R	R	R	R	42	R	R	42	R	R	R	58	92	R	

<sup>1</sup> Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae*.

<sup>2</sup> R = intrinsic resistance.

<sup>3</sup> — = Not routinely tested and/or not applicable.

<sup>4</sup> 3<sup>rd</sup> generation cephalosporins should not be used for serious infections.

<sup>5</sup> Calculated from fewer than the standard recommendation of 30 isolates.

**Table 3. RRUMC: Adults (>21 y.o.) Gram-negative Bacteria – Urine Isolates, % Susceptible**

Organism	Source	No. Isolates	Penicillin		Cephalosporins			Carbapenems			Amino-glycoside	Fluoro-quinolone	Other	
			Ampicillin	Oral Cephalosporins <sup>1</sup>	Cefepime	Ceftaxone <sup>2</sup>	Ertapenem	Imipenem	Meropenem	Gentamicin	Ciprofloxacin	Nitrofurantoin	Trimethoprim - sulfamethoxazole	
<i>Enterobacter cloacae</i>	OP	87	R <sup>3</sup>	R	99	— <sup>4,5</sup>	98	99	99	97	98	31	81	
	IP	23 <sup>6</sup>	R	R	96	— <sup>5</sup>	78	99	99	96	96	36	70	
<i>Escherichia coli</i>	OP	3198	54	89	—	93	99	99	99	90	78	94	72	
	IP	331	35	71	—	75	99	99	99	82	59	89	55	
<i>Klebsiella pneumoniae</i>	OP	536	R	91	—	92	99	99	99	96	96	27	83	
	IP	102	R	78	—	78	91	95	94	84	82	27	78	
<i>Proteus mirabilis</i>	OP	223	83	95	99	96	93	—	99	91	85	R	81	
	IP	44	82	93	98	99	96	—	99	91	82	R	80	
<i>Pseudomonas aeruginosa</i> <sup>7</sup>	OP	125	R	R	93	R	R	R	86	94	73	R	R	
	IP	66	R	R	88	R	R	R	74	96	80	R	R	

OP, outpatient (includes EMC); IP, inpatient (includes all units and ICUs)

<sup>1</sup> Oral cephalosporins include cefpodoxime and cephalixin for treatment of uncomplicated urinary tract infections.

<sup>2</sup> Cefotaxime and ceftaxone have comparable activity against *Enterobacteriaceae*

<sup>3</sup> R = intrinsic resistance.

<sup>4</sup> — = Not routinely tested and/or not applicable.

<sup>5</sup> 3<sup>rd</sup> generation cephalosporins should not be used for serious infections.

<sup>6</sup> Calculated from fewer than the standard recommendation of 30 isolates

<sup>7</sup> Ceftazidime: OP 91%, IP 85%, Piperacillin-tazobactam: OP 89%, IP 79%



**Table 4. RRUMC: Adults (>21 y.o.) Gram-positive Cocci, % Susceptible**

Organism	Source	No. Isolates	Penicillins			Amino-glycosides		Other										
			Ampicillin	Oxacillin	Penicillin	Gentamicin synergy	Streptomycin synergy	Ciprofloxacin	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Linezolid	Quinupristin-dalfopristin	Rifampin <sup>1</sup>	Trimethoprim-sulfamethoxazole	Vancomycin	Ceftaroline
<i>Staphylococcus aureus</i> <sup>2</sup>	All	1479	— <sup>3</sup>	71	<10	—	—	66	73	99	99	54	99	99	99	98	99	100
Oxacillin-resistant <i>S. aureus</i> (MRSA) <sup>2,4</sup>	OP	261	—	R	R	—	—	18	57	99	98	12	99	99	99	96	99	100
	IP	75	—	R	R	—	—	12	39	99	99	8	99	99	93	96	99	99
	ICU	85	—	R	R	—	—	11	52	99	95	12	99	98	92	94	99	100
Oxacillin-susceptible <i>S. aureus</i> (MSSA)	OP	721	—	100	<10	—	—	86	77	99	99	68	99	99	99	99	99	100
	IP	114	—	100	<10	—	—	80	83	99	99	73	99	99	98	98	99	100
	ICU	127	—	100	<10	—	—	89	78	99	99	74	99	99	98	99	99	100
Coagulase-negative <i>Staphylococcus</i> <sup>4,5</sup>	All	448	—	48	<10	—	—	48	61	99	91	39	99	99	95	63	99	—
<i>Enterococcus</i> spp. <sup>4,6</sup>	All	450	75	—	—	82	71	53	R	99	45	R	99	—	38	R	78	R
<i>Enterococcus faecalis</i> <sup>4,7</sup>	All	82	99	—	—	68	73	62	R	99	49	R	99	R	43	R	98	R
<i>Enterococcus faecium</i> <sup>4,8</sup>	All	108	8	—	—	94	51	5	R	97	52	R	99	97	5	R	19	R

OP, outpatient (includes EMC); IP, inpatient (excludes ICU); ICU, intensive care unit

<sup>1</sup> Rifampin should not be used as monotherapy.

<sup>2</sup> *Staphylococcus* resistant to oxacillin are resistant to ceftazolin, cephalixin, ceftriaxone and all other beta-lactams except ceftaroline.

<sup>3</sup> — = Not routinely tested and/or not applicable.

<sup>4</sup> Serious Enterococcal infections need combination therapy with Ampicillin, Penicillin, or Vancomycin plus an Aminoglycoside.

<sup>5</sup> *S. saprophyticus* urinary tract infections respond to antibiotic concentrations achieved in urine with agents commonly used to treat acute uncomplicated UTIs

<sup>6</sup> Includes isolates tested from all body sites.

<sup>7</sup> 17% High-level resistance to both gentamicin and streptomycin. Includes isolates tested from sterile body sites only.

<sup>8</sup> 2% High-level resistance to both gentamicin and streptomycin. Includes isolates tested from sterile body sites only.

**Table 4. RRUMC: Adults (>21 y.o.) Gram-positive Cocci, % Susceptible (cont.)**

Organism	No. Isolates	Penicillins		Cephalosporins		Other					
		Amoxicillin	Penicillin	Cefotaxime	Ceftriaxone	Clindamycin	Doxycycline	Erythromycin	Levofloxacin	Trimethoprim - sulfamethoxazole	Vancomycin
<i>Streptococcus pneumoniae</i>	29 <sup>1</sup>	97	— <sup>2</sup>	5	— <sup>2</sup>	86	69	55	99	79	100
Meningitis <sup>3</sup>		—	58	86	89	—	—	—	—	—	—
Non-meningitis <sup>4</sup>		—	95	96	99	—	—	—	—	—	—
Viridans group <i>Streptococcus spp.</i>	53	—	65 <sup>5</sup>	96	98	—	—	—	—	—	100
Beta-hemolytic group <i>Streptococcus spp.</i>	<p>1. All remain predictably susceptible to penicillin</p> <p>2. Group B streptococci (<i>S. agalactiae</i>) are approximately 30% R to clindamycin.</p> <p>3. Group A streptococci (<i>S. pyogenes</i>) are:  a. 25% R to erythromycin  b. 5% R to clindamycin  c. 20% R to tetracyclines</p>										

<sup>1</sup> Calculated from fewer than the standard recommendation of 30 isolates.

<sup>2</sup> — = Not routinely tested and/or not applicable.

<sup>3</sup> % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients with meningitis.

<sup>4</sup> % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients without meningitis.

<sup>5</sup> Resistant (R) includes 33% Intermediate (MIC 0.25-2 µg/ml) and 2% High-level (MIC >2 µg/ml) resistance



**Table 5. RRUMC: Miscellaneous Gram-negative Bacteria**

<b>Organism</b>	<b>No. Isolates</b>	<b>% beta-lactamase positive<sup>1</sup></b>
<i>Haemophilus influenzae</i>	80 (pts. >21 y.o) 29 (pts. ≤21 y.o.)	26 21
<i>Moraxella catarrhalis</i>	24 (pts. >21 y.o) 10 (pts. ≤21 y.o.)	96 100
<i>Neisseria gonorrhoeae</i>	The current therapy recommendation is ceftriaxone in combination with azithromycin or doxycycline. Culture and susceptibility testing should be performed in cases of treatment failure. See <a href="http://www.cdc.gov/std/Gonorrhea/treatment.htm">http://www.cdc.gov/std/Gonorrhea/treatment.htm</a>	
<i>Neisseria meningitidis</i>	<i>Neisseria meningitidis</i> remain susceptible to penicillin and ceftriaxone, the drugs of choice for treating meningococcal infections. However, reports (MMWR. 2008. 57:173-175) have noted some isolates with resistance to fluoroquinolones, agents often used for prophylaxis.	

<sup>1</sup> Resistant to ampicillin, amoxicillin, and penicillin

**Table 6. RRUMC: *Pseudomonas aeruginosa* – %Susceptible to One or Two Antimicrobials**

Information provided for two drug combination does NOT imply synergism, antagonism or likely activity in vivo; 778 patients, includes the most resistant result for each drug if patient had >1 isolate

	Amikacin (95) <sup>1</sup>	Gentamicin (91)	Tobramycin (95)	Ciprofloxacin (79)
Cefepime (87)	99 <sup>2</sup>	99	99	96
Meropenem (86)	99	98	98	93
Piperacillin-tazobactam (84)	99	98	99	95
Ciprofloxacin (79)	99	97	98	–

<sup>1</sup> Percent susceptible for individual drug in parenthesis

<sup>2</sup> Percent susceptible for either or both drugs (e.g. %S to amikacin and/or cefepime)



**Table 7. RRUMC: Pediatrics (≤ 21 y.o.) Gram-negative Bacteria – Non-Urine Isolates, % Susceptible**

Organism	No. Isolates	Penicillins			Cephalosporins				Carbapenems			Aminoglycosides			Fluoroquinolone <sup>2</sup>	Other
		Ampicillin	Ampicillin-sulbactam	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone <sup>1</sup>	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin		
<i>Enterobacter cloacae</i>	22 <sup>3</sup>	R <sup>4</sup>	R	82	R	96	—	—	91	99	99	99	99	99	99	91
<i>Escherichia coli</i>	45	31	43	96	53	84	84	77	96	98	98	89	86	66	58	
<i>Klebsiella pneumoniae</i>	42	R	81	91	81	88	88	88	98	98	98	88	88	86	81	
<i>Serratia marcescens</i>	18 <sup>3</sup>	R	R	94	R	99	—	—	99	99	99	99	99	94	99	
<i>Pseudomonas aeruginosa</i>	81	R	R	80	R	86	89	R	R	89	94	98	95	98	89	R

<sup>1</sup> Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae*.

<sup>2</sup> Ciprofloxacin is associated with arthropathy and histological changes in weight-bearing joints of juvenile animals and is currently not FDA approved for pediatric use.

<sup>3</sup> Calculated from fewer than the standard recommendation of 30 isolates.

<sup>4</sup> R = intrinsic resistance (inherent or innate antimicrobial resistance).

<sup>5</sup> 3<sup>rd</sup> generation cephalosporins should not be used for serious infections.



**Table 8. RRUMC: Pediatrics ( ≤ 21 y.o.) Gram-negative Bacteria – Urine Isolates, % Susceptible**

Organism	No. Isolates	Penicillins		Cephalosporins				Carbapenems			Aminoglycosides		Fluoroquinolone	Other		
		Ampicillin	Ampicillin-sulbactam	Oral Cephalosporins	Cefepime	Ceftazidime	Ceftriaxone <sup>1</sup>	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin <sup>2</sup>	Trimethoprim – sulfamethoxazole	Nitrofurantoin
<i>Enterobacter cloacae</i>	20 <sup>3</sup>	R <sup>4</sup>	R	R	95	— <sup>5</sup>	—	80	99	99	99	—	99	99	85	26
<i>Escherichia coli</i>	407	60	67	93	—	—	95	99	99	99	93	—	89	77	95	
<i>Klebsiella pneumoniae</i>	47	R	79	89	—	—	92	99	99	99	92	—	98	85	21	
<i>Proteus mirabilis</i>	46	83	87	96	—	—	98	94	ND	99	89	—	99	74	R	
<i>Pseudomonas aeruginosa</i>	30	R	R	R	87	87	R	R	87	90	97	97	90	R	R	

<sup>1</sup> Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae*.

<sup>2</sup> Ciprofloxacin is associated with arthropathy and histological changes in weight-bearing joints of juvenile animals and is not FDA approved for pediatric use.

<sup>3</sup> Calculated from fewer than the standard recommendation of 30 isolates.

<sup>4</sup> R = intrinsic resistance (inherent or innate antimicrobial resistance).

<sup>5</sup> — = Not routinely tested and/or not applicable.



**Table 9. RRUMC: Pediatrics ( ≤ 21 y.o.) Gram-positive Cocci, % Susceptible**

Organism	Location	No. Isolates	Penicillins			Cephalo- sporins		Aminoglycosides		Other										
			Ampicillin	Oxacillin	Penicillin	Ceftriaxone	Cefotaxime	Gentamicin synergy	Streptomycin synergy	Ciprofloxacin <sup>1</sup>	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Linezolid	Quinupristin- dalbopristin	Rifampin <sup>2</sup>	Trimethoprim- sulfamethoxazole	Vancomycin	Ceftaroline
<i>Staphylococcus aureus</i> (All) <sup>3</sup>	OP	187	— <sup>4</sup>	82	<10	—	—	—	78	76	99	99	55	99	99	99	99	99	99	100
	IP	91	—	79	<10	—	—	—	79	88	99	99	69	99	99	99	99	99	99	100
Oxacillin-resistant <i>S. aureus</i> (MRSA) <sup>3</sup>	OP	34	—	R <sup>6</sup>	R	R	R	—	19	76	99	99	6	99	99	99	97	97	99	100
	IP	19 <sup>5</sup>	—	R	R	R	R	—	26	90	99	99	32	99	99	99	99	99	99	100
Oxacillin-susceptible <i>S. aureus</i> (MSSA)	OP	154	—	100	<10	—	—	—	90	75	99	99	64	99	99	99	99	99	99	100
	IP	73	—	100	<10	—	—	—	92	84	99	99	78	99	99	99	99	99	99	100
Coagulase negative <i>Staphylococcus</i> (sterile body sites)	OP	37	—	50	<10	—	—	—	87	67	99	95	32	99	99	99	97	68	99	—
	IP	52	—	25	<10	—	—	—	73	39	99	92	23	98	99	99	99	79	99	—
<i>Enterococcus</i> spp. <sup>7</sup>	All	39	85	—	—	R	R	84	76	R	97	44	R	99	—	51	R	87	—	
<i>Enterococcus faecalis</i> <sup>8</sup>	All	13 <sup>5</sup>	99	—	—	R	R	77	85	R	99	23	R	99	R	62	R	99	—	
<i>Enterococcus faecium</i> <sup>8</sup>	All	6 <sup>5</sup>	17	—	—	R	R	99	83	R	99	50	R	99	99	0	R	17	—	

OP, outpatient (includes EMC); IP, inpatient (includes ICU)

<sup>1</sup> Ciprofloxacin is associated with arthropathy and histological changes in weight bearing joints of juvenile animals and is not FDA approved for pediatric use.

<sup>2</sup> Rifampin should not be used as monotherapy.

<sup>3</sup> *Staphylococcus* resistant to oxacillin are resistant to ceftazolin, cephalixin, ceftriaxone and all other beta-lactams except ceftaroline.

<sup>4</sup> — = Not routinely tested and/or not applicable.

<sup>5</sup> Calculated from fewer than the standard recommendation of 30 isolates.

<sup>6</sup> R = intrinsic resistance

<sup>7</sup> Includes isolates tested from all body sites.

<sup>8</sup> 11% High-level resistance to both gentamicin and streptomycin. Includes isolates tested from sterile body sites only.

**Table 9. RRUMC: Pediatrics ( ≤ 21 y.o.) Gram-positive Cocci, % Susceptible (cont.)**

Organism	No. Isolates	Penicillins		Cephalosporins		Other				
		Amoxicillin	Penicillin	Cefotaxime	Ceftriaxone	Clindamycin	Doxycycline	Erythromycin	Trimethoprim - sulfamethoxazole	Vancomycin
<i>Viridans group Streptococcus (sterile body sites)</i>	14 <sup>1</sup>	— <sup>2</sup>	64	79	79	—	—	—	—	100
<i>Streptococcus pneumoniae</i>	16 <sup>1</sup>	100	—	—	—	94	81	81	69	100
Meningitis <sup>3</sup>		—	69	94	100	—	—	—	—	—
Non-meningitis <sup>4</sup>		—	100	100	100	—	—	—	—	—

<sup>1</sup> Calculated from fewer than standard recommendation of 30 isolates

<sup>2</sup> — = Not routinely tested and/or not applicable.

<sup>3</sup> % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients with meningitis.

<sup>4</sup> % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients without meningitis.



**Table 10. RRUMC: Yeasts, % Susceptible, 2014-2015**

- When antifungal therapy is necessary, most yeast infections can be treated empirically. Antifungal testing of yeasts may be warranted for the following:
  - 1) oropharyngeal infections due to *Candida* spp. in patients who appear to be failing therapy
  - 2) management of invasive *Candida* spp. infections when utility of an azole agent is uncertain (e.g., *Candida* spp. other than *C. albicans*), per IDSA guidelines for candidiasis: CID 2016:62, E1-E50. Clinical Practice Guidelines for the Management of Candidiasis.
- Yeast isolates from sterile body sites are tested every 7 days; isolates from other sources are tested upon special request.

Organism	No. Isolates <sup>2</sup>	Percent Susceptible/Dose Dependent/Resistant at Breakpoints <sup>1</sup> (µg/ml)							
		Fluconazole		Caspofungin	Voriconazole		Flucytosine		
		≤ 8 S	16-32 S-DD	≥64 R	≤ 2 S	≤ 1 S	2 S-DD	≥4 R	≤ 4 S
<i>C. albicans</i>	172	100	0	0	100	99	0	1	99
<i>C. glabrata</i>	160	43	40	17	99	88	9	3	97
<i>C. parapsilosis</i>	48	100	0	0	98	100	0	0	99
<i>C. tropicalis</i>	42	95	5	0	100	100	0	0	95
<i>C. krusei</i>	28 <sup>3</sup>	R <sup>4</sup>	R	R	100	96	4	0	36

<sup>1</sup> S = Susceptible. S-DD = Susceptible dose dependent; susceptibility dependent on achieving maximal possible blood level; no dose dependent category for flucytosine and caspofungin. R = Resistant

<sup>2</sup> Not all isolates were tested against all four antifungal agents.

<sup>3</sup> Calculated from fewer than the standard recommendation of 30 isolates

<sup>4</sup> R = intrinsic resistance (inherent or innate antimicrobial resistance).

**Table 11. SMH-UCLA: Non-Urine Gram-negative Bacteria, % Susceptible**

Organism		Penicillins			Cephalosporins				Carbapenems			Aminoglycosides			Fluoro-quinolone	Other
		Ampicillin	Ampicillin-sulbactam	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone <sup>1</sup>	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Trimethoprim - sulfamethoxazole
No. Isolates																
<i>Escherichia coli</i>		41	47	99	63	90	89	87	99	99	99	84	88	76	68	
<i>Pseudomonas aeruginosa</i>		R <sup>2</sup>	R	78	R	86	84	R	R	81	83	91	72	R		

Organism		Penicillins			Cephalosporins				Carbapenems			Aminoglycosides			Fluoro-quinolone	Other
		Ampicillin	Ampicillin-sulbactam	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone <sup>1</sup>	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Trimethoprim - sulfamethoxazole
No. Isolates																
<i>Enterobacter cloacae</i>		R <sup>2</sup>	R	67	R	83	— <sup>4,5</sup>	— <sup>5</sup>	94	99	99	83	89	78	78	
<i>Escherichia coli</i>		28	37	90	52	82	79	76	99	99	99	83	83	52	56	
<i>Klebsiella pneumoniae</i>		R	57	71	57	75	71	67	82	84	96	78	71	73	64	
<i>Proteus mirabilis</i>		46	70	99	9	85	88	73	99	—	99	73	79	42	39	
<i>Serratia marcescens</i>		R	R	99	R	99	— <sup>5</sup>	— <sup>5</sup>	99	99	93	99	93	93	99	
<i>Pseudomonas aeruginosa</i>		R	R	68	R	78	75	R	R	60	98	88	88	66	R	

<sup>1</sup> Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae*

<sup>2</sup> R = intrinsic resistance.

<sup>3</sup> Calculated from fewer than the standard recommendation of 30 isolates

<sup>4</sup> — = Not routinely tested and/or not applicable.

<sup>5</sup> 3<sup>rd</sup> generation cephalosporins should not be used for serious infections.



**Table 12. SMH-UCLA: Urine Gram-negative Bacteria, % Susceptible**

Organism	Location	No. Isolates	Penicillins		Cephalosporins				Carbapenems			Aminoglycosides			Fluoro-quinolone	Other	
			Ampicillin	Piperacillin-tazobactam	Oral Cephalosporins <sup>1</sup>	Cefepime	Ceftriaxone <sup>2</sup>	Ceftazidime	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Nitrofurantoin	Other
<i>Escherichia coli</i>	OP	1796	52	— <sup>3</sup>	89	—	91	—	99	99	99	91	—	79	95	72	
	IP	183	48	—	80	—	83	—	99	99	99	86	—	58	94	64	
<i>Klebsiella pneumoniae</i>	OP	307	R <sup>4</sup>	—	93	—	94	—	99	99	99	97	—	95	26	91	
	IP	53	R	—	87	—	87	—	93	93	93	98	—	87	18	85	
<i>Proteus mirabilis</i>	OP	193	81	—	95	—	96	—	91	—	99	88	88	71	R	75	
	IP	36	69	—	92	—	92	—	86	—	97	86	—	67	R	69	
<i>Pseudomonas aeruginosa</i>	OP	88	R	80	R	85	R	84	R	77	82	99	91	73	R	R	
	IP	24 <sup>5</sup>	R	71	R	75	R	75	R	67	71	99	79	58	R	R	

OP, outpatient (includes EMC); IP, inpatient (includes ICU)

<sup>1</sup> Oral cephalosporins include cefpodoxime and cephalixin for treatment of uncomplicated urinary tract infections.

<sup>2</sup> Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae*

<sup>3</sup> — = Not routinely tested and/or not applicable.

<sup>4</sup> R = intrinsic resistance

<sup>5</sup> Calculated from fewer than the standard recommendation of 30 isolates

**Table 13. SMH-UCLA (Inpatient): Gram-positive Cocci, % Susceptible**

Organism	No. Isolates	Penicillins			Cephalosporin	Fluoroquinolones	Tetracyclines	Other									
		Ampicillin	Oxacillin	Penicillin				Ceftriaxone	Ciprofloxacin	Doxycycline	Clindamycin	Daptomycin	Erythromycin	Linezolid	Quinupristin-dalfopristin	Rifampin	Trimethoprim-sulfamethoxazole
<i>Staphylococcus aureus</i> (All)	177	— <sup>1</sup>	50	<10	—	44	98	65	99	41	99	99	99	99	99	99	100
oxacillin-resistant (MRSA) <sup>2</sup>	91	R <sup>3</sup>	R	R	R	10	96	48	99	14	99	99	98	99	99	99	100
oxacillin-susceptible (MSSA)	91	—	100	<10	—	78	99	80	99	65	99	99	99	99	99	99	100
<i>Staphylococcus</i> , coagulase-negative <sup>2,4</sup>	33	—	32	<10	—	34	97	56	99	38	99	99	94	99	56	99	100
<i>Enterococcus</i> spp. (all) <sup>5,6</sup>	116	74	—	52	R	—	44	R	99	—	99	41 <sup>7</sup>	—	R	R	74	R

<sup>1</sup> — = Not routinely tested and/or not applicable.

<sup>2</sup> *Staphylococcus* resistant to oxacillin are resistant to cefazolin, cephalixin, ceftriaxone and all other beta-lactams except ceftaroline

<sup>3</sup> R = intrinsic resistance

<sup>4</sup> *S. saprophyticus* urinary tract infections respond to antibiotic concentrations achieved in urine with agents commonly used to treat acute uncomplicated UTIs

<sup>5</sup> Includes 11 *E. faecalis*, 6 *E. faecium*, and 99 isolates not identified to species level

<sup>6</sup> Gentamicin synergy 82% susceptible, streptomycin synergy 69% susceptible

<sup>7</sup> Only *E. faecium* are susceptible



**Table 14. RRUMC: Emerging Resistance Concerns**

When unusual antimicrobial resistance (R) is observed, an Infectious Disease (ID) consult is strongly suggested to optimize therapy and prevent nosocomial transmission.

<b>Organism</b>	<b>Resistant to:</b>	<b>Percent Resistant:</b>	<b>Therapeutic Options</b>	<b>Comments</b>
<i>Staphylococcus aureus</i>	oxacillin (MRSA)	Inpatients (n=401) 40% Outpatients (n=982) 27%	vancomycin ceftaroline daptomycin	MRSA are clinically resistant to all $\beta$ -lactams, $\beta$ -lactam / $\beta$ -lactamase inhibitor combinations and carbapenems, excluding ceftaroline. <sup>1</sup> MRSA are also typically resistant to fluoroquinolones
<i>Streptococcus pneumoniae</i> (non-meningitis)	penicillin (MIC > 2 $\mu$ g/ml)	All isolates (n = 29) 3%	ceftriaxone or cefotaxime or vancomycin	If susceptible (MIC $\leq$ 2.0 $\mu$ g/ml), high dose penicillin has been shown to be effective for infections other than meningitis. <sup>1</sup>
<i>Streptococcus pneumoniae</i> (non-meningitis)	cefotaxime, ceftriaxone (penicillin resistant always)	All isolates (n = 29) low level R 3% high level R 0%	vancomycin levofloxacin	If low-level resistance (MIC=2.0 $\mu$ g/ml), high dose cefotaxime or ceftriaxone may be effective for infections other than meningitis. <sup>1</sup>



## Table 14. RRUMC: Emerging Resistance Concerns (cont.)

When unusual antimicrobial resistance (R) is observed, an Infectious Disease (ID) consult is strongly suggested to optimize therapy and prevent nosocomial transmission.

Organism	Resistant to:	Percent Resistant:	Therapeutic Options	Comments
Viridans group <i>Streptococcus</i>	penicillin	Blood isolates (n = 57) low level R 31% high level R 6%	vancomycin or penicillin + aminoglycoside	Level of penicillin resistance is particularly useful in guiding therapy for endocarditis. <sup>1</sup> For low level resistance, MICs are 0.25–2.0 µg/ml; for high level, MICs are >2.0 µg/ml. <sup>2</sup>
<i>Enterococcus</i> spp.	vancomycin (VRE)	Blood isolates <i>E. faecium</i> (n = 87) 85% <i>E. faecalis</i> (n = 62) 2%	Check in vitro susceptibility results and contact Infectious Diseases.	Vancomycin-resistant <i>Enterococcus</i> (VRE) are often resistant to many potentially useful agents. Therapeutic management must be determined on a case-by-case basis.
	gentamicin synergy screen (GENT) streptomycin synergy screen (STR)	Blood isolates <i>E. faecium</i> (n = 87) GENT 3% STR 53% <i>E. faecalis</i> (n = 62) GENT 34% STR 26%	Check in vitro susceptibility results and contact Infectious Diseases.	Both aminoglycoside and cell wall active agent (ampicillin, penicillin, or vancomycin) must be susceptible for synergistic interaction.

**Table 14. RRUMC: Emerging Resistance Concerns (cont.)**

Organism	Resistant to:	Percent Resistant:	Therapeutic Options	Comments
<i>Klebsiella</i> spp. <i>E. coli</i>	ceftriaxone or other 3rd generation cephalosporin	Blood isolates: <i>Klebsiella</i> spp. (n =111) 29% <i>E. coli</i> (n =156) 22%	ertapenem ciprofloxacin	In vitro resistance to 3rd generation cephalosporins suggests the strain is producing extended-spectrum $\beta$ -lactamases (ESBL), or Ampc
<i>K. pneumoniae</i> and other <i>Enterobacteriaceae</i>	carbapenem	All isolates: <1%	Check in vitro susceptibility results and contact Infectious Diseases.	Decreased susceptibility to carbapenems is increasing primarily among ICU patients' isolates. These isolates may be resistant to all available antimicrobial agents. See Table 16.
<i>Citrobacter freundii</i> <i>Enterobacter</i> spp. / <i>Providencia</i> spp. / <i>Proteus</i> spp. (except <i>P. mirabilis</i> ) <i>Serratia marcescens</i>	3rd generation cephalosporins (e.g. ceftriaxone)	See comments	aminoglycoside ciprofloxacin ertapenem meropenem trimeth-sulfa	Organisms listed typically produce inducible $\beta$ -lactamases. Isolates that appear susceptible to 3rd generation cephalosporins may develop resistance during therapy. <sup>1</sup>
<i>Pseudomonas aeruginosa</i>	cefepime and/or piperacillin-tazobactam	All isolates: (n=820) 11%	Check in vitro susceptibility results and contact Infectious Diseases.	Combination therapy with a beta-lactam plus ciprofloxacin or an aminoglycoside (with susceptible results in vitro) should be considered. Therapeutic management must be determined on a case by case basis.
<i>Acinetobacter baumannii</i>	amikacin, ampicillin-sulbactam, cefepime, ceftazidime, ciprofloxacin, meropenem, pip-tazo, trimeth-sulfa	All isolates: (n=59) 15%	Check in vitro susceptibility results and contact Infectious Diseases.	Therapeutic management must be determined on a case by case basis.

## Table 14. RRUMC: Emerging Resistance Concerns (cont.)

When specific antimicrobial resistance (R) is detected, an Infectious Disease (ID) consult is strongly suggested.

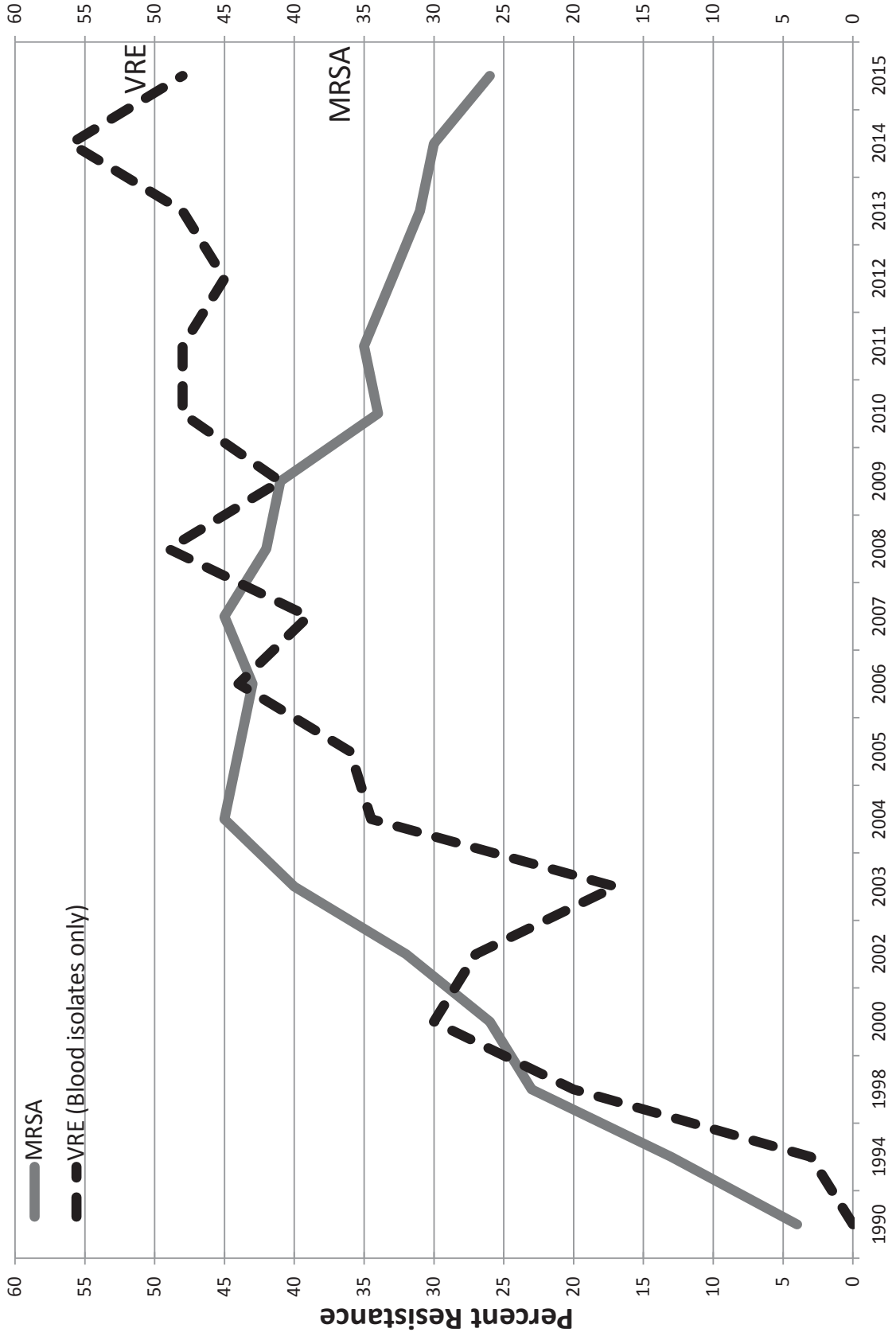
Organism	If Resistant to:	Therapeutic Options	Comments
<i>Candida krusei</i>	caspofungin	voriconazole <sup>3</sup> amphotericin <sup>4</sup>	Typically susceptible to caspofungin. Breakthrough infections have been reported.
	voriconazole	caspofungin <sup>6</sup> amphotericin <sup>4,7</sup>	Intrinsically resistant to fluconazole. <sup>8,9</sup> Typically susceptible to voriconazole. <sup>8,9</sup>
<i>Candida glabrata</i>	caspofungin	fluconazole <sup>10</sup> voriconazole <sup>3</sup> amphotericin <sup>4,7</sup>	Caspofungin resistance may be emerging. <sup>8</sup>
	fluconazole	voriconazole <sup>3</sup> caspofungin <sup>6</sup> amphotericin <sup>4,7</sup>	Typically resistant to fluconazole. <sup>8,9</sup>
<i>Candida albicans</i>	caspofungin	fluconazole <sup>10</sup> amphotericin <sup>4,7</sup>	Typically susceptible to caspofungin. <sup>8,9</sup>
	fluconazole	caspofungin <sup>6</sup> amphotericin <sup>4,7</sup>	Typically susceptible to fluconazole but resistance can develop during therapy. <sup>8,9</sup>

For additional resistance data, see Tables 5-13.

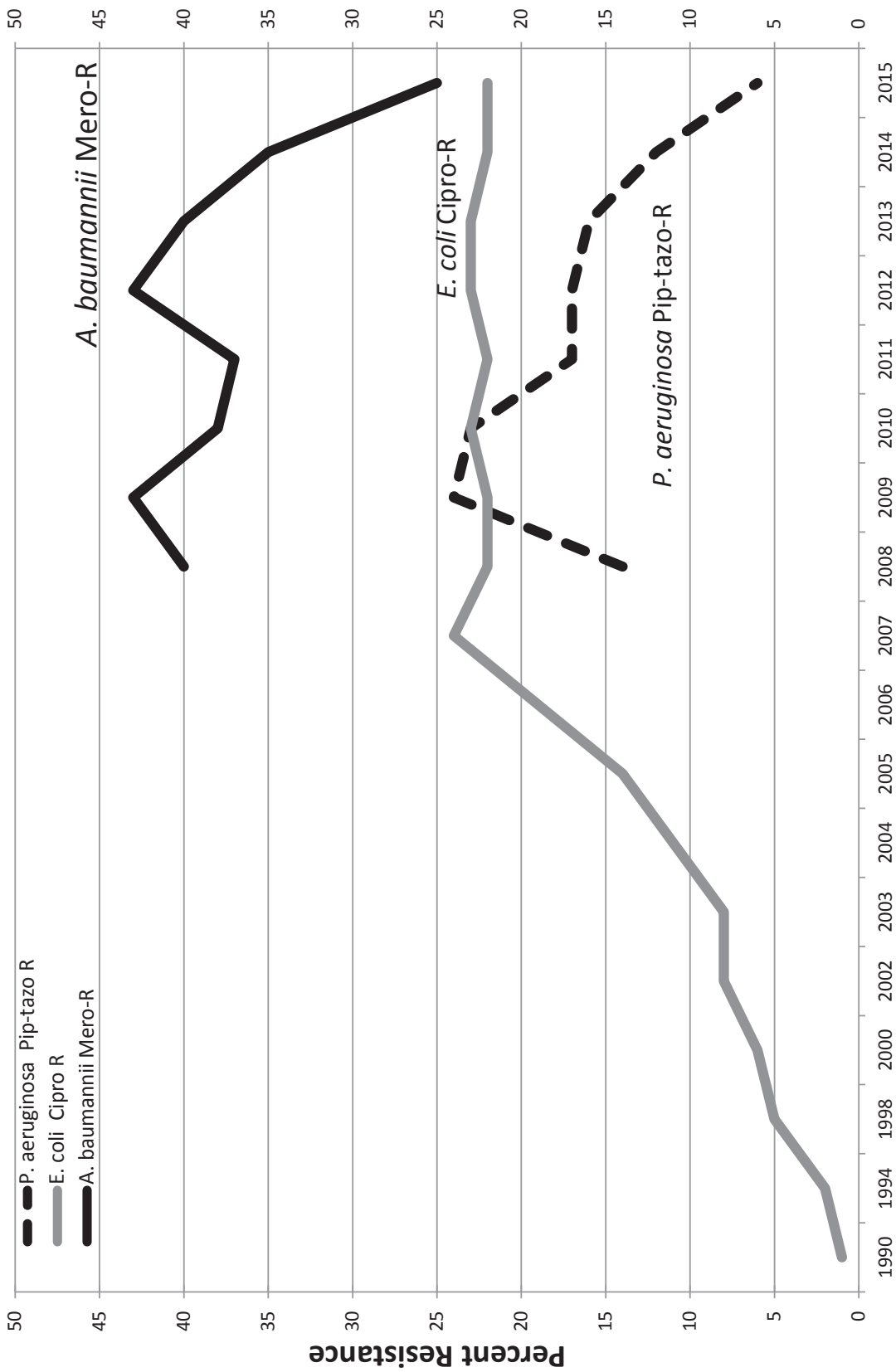
These are therapeutic options in adults. For therapeutic options in pediatric patients, please contact the Antimicrobial Stewardship.

- 1 The Sanford Guide. 2015
- 2 Circulation. 2015;132:1435-1486
- 3 Voriconazole has poor penetration in urine.
- 4 Amphotericin has poor penetration in urine.
- 5 Bone Marrow Transplantation. 2015;50:158-160.
- 6 Caspofungin may not reach therapeutic concentration in the CSF, vitreous fluid or urine.
- 7 Among patients without baseline renal dysfunction and suspected azole- and echinocandin-resistant *Candida* infections, liposomal amphotericin B is recommended. Infectious Disease consult is highly recommended.
- 8 Clin. Infect. Dis. 2016;62(4):e1-e50
- 9 Treatment Guidelines from the Med. Letter-Antifungal Drugs. 2012;10(120):61-68
- 10 For initial treatment with fluconazole, careful consideration should be given, especially in critically ill patients or those with prior azole exposure or prophylaxis. Infections Disease consult is highly recommended.

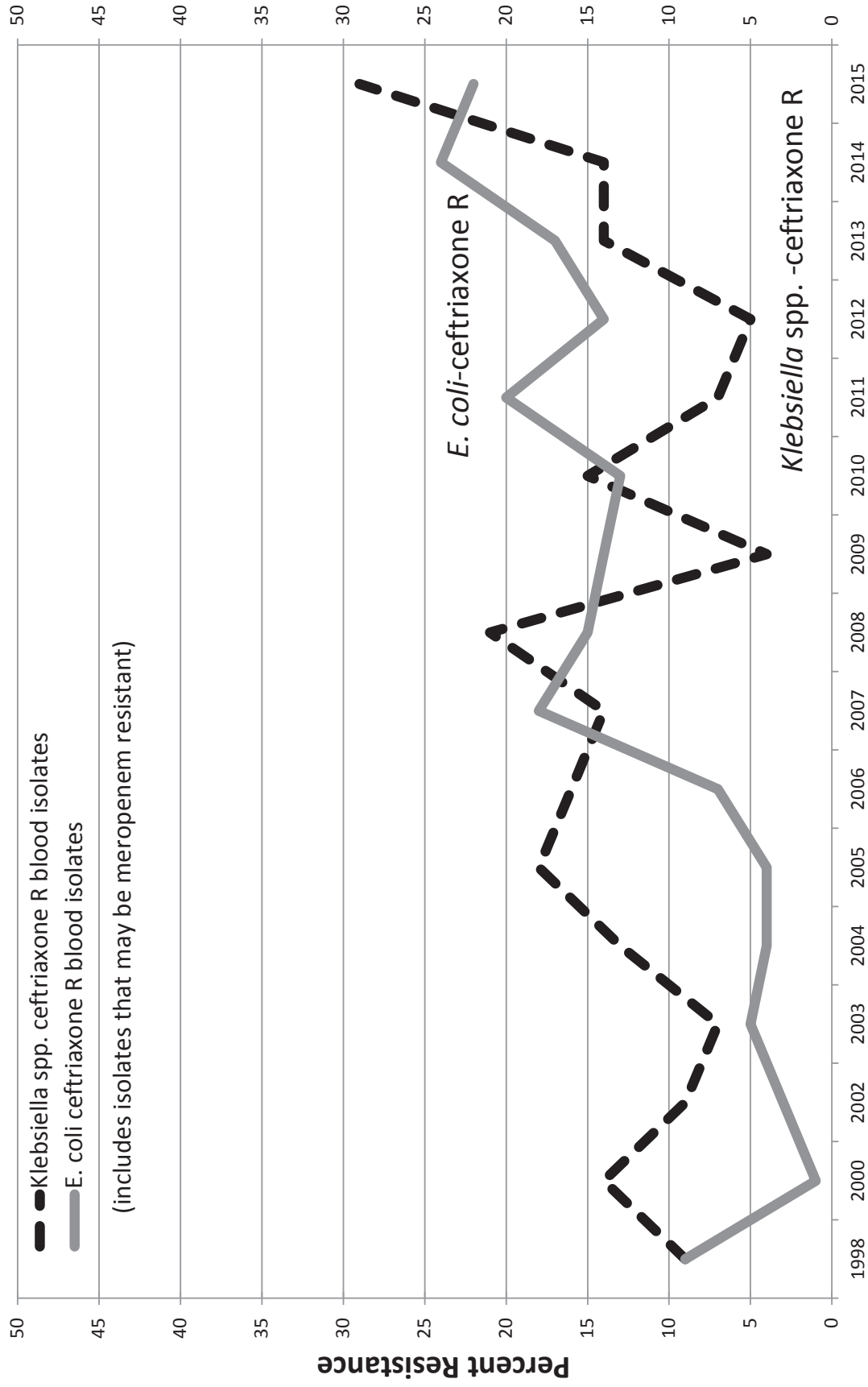
**Table 15. Resistance Trends: RRUMC, 1990-2015**



**Table 15. Resistance Trends: RRUMC, 1990-2015  
(cont.)**

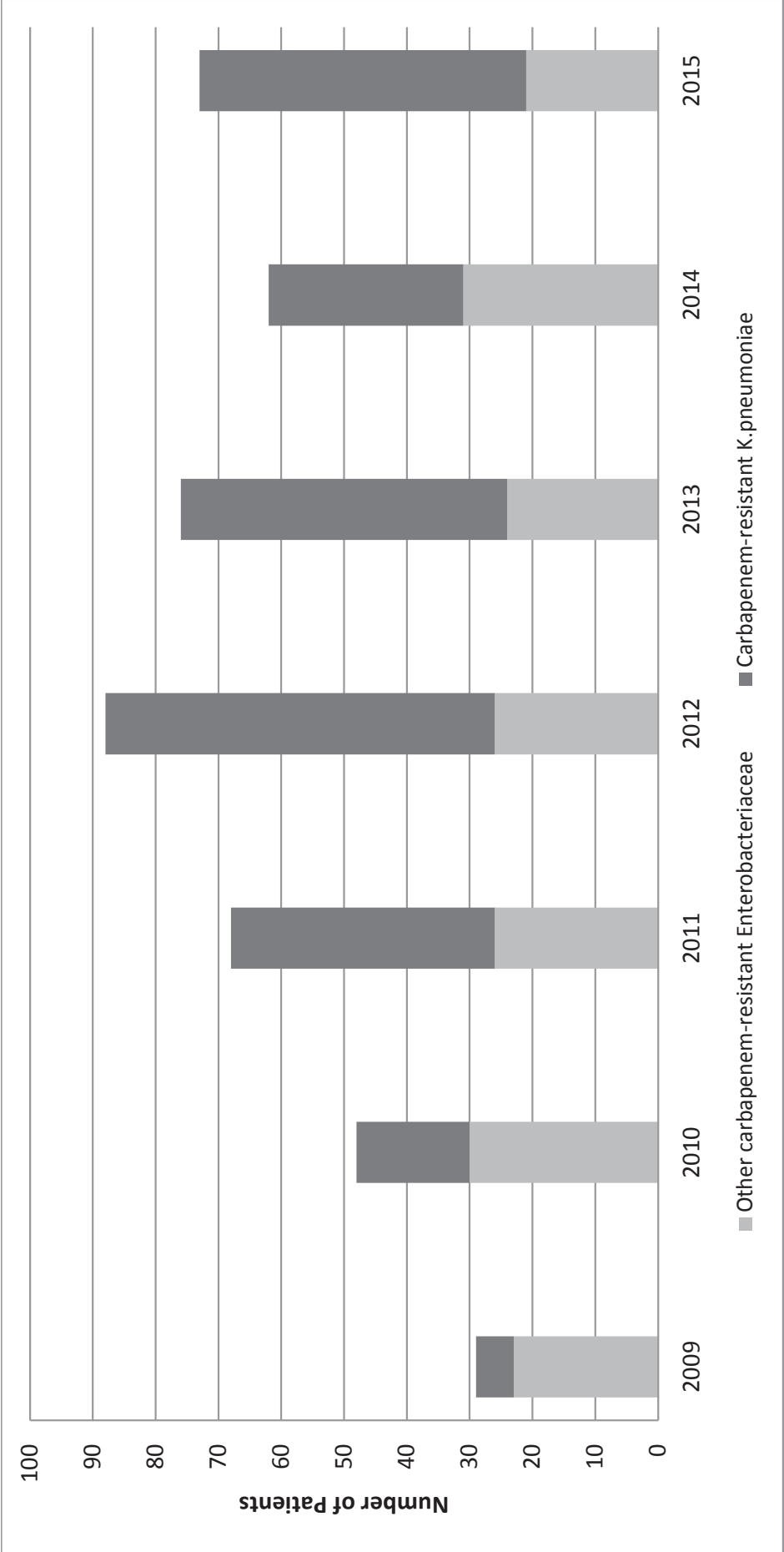


**Table 15. Resistance Trends: RRUMC, 1998-2015**  
**(cont.)**



Note: No data prior to 1998

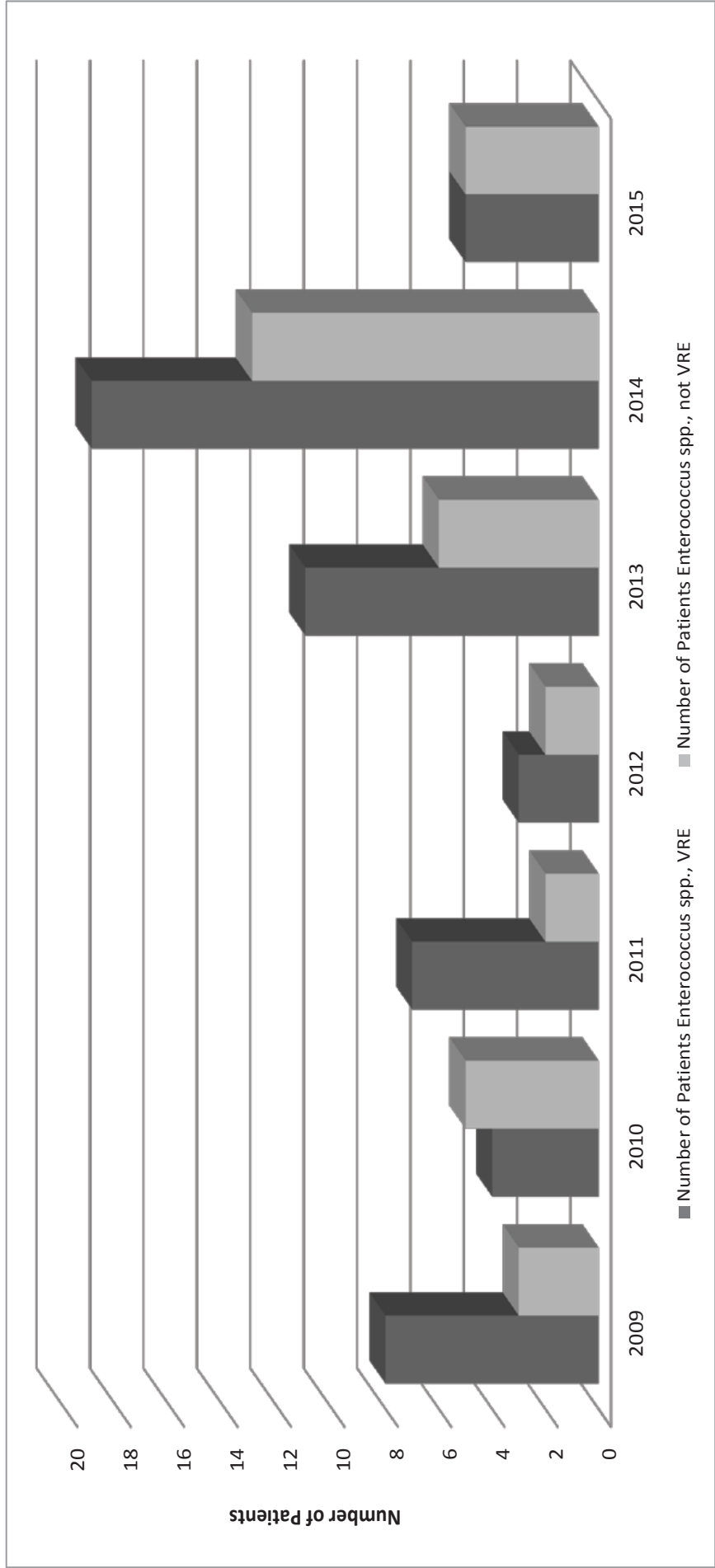
**Table 16. Carbapenem-resistant *Enterobacteriaceae* (CRE): RRUMC and SMH-UCLA, 2009-2015**



<sup>1</sup> Includes isolates that produce carbapenemases such as KPC, NDM, and OXA-232



**Table 17. Daptomycin Non-susceptible Enterococcus: RRUMC and SMH-UCLA, 2009-2015**



*Staphylococcus* spp. are usually susceptible to daptomycin.



**Table 18. SMH-UCLA: Emerging Resistance Concerns**

Incidence of Resistant Organisms, 2015				Beta-lactamase Results for Respiratory Pathogens		
Organism	No. Isolates	Resistant to:	% Resistant	Organism	No. Isolates	% Beta-lactamase Positive <sup>1</sup>
<i>Staphylococcus aureus</i>	630	Oxacillin (MRSA)	34	<i>Haemophilus influenzae</i>	26 <sup>2</sup>	16
	176		50			
<i>Enterococcus</i> spp. (blood isolates only)	33	Vancomycin (VRE)	27	<i>Moraxella catarrhalis</i>	10 <sup>2</sup>	90

<sup>1</sup> Resistant to ampicillin, amoxicillin, penicillin

<sup>2</sup> Calculated from fewer than the standard recommendation of 30 isolates

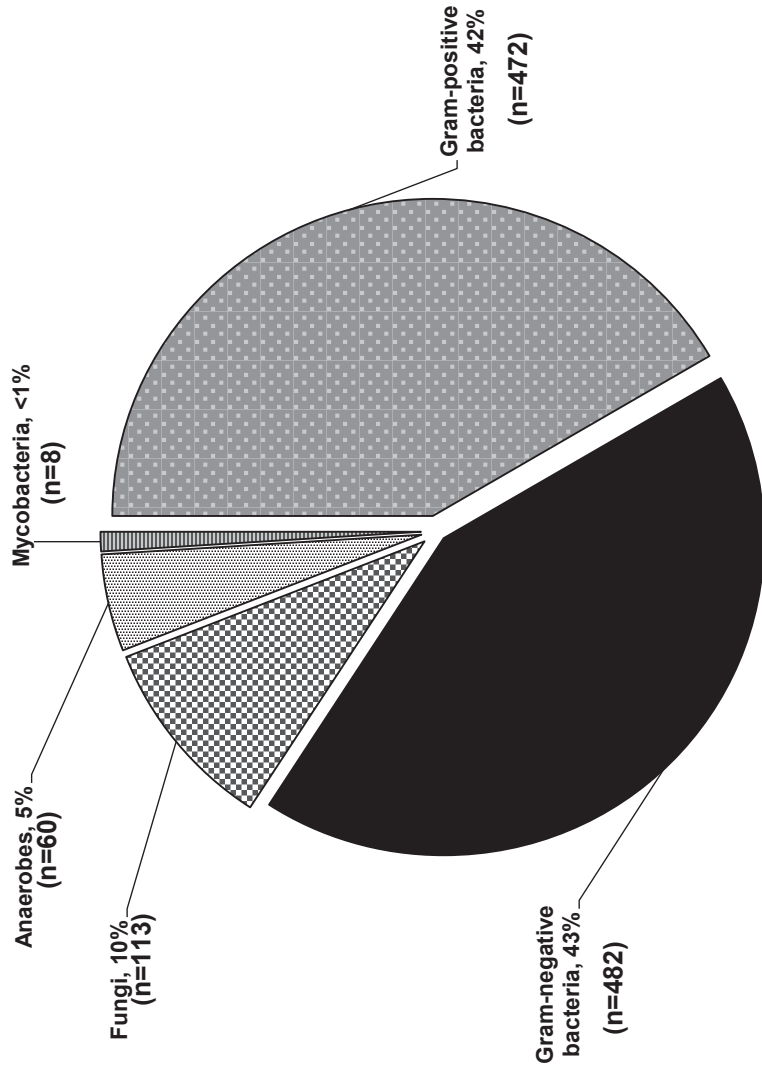


**Table 19. Treatment Suggestions for Organisms for which Susceptibility Testing is not Routinely Performed**

<b>Organism</b>	<b>Recommended</b>	<b>Alternate treatment</b>
<i>Bordetella pertussis</i>	Azithromycin, Clarithromycin	Trimethoprim-sulfamethoxazole
<i>Campylobacter jejuni</i>	Azithromycin	Erythromycin or Ciprofloxacin
<i>Campylobacter fetus</i>	Gentamicin	Imipenem or Ceftriaxone
<i>Legionella spp.</i>	Levofloxacin or Moxifloxacin	Azithromycin
<i>Mycoplasma pneumoniae</i>	Doxycycline	Azithromycin
<i>Ureaplasma</i>	Azithromycin, Doxycycline	

For additional information, refer to the Antimicrobial Stewardship website, [www.asp.mednet.ucla](http://www.asp.mednet.ucla)

**Table 20. RRUMC Blood: One Isolate per Patient, 2015**



Organism	n	% of Total Blood Isolates
1 <i>Enterococcus</i> spp., 48% VRE	198	15
2 <i>Escherichia coli</i> , 22% ceftriaxone R	156	16
3 <i>Staphylococcus aureus</i> , 31% MRSA	148	13
4 <i>Klebsiella</i> spp., 29% ceftriaxone R	111	9
5 Viridans group <i>Streptococcus</i>	86	7
6 Other <i>Enterobacteriaceae</i> spp.	58	5
7 <i>Pseudomonas aeruginosa</i>	50	4
8 <i>Candida glabrata</i>	40	3
9 <i>Enterobacter cloacae</i>	37	3
10 <i>Candida albicans</i>	30	4
Other isolates	261	23

**Total blood isolates 1135\***

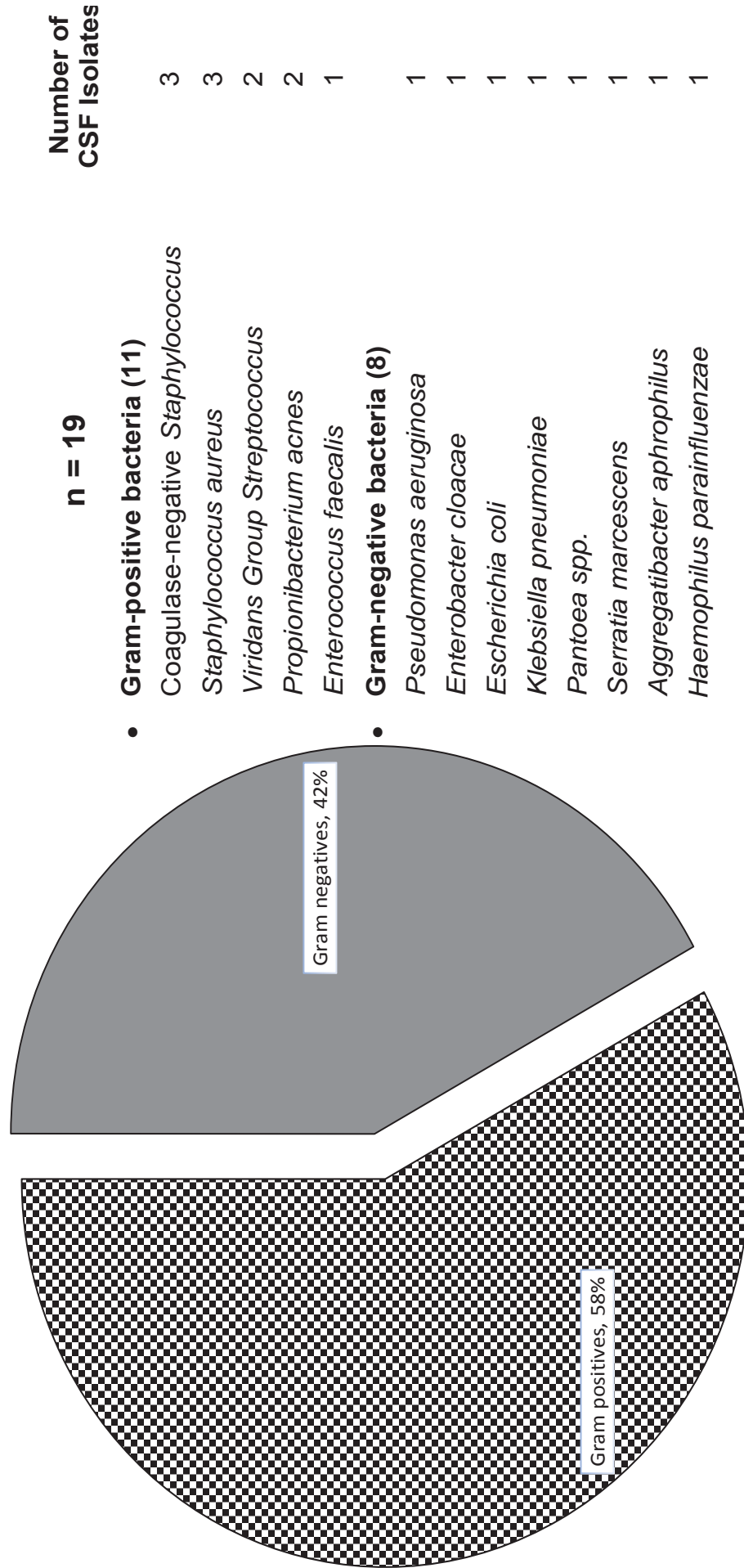
\*Excludes coagulase-negative staphylococcus (n=533), *Corynebacterium* spp. (n=37), *Bacillus* spp. (n=12), *Micrococcus* spp. (n=8), *Propionibacterium* spp. (n=13)

**Table 20. RRUMC Blood: One Isolate per Patient, 2015  
(cont.)**

**By Organism Group**

<b>Gram-positive Bacterial Isolates</b>	<b>n</b>	<b>% of Gram-positive Isolates</b>	<b>Fungal Isolates</b>	<b>n</b>	<b>% of Fungal Isolates</b>
<i>Enterococcus</i> spp., 48% VRE	158	34	<i>Candida glabrata</i>	40	35
<i>Staphylococcus aureus</i> , 31% MRSA	148	31	<i>Candida albicans</i>	30	27
Viridans group <i>Streptococcus</i>	86	18	<i>Candida tropicalis</i>	9	8
Other gram-positives (includes 6 <i>S. lugdunensis</i> )	42	9	<i>Candida krusei</i>	8	7
Beta-hemolytic <i>Streptococcus</i>	23	5	Other yeast	7	6
<i>Streptococcus pneumoniae</i>	15	3	<i>Candida parapsilosis</i>	5	4
			<i>Cryptococcus</i> spp.	5	4
			<i>Candida dubliniensis</i>	4	3
			<i>Scedosporium</i> spp.	2	2
			<i>Mucor</i> spp.	1	1
			<i>Myrothecium</i> spp.	1	1
<b>Total</b>	<b>472</b>		<b>Total</b>	<b>113</b>	
(excludes other coagulase -negative staphylococcus, <i>Corynebacterium</i> spp., <i>Bacillus</i> spp., <i>Micrococcus</i> spp.)					
<b>Gram-negative Bacterial Isolates</b>	<b>n</b>	<b>% of Gram-negative Isolates</b>	<b>Anaerobic Bacterial Isolates</b>	<b>n</b>	<b>% of Anaerobic Bacterial Isolates</b>
<i>Escherichia coli</i> , 21% ceftriaxone R	156	32	<i>Prevotella</i> spp.	23	38
<i>Klebsiella</i> spp., 14% ceftriaxone R	111	23	<i>Bacteroides</i> spp.	12	20
Other <i>Enterobacteriaceae</i> spp.	58	12	<i>Clostridium</i> spp.	12	20
<i>Pseudomonas aeruginosa</i>	50	10	<i>Fusobacterium</i> spp.	6	10
Other gram-negatives	47	10	<i>Fingoldia magna</i>	4	6
<i>Enterobacter cloacae</i>	37	8	<i>Parvimonas micra</i>	1	2
<i>Acinetobacter</i> spp.	14	3	<i>Eubacterium lentum</i>	1	2
<i>Stenotrophomonas maltophilia</i>	9	2	<i>Veillonella</i> Spp.	1	1
<b>Total</b>	<b>482</b>		<b>Total</b>	<b>60</b>	
<b>% of Mycobacterial Isolates</b>					
<b>Mycobacterial Isolates</b>	<b>n</b>		<b>% of Mycobacterial Isolates</b>	<b>n</b>	
<i>Mycobacterium avium</i> complex	4			4	50
<i>Mycobacterium abscessus</i>	1			1	12.5
<i>Mycobacterium fortuitum</i>	1			1	12.5
<i>Mycobacterium tuberculosis</i> complex	1			1	12.5
<i>Mycobacterium</i> spp.	1			1	12.5
<b>Total</b>	<b>8</b>		<b>Total</b>	<b>8</b>	

**Table 21. RRUMC CSF: One Isolate per Patient, 2015**



**Table 22. Mycobacteria, One Isolate per Patient per Source, 2015**

Species (n)	# Patients By Source <sup>1</sup>							
	Respiratory		Blood		Abscess/wound/ tissue/other			
	RRUMC	SMH- UCLA	RRUMC	SMH- UCLA	RRUMC	SMH- UCLA	RRUMC	SMH- UCLA
<i>Mycobacterium avium complex</i> (122)	80	31	2		8			1
<i>Mycobacterium chelonae/abscessus group</i> (18)	13	1	2		1			1
<i>Mycobacterium abscessus</i> (18)	5	3	2		5			3
<i>Mycobacterium goodii</i> (16)	15	1						
<i>Mycobacterium mucogenicum</i> (14)	9	3	1		1			
<i>Mycobacterium tuberculosis complex</i> (12)	6	4	1		1			
<i>Mycobacterium tuberculosis</i> (11)	9	1			1			
<i>Mycobacterium fortuitum</i> (9)	5	1	1		2			
<i>Mycobacterium simiae</i> (5)	4	1						
<i>Mycobacterium porcinum</i> (3)	3							
<i>Mycobacterium chelonae</i> (2)	1	1						
<i>Mycobacterium canariense</i> (2)	2							
<i>Mycobacterium nonchromogenicum</i> (2)		2						
<i>Mycobacterium xenopi</i> (2)	2							
<i>Mycobacterium immunogenum</i> (1)	1							
<i>Mycobacterium kansasii</i> (1)	1							
<i>Mycobacterium lentiflavum</i> (1)	1							
<i>Mycobacterium houstonense</i> (1)								1
<i>Mycobacterium arupense</i> (1)								1
<i>Mycobacterium</i> spp. (1)						1		
<b>Total mycobacteria (242)</b>	<b>157</b>	<b>49</b>	<b>9</b>	<b>1</b>	<b>19</b>	<b>1</b>	<b>1</b>	<b>7</b>

<sup>1</sup> Some patients have isolates in more than one source

## Table 23. Mycobacteria Antimicrobial Susceptibility Testing

1. ***Mycobacterium tuberculosis*:**

Performed on first isolate per patient; performed on additional isolates recovered after 30 days, testing performed at reference lab.

**Primary agents**

ethambutol  
isoniazid (INH)  
pyrazinamide  
rifampin

**Secondary agents**

amikacin  
capreomycin  
ciprofloxacin  
ethionamide  
p-aminosalicylic acid  
streptomycin

2. ***Mycobacterium avium* complex:**

Performed on first isolate per patient; performed on additional isolates recovered after 30 days, testing performed at reference lab.

Correlation between in vitro susceptibility and clinical response has been demonstrated only for clarithromycin. Clarithromycin results predict azithromycin results. Susceptibility testing for clarithromycin should be performed on isolates from patients only when failing prior macrolide therapy or prophylaxis.

3. **Rapidly growing *Mycobacterium* spp. (e.g. *M. abscesses*, *M. chelonae*, *M. fortuitum* and *M. mucogenicum*):**

Performed on one isolate per patient, testing performed inhouse. Additional agents on request.

**Agents routinely reported**

amikacin  
cefoxitin  
ciprofloxacin  
clarithromycin (inducible)  
doxycycline  
trimethoprim-sulfamethoxazole

**Agents conditionally reported**

imipenem  
linezolid  
meropenem  
moxifloxacin  
tigecycline  
tobramycin (*M. chelonae* isolates only)

4. **Other Nontuberculous Mycobacteria (NTM):**

*M. kansasii* – Performed on one isolate per patient, at reference lab. Other NTM by physician request.

**Table 24. California *Mycobacterium tuberculosis* % Resistant, 2012-2014**

<b>Antimicrobial Agent</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Isoniazid	10.9%	10.0%	10.6%	9.8%
Rifampin	2.2%	0.9%	1.8%	1.3%
Ethambutol	1.6%	0.9%	1.1%	0.8%
Pyrazinamide	7.0%	6.7%	6.7%	5.5%
Streptomycin	10.3%	11.3%	10.7%	7.1%
Multi-drug Resistant Tuberculosis rates <sup>1</sup>	2.0%	0.8%	1.6%	1.1%
Number of Cases	1840	1738	1756	1719

<sup>1</sup> MDR = resistant to isoniazid and rifampin



**Table 25. Rapidly Growing - Mycobacteria % Susceptible, 2011-2015**

Organism	No. Isolates	Amikacin	Cefoxitin	Ciprofloxacin	Clarithromycin	Doxycycline	Imipenem	Trimethoprim-sulfamethoxazole	Tobramycin
<i>Mycobacterium abscessus</i>	39	85	24	R <sup>1</sup>	53	R	36	R	— <sup>2</sup>
<i>Mycobacterium fortuitum</i>	31	100	23	100	7	47	94	96	—
<i>Mycobacterium chelonae</i>	26 <sup>3</sup>	85	4	31	96	12	29	4	100
<i>Mycobacterium mucogenicum</i>	28 <sup>3</sup>	100	99	89	100	82	100	100	—

<sup>1</sup> R = Intrinsic resistance.

<sup>2</sup> — = Not routinely tested and/or not applicable.

<sup>3</sup> Calculated from fewer than the standard recommendation of 30 isolates.



**Table 26. Anaerobic Bacteria, % Susceptible**

Gram-negative anaerobic bacteria – antimicrobials listed in alphabetical order within percent susceptible categories<sup>1</sup>

Percent Susceptible	<i>Bacteroides fragilis</i>	Other <i>B. fragilis</i> Group <sup>2</sup>	<i>Fusobacterium nucleatum</i> and <i>F. necrophorum</i>	<i>Prevotella</i> spp.
>95	ertapenem, imipenem, meropenem, metronidazole, piperacillin-tazobactam	ertapenem, imipenem, meropenem, metronidazole	ampicillin, ampicillin-sulbactam, ceftioxin, clindamycin, ertapenem, imipenem, meropenem, metronidazole, moxifloxacin, penicillin piperacillin-tazobactam	ampicillin-sulbactam, ceftioxin, ertapenem, imipenem, meropenem, metronidazole, piperacillin-tazobactam
85–95	ampicillin-sulbactam, ceftioxin	piperacillin-tazobactam		
70–84	clindamycin			clindamycin, moxifloxacin
50–69	moxifloxacin	ampicillin-sulbactam		
<50		ceftioxin, clindamycin, moxifloxacin		ampicillin, penicillin

<sup>1</sup> Adapted from CLSI M100S 26<sup>th</sup> ed.

<sup>2</sup> *B. fragilis* group includes ssp. *distansis*, *uniformis*, *vulgatus*, *ovatus*, and *thetaiotaomicron*.

**Table 27. Antimicrobials (IV, PO), Formulary Status and Cost Reference**

<b>Drug</b>	<b>Usual Dose</b>	<b>Usual Interval</b>	<b>(\$)*Per Day</b>
<b>Penicillins</b>			
Ampicillin	1 gm	q6h	26.50
Ampicillin	2 gm	q6h	30.10
Ampicillin-sulbactam	3 gm	q6h	29.70
Oxacillin(24-hr infusion)	12 gm	q24h	71.50
Penicillin G (24-hr infusion)	24 million units	q24h	40.80
Piperacillin-tazobactam (Extended 4-hr infusion)	3.375 gm	q8h	25.45
Ampicillin (PO)	500 mg	q6h	0.75
Amoxicillin (PO)	500 mg	q8h	0.25
Amoxicillin- clavulanic acid (PO)	500 mg	q8h	2.25
Dicloxacillin (PO)	500 mg	q6h	1.35
<b>Cephalosporins</b>			
Cefazolin	1 gm	q8h	8.55
Cefepime <sup>1,2</sup>	1 gm	q8h	27.25
Cefotaxime <sup>1,3</sup>	1 gm	q8h	19.30
Cefoxitin <sup>1,4</sup>	1 gm	q6h	30.10
Ceftriaxone	1 gm	q24h	6.40
Ceftriaxone	2 gm	q24h	7.80
Cephalexin (PO)	500 mg	q6h	1.35
Cefpodoxime (PO-UTI)	100 mg	q12h	8.45
Cefpodoxime (PO)	200 mg	q12h	10.40
<b>Carbapenems/monobactam</b>			
Aztreonam <sup>1,5</sup>	2 gm	q8h	197.90
Ertapenem <sup>1,6</sup>	1 gm	q24h	83.40
Meropenem <sup>1,7</sup>	1 gm	q8h	45.10
<b>Aminoglycosides</b>			
Amikacin <sup>1,8</sup>	1000 mg (15 mg/kg/dose)	q24h	16.45
Gentamicin	500 mg (7 mg/kg/dose)	q24h	15.55

**Table 27. Antimicrobials (IV, PO), Formulary Status and Cost Reference (cont.)**

<b>Drug</b>	<b>Usual Dose</b>	<b>Usual Interval</b>	<b>(\$)*Per Day</b>
<b>Others</b>			
Azithromycin	500 mg	q24h	11.85
Ciprofloxacin	400 mg	q12h	4.40
Clindamycin	600 mg	q8h	48.80
Colistimethate <sup>10</sup>	150 mg (CBA)**	q12h	30.95
Daptomycin <sup>1,11</sup>	500 mg	q24h	421.40
Doxycycline	100 mg	q12h	44.60
Levofloxacin <sup>1,12</sup>	750 mg	q24h	3.15
Linezolid <sup>1,13</sup>	600 mg	q12h	89.00
Metronidazole	500 mg	q8h	3.90
Rifampin <sup>1,14</sup>	600 mg	q24h	148.00
Tigecycline <sup>1,11</sup>	50 mg	q12h	274.70
TMP/SMX***	320 mg TMP	q12h	45.40
Vancomycin	1 gm	q12h	15.15
Azithromycin (PO)	500 mg	q24h	2.65
Ciprofloxacin (PO)	500 mg	q12h	0.30
Clarithromycin (PO)	500 mg	q12h	9.05
Doxycycline (PO)	100 mg	q12h	6.45
Levofloxacin (PO) <sup>1,12</sup>	750 mg	q24h	0.40
Linezolid (PO) <sup>1,13</sup>	600 mg	q12h	24.00
Metronidazole (PO)	500 mg	q8h	2.00
Nitrofurantoin (PO) (macrocrystal formulation)	100 mg	q6h	9.60
Rifampin (PO)	600 mg	q24h	2.05
TMP/SMX (PO)	160 mg/800 mg	q12h	0.35
Vancomycin (PO)	125 mg	q6h	23.25

**Table 27. Antimicrobials (IV, PO), Formulary Status (cont.) and Cost Reference**

Drug	Usual Dose	Usual Interval	(\$)*Per Day
<b>Antifungal Agents</b>			
<b>Amphotericin B</b>	<b>50 mg</b>	<b>q24h</b>	<b>37.25</b>
<b>Amphotericin B<sup>1,11</sup> Liposomal (AmBisome)</b>	<b>350 mg</b>	<b>q24h</b>	<b>402.70</b>
<b>Caspofungin<sup>1,11</sup></b>	<b>50 mg</b>	<b>q24h</b>	<b>44.85</b>
<b>Fluconazole</b>	<b>400 mg</b>	<b>q24h</b>	<b>5.10</b>
<b>Posaconazole<sup>1,6,14,15</sup></b>	<b>300 mg</b>	<b>q24h</b>	<b>327.30</b>
<b>Voriconazole<sup>1,16</sup></b>	<b>300 mg</b>	<b>q12h</b>	<b>234.35</b>
<b>Fluconazole (PO)</b>	<b>400 mg</b>	<b>q24h</b>	<b>4.80</b>
<b>Posaconazole (PO-DR) 1,6,15</b>	<b>300 mg</b>	<b>q24h</b>	<b>56.40</b>
<b>Voriconazole (PO)<sup>1,16</sup></b>	<b>200 mg</b>	<b>q12h</b>	<b>44.15</b>

\* Includes drug acquisition cost plus estimated preparation and administrative costs; charges rounded up to the nearest \$0.05

\*\* CBA: Colistin-base activity

\*\*\* TMP/SMX: Trimethoprim/Sulfamethoxazole

<sup>1</sup> Use of Controlled Formulary (CF) antimicrobials is restricted to UCLA Health System-approved criteria.

<sup>2</sup> Restricted: suspected or documented *Pseudomonas aeruginosa* infection and in the management of gram-negative meningitis.

<sup>3</sup> For neonatal use only.

<sup>4</sup> Restricted: surgical prophylaxis; refer to Pre-incisional Antimicrobial Recommendations.

<sup>5</sup> Restricted: aerobic gram-negative infections in beta-lactam allergic patients.

<sup>6</sup> For Pediatric patients: restricted to use by Pediatric Infectious Diseases Service approval.

<sup>7</sup> Restricted: clinical deterioration on concurrent/recent antimicrobials or febrile neutropenia and/or overt sepsis in an immunocompromised patient.

<sup>8</sup> Restricted: organisms with suspected/documentated resistance to gentamicin and tobramycin.

<sup>9</sup> Restricted: infections caused by organisms with suspected/documentated resistance to gentamicin.

<sup>10</sup> Restricted: requires formal consultation by an Infectious Diseases physician

<sup>11</sup> Restricted to use by Adult or Pediatric Infectious Diseases Service approval.

<sup>12</sup> Restricted: all services, lower respiratory tract infections where RESISTANT organisms are suspected (e.g. penicillin- and cephalosporin-resistant *S. pneumoniae*).

<sup>13</sup> Restricted: suspected or documented VRE infection, documented allergy to vancomycin (not Redman's Syndrome).

<sup>14</sup> Injection: For use in patients unable to tolerate the oral formulations.

<sup>15</sup> For prophylaxis of invasive *Aspergillus* and *Candida* infections in severely immunocompromised patients

<sup>16</sup> Restricted: treatment of suspected/documentated invasive aspergillosis. For treatment of infections caused by *S. apiospermum*, *Fusarium* species (including *F. solani*) and non-albicans *Candida* species in patients intolerant of, or refractory to other therapy.

## Table 28. Indications for Performing Routine Antimicrobial Susceptibility Tests - Aerobic Bacteria

Susceptibility tests will be performed as follows:

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1. **Blood—all isolates except\*:**
  - Bacillus* spp.<sup>1</sup>
  - Corynebacterium* spp.<sup>1</sup>
  - Coagulase-negative *Staphylococcus*<sup>1, 2</sup>
  - Viridans group *Streptococcus*<sup>1</sup>
  
2. **Urine**
  - >10<sup>5</sup> CFU/ml (1 or 2 species)
  - >50,000 CFU/ml (pure culture):
    - Gram-negative bacilli; *Staphylococcus aureus*
  
3. **Respiratory (sputum, nasopharynx, bronchial washing and tracheal aspirate):**
  - Moderate /many growth ≤2 potential pathogens
  - Cystic fibrosis patients: any quantity of gram-negative bacilli, *S. aureus*, *S. pneumoniae*
  
4. **Stool**
  - Salmonella* spp.<sup>3</sup> (≤ 3 mo. only)
  - Shigella* spp.
  - Yersinia* spp.
  - Vibrio* spp.

<sup>1</sup> Susceptibilities performed if isolated from multiple cultures

<sup>2</sup> Susceptibilities performed on all isolates of *S. lugdunensis*

<sup>3</sup> Susceptibilities performed on all isolates of *S. Typhi* and *S. Paratyphi*

\* neonates, susceptibilities performed on all isolates

**Table 28. Indications for Performing Routine Antimicrobial Susceptibility Tests - Aerobic Bacteria (cont.)**

5. Wounds, abscesses and other contaminated body sites,  $\leq 2$  potential pathogens.
6. If isolate is from sterile body site, susceptibility testing will be performed on subsequent isolates from similar site(s) every 3 days. Exception: *S. aureus* and *P. aeruginosa* tested each day of collection from blood.
7. If isolate is from non-sterile body site, susceptibility testing will be performed on subsequent isolates from similar site(s) every 5 days.

**Additional notes:**

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- Susceptibility tests will not be performed on more than two potential pathogens per culture unless specifically requested following discussion with clinician.
- Blood and CSF isolates are held for 1 year.
- Other potentially significant isolates are held in lab for 7 days. Contact lab at (310) 794-2758 within 48 hours if susceptibilities are desired.



# Table 29. Antimicrobial Agents Routinely Reported - Aerobic Bacteria

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s) <sup>1,4</sup>
<b><i>E. coli</i>, <i>Klebsiella</i> spp., <i>P. mirabilis</i> – Excludes urine isolates</b>		
ceftriaxone <sup>5</sup>	Resistant to ceftriaxone	ertapenem and imipenem & meropenem (< 18 y.o.)
ciprofloxacin (>11 y.o.)	Resistant to ertapenem	imipenem, meropenem (≥ 18 y.o.)
gentamicin	Resistant to gentamicin	amikacin, tobramycin
piperacillin-tazobactam <sup>5</sup>	Resistant to piperacillin-tazobactam	ertapenem and imipenem & meropenem (< 18 y.o.)
trimethoprim-sulfamethoxazole	Resistant to meropenem or imipenem	cefazidime-avibactam & colistin
<b><i>E. coli</i>, <i>Klebsiella</i> spp., <i>P. mirabilis</i> – Urine isolates</b>		
ampicillin	Resistant to ceftriaxone	ertapenem and imipenem & meropenem (< 18 y.o.)
Oral cephalosporins <sup>3</sup>	Resistant to ertapenem	imipenem, meropenem (≥ 18 y.o.)
ceftriaxone <sup>5</sup>	Resistant to gentamicin	amikacin
ciprofloxacin (>11 y.o.)	Resistant to piperacillin-tazobactam	ertapenem and imipenem & meropenem (< 18 y.o.)
gentamicin	Resistant to meropenem or imipenem	cefazidime-avibactam & colistin
nitrofurantoin		
piperacillin-tazobactam <sup>5</sup>		
trimethoprim-sulfamethoxazole		
<b>SPICE organisms<sup>2</sup> – Excludes urine isolates</b>		
cefepime <sup>5</sup>	Resistant to ceftazidime	ertapenem and imipenem & meropenem (< 18 y.o.)
ciprofloxacin (>11 y.o.)	Resistant to ertapenem	imipenem, meropenem (≥ 18 y.o.)
gentamicin	Resistant to gentamicin	amikacin, tobramycin
piperacillin-tazobactam <sup>5</sup>	Resistant to piperacillin-tazobactam	ertapenem and imipenem & meropenem (< 18 y.o.)
trimethoprim-sulfamethoxazole	Resistant to meropenem or imipenem	cefazidime-avibactam & colistin
<b>SPICE organisms<sup>2</sup> – Urine isolates</b>		
ampicillin	Resistant to ceftazidime	ertapenem and imipenem & meropenem (< 18 y.o.)
cefepime <sup>5</sup>	Resistant to ertapenem	imipenem, meropenem (≥ 18 y.o.)
ciprofloxacin (>11 y.o.)	Resistant to gentamicin	amikacin
gentamicin	Resistant to piperacillin-tazobactam	ertapenem and imipenem & meropenem (< 18 y.o.)
nitrofurantoin	Resistant to meropenem or imipenem	cefazidime-avibactam & colistin
piperacillin-tazobactam <sup>5</sup>		
trimethoprim-sulfamethoxazole		

<sup>1</sup> The following antimicrobial agents are reported on carbapenem resistant gram-negative rods (resistant to meropenem and/or imipenem): Fosfomycin, Minocycline, Moxifloxacin, Colistin, Tigecycline, Ceftazidime-avibactam and Ceftolozane-tazobactam.  
<sup>2</sup> *Enterobacteriaceae* other than *E. coli*, *Klebsiella* spp., *P. mirabilis*, *Salmonella* spp., *Shigella* spp.  
<sup>3</sup> Cefazolin results should only be used to predict potential effectiveness of oral cephalosporins for uncomplicated UTIs.  
<sup>4</sup> Colistin is not reported on *Serratia marcescens*, *Proteus* spp., *Providencia* spp. and *Morganella morganii* because these organisms are intermediate/resistant to colistin.  
<sup>5</sup> If result is intermediate (I) or resistant (R): ertapenem, imipenem (≤ 18 y.o.) and meropenem (≤ 18 y.o.) are reported.



**Table 29. Antimicrobial Agents Routinely Reported - Aerobic Bacteria (cont.)**

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s) <sup>1</sup>
<b><i>Salmonella</i> spp.<sup>1</sup>, <i>Shigella</i> spp.<sup>2</sup></b>		
ampicillin ciprofloxacin (>11 y.o.) trimethoprim-sulfamethoxazole	Non-fecal sources/resistant to all primary antimicrobials	ceftriaxone
<b><i>Pseudomonas aeruginosa</i></b>		
cefepime ciprofloxacin (>11 y.o.) gentamicin piperacillin-tazobactam	Resistant to cefepime and piperacillin-tazobactam If gentamicin > 1 ug/ml Resistant to cefepime and piperacillin-tazobactam	imipenem, meropenem, ceftiozane - tazobactam amikacin, tobramycin imipenem, meropenem
<b><i>Acinetobacter</i> spp.</b>		
ampicillin-sulbactam cefepime ceftazidime ciprofloxacin (>11 y.o.) gentamicin piperacillin-tazobactam trimethoprim-sulfamethoxazole	Resistant to ceftazidime Resistant to meropenem or imipenem Resistant to gentamicin	imipenem, meropenem minocycline, colistin amikacin, tobramycin
<b><i>Stenotrophomonas maltophilia</i>- Sterile body site isolates</b> <b><i>Burkholderia cepacia</i></b>		
ceftazidime levofloxacin (>11 y.o.) meropenem ( <i>B. cepacia</i> only) minocycline trimethoprim-sulfamethoxazole		

<sup>1</sup> If stool isolates, perform on patients ≤3 mo., or if isolate is *Salmonella typhi* or *Salmonella paratyphi* A.

<sup>2</sup> Susceptibility performed on stool isolates.



**Table 29. Antimicrobial Agents Routinely Reported - Aerobic Bacteria (cont.)**

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s)
<b>Nonfermenting Gram Negative Rods not otherwise listed</b>		
cefepime ceftazidime ciprofloxacin (>11 y.o ) gentamicin piperacillin-tazobactam trimethoprim-sulfamethoxazole	Resistant to ceftazidime  If gentamicin >1 ug/ml	imipenem, meropenem  amikacin, tobramycin
<b><i>Haemophilus influenzae</i></b>		
Beta-lactamase test	Sterile body site isolates: If beta-lactamase positive If beta-lactamase negative CSF only	ceftriaxone ampicillin, ceftriaxone meropenem

**Table 29. Antimicrobial Agents Routinely Reported - Aerobic Bacteria (cont.)**

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s)
<b><i>Staphylococcus</i> spp.</b> clindamycin <sup>3</sup> oxacillin penicillin vancomycin	Resistant to oxacillin (MRSA)  <i>S. aureus</i> on blood (vancomycin ≥ 2µg/ml) Urine isolates	doxycycline, trimethoprim-sulfamethoxazole; all beta-lactams considered resistant except ceftaroline  daptomycin, linezolid ciprofloxacin <sup>4</sup> , nitrofurantoin, trimethoprim-sulfamethoxazole
<b><i>Enterococcus</i> spp.</b> ampicillin vancomycin	Resistant to vancomycin (VRE) from sterile body sites  Sterile body site isolates Urine isolates	daptomycin, doxycycline, linezolid, quinupristin-dalfopristin (excluding <i>E. faecalis</i> ), rifampin  gentamicin & streptomycin synergy screens ciprofloxacin <sup>4</sup> , doxycycline, nitrofurantoin
<b><i>Streptococcus pneumoniae</i></b> amoxicillin, cefotaxime, ceftriaxone, erythromycin <sup>3</sup> , levofloxacin <sup>4</sup> , penicillin, tetracycline <sup>5</sup> , trimethoprim-sulfamethoxazole <sup>5</sup> , vancomycin		
<b>Viridans group <i>Streptococcus</i></b> cefotaxime, ceftriaxone, penicillin, vancomycin		
<b>Beta-hemolytic <i>Streptococcus</i></b> clindamycin <sup>3</sup> , penicillin, vancomycin		
<b><i>Listeria monocytogenes</i></b> penicillin, trimethoprim-sulfamethoxazole		

<sup>3</sup> excluding urine and sterile body site isolates

<sup>4</sup> patients > 11 y.o.

<sup>5</sup> excluding CSF isolates



**Table 30. Susceptible MIC (µg/ml) Breakpoints for Aerobic Gram-negative Bacilli**

Organism	Penicillins			Cephalosporins					Carbapenems			Aminoglycosides			Fluoroquinolones				Other			
	Ampicillin	Ampicillin-sulbactam	Piperacillin-tazobactam	Cefazolin	Cefepime	Cefotaxime	Ceftazidime	Ceftriaxone	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin <sup>1</sup>	Levofloxacin <sup>2</sup>	Colistin	Trimethoprim-sulfamethoxazole	Nitrofurantoin	Minocycline	Tigecycline	
<b>ENTEROBACTERIACEAE<sup>3</sup></b>	≤8	≤8	≤16	≤2	≤2	≤1	≤4	≤1	≤.5	≤1	≤16	≤4	≤4	≤1	≤2	≤2	≤2	≤2/38	≤32	≤4	≤2	
<b>NONFERMENTERS</b>																						
<i>Acinetobacter baumannii</i>	R <sup>4</sup>	≤8	≤16	R	≤8	≤8	≤8	≤8	R	≤2	≤2	≤16	≤4	≤1	≤2	≤2	≤2	≤2/38	— <sup>5</sup>	≤4	—	
<i>Burkholderia cepacia</i>	R	R	R	R	R	—	≤8	R	R	R	≤4	R	R	—	≤2	≤2	R	≤2/38	—	≤4	—	
<i>Pseudomonas aeruginosa</i>	R	R	≤16	R	≤8	R	≤8	R	R	≤2	≤16	≤4	≤4	≤1	≤2	≤2	≤2	R	—	—	R	
<i>Stenotrophomonas maltophilia</i>	R	R	R	R	—	R	R	R	R	R	R	R	R	—	≤2	≤2	—	≤2/38	—	≤4	—	
<b>Other nonfermenters</b>	—	—	≤16	—	≤8	≤8	≤8	≤8	—	≤4	≤4	≤16	≤4	≤1	≤2	≤2	≤2	≤2/38	—	≤4	—	

<sup>1</sup> *Salmonella* spp. breakpoint for ciprofloxacin ≤ 0.06 µg/ml

<sup>2</sup> *Salmonella* spp. breakpoint for levofloxacin ≤ 0.12 µg/ml

<sup>3</sup> Enterobacteriaceae: *Citrobacter*, *Enterobacter* spp., *Escherichia coli*, *Klebsiella* spp., *Morganella*, *Proteus* spp., *Providencia* spp., *Salmonella* spp., *Serratia* spp., *Shigella* spp.

<sup>4</sup> R = Intrinsic resistance

<sup>5</sup> — = Not routinely tested and/or not applicable.

**Table 31. Susceptible MIC (µg/ml) Breakpoints for Aerobic Gram-positive Cocci**

Organism	Penicillins			Cephalosporin	Aminoglycosides			Fluoroquinolone	Other								
	Ampicillin	Oxacillin	Penicillin		Gentamicin	Gentamicin synergy	Streptomycin synergy		Ciprofloxacin	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Linezolid	Nitrofurantoin	Quinupristin-dalfopristin	Ritampin
<i>Staphylococcus aureus</i>	— <sup>4</sup>	≤2	≤.12 <sup>2</sup>	≤1	≤4	—	—	≤1	≤.5	≤1	≤4	≤.5	≤32	≤1	≤1	≤2/38	≤2
<i>Staphylococcus lugdunensis</i>	—	≤.25	≤.12 <sup>2</sup>	—	≤4	—	—	≤1	≤.5	≤1	≤4	≤.5	≤32	≤1	≤1	≤2/38	≤4
Coagulase-negative <i>Staphylococcus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Enterococcus</i> spp.	≤8	—	≤8	R <sup>3</sup>	R	≤500	≤1000	≤1	R <sup>2</sup>	≤4	R	≤2	≤32	≤1	≤1	R	≤4

<sup>1</sup> *S. aureus* only, including MRSA

<sup>2</sup> beta-lactamase negative

<sup>3</sup> R - Intrinsic resistance

<sup>4</sup> — = Not routinely tested and/or not applicable.

Organism	Penicillins		Cephalosporins		Tetracyclines			Other	
	Amoxicillin	Penicillin	Cefotaxime	Ceftaxone	Doxycycline	Tetracycline	Erythromycin	Levofloxacin	Vancomycin
<i>Streptococcus pneumoniae</i>	—	—	—	—	≤.25	≤1	—	≤2	≤1
Meningitis	—	≤.06	≤.5	≤.5	—	—	—	—	—
Non-meningitis	≤2	≤2	≤1	≤1	—	—	≤.25	—	—
Viridans group <i>Streptococcus</i>	—	≤.12	≤1	≤1	—	—	—	—	≤1

<sup>1</sup> — = Not routinely tested and/or not applicable.

## Table 32. Antimicrobial Stewardship

- 1) Treatment of asymptomatic bacteriuria
  - a. A urine culture must ALWAYS be interpreted in the context of the urinalysis and patient symptoms, consider adding UA with reflex to culture (LAB)
  - b. If a patient has no signs of infection on urinalysis and no symptoms of infection, but a positive urine culture, the patient by definition has **asymptomatic bacteriuria**.
  - c. Patients with chronic indwelling catheters, urinary stoma, and neobladders will almost universally have positive urine cultures.
  - d. The only patient populations for which it is recommended to screen for and treat asymptomatic bacteriuria are **pregnant women** and **patients scheduled for a genitourinary surgical procedure**.
  - e. Avoid routine urine analysis and/or urine cultures for the sole purpose of screening for UTI in asymptomatic patients
- 2) Treatment of VRE Isolated from stool cultures
  - a. *Enterococcus* are normal bowel flora and do not cause enteric infections, regardless of vancomycin susceptibility
  - b. Antibiotic treatment of VRE in stool cultures is discouraged, and may lead to increased transmission by causing diarrhea and emergence of antimicrobial resistance among VRE
- 3) Treatment of *Candida* isolated from bronchoscopic samples in non-neutropenic patients
  - a. Isolation of *Candida*, even in high concentrations, from respiratory samples of immunocompetent patients, including bronchoscopy, should be interpreted as airway colonization.
  - b. Antifungal therapy should not be initiated unless *Candida* is also isolated from sterile specimens or by histologic evidence in tissue from at-risk patients.
- 4) Use of “double coverage” for gram-negative bacteria
  - a. “Double coverage” of suspected gram-negative infections serves the purpose of providing broad spectrum initial empiric coverage until susceptibility data are known.
  - b. No evidence exists to support the superiority of combination therapy over monotherapy for gram-negative infections once susceptibilities are known.
  - c. Once culture identification and susceptibilities have been reported, de-escalation to a single agent is strongly recommended.
- 5) Use of two agents with anaerobic activity to treat infections with potential anaerobic bacteria involvement
  - a. Double anaerobic coverage is not necessary and puts the patient at risk for additional drug toxicities. No data or guidelines support double anaerobic coverage in clinical practice.
  - b. Example: use of piperacillin/tazobactam + metronidazole
  - c. Two clinical exceptions are:
    - 1) addition of metronidazole to another agent with anaerobic activity to treat *Clostridium difficile* infection
    - 2) clindamycin added to another agent with anaerobic activity when treating necrotizing fasciitis

For additional information, refer to the Antimicrobial Stewardship website, [www.asp.mednet.ucla.edu](http://www.asp.mednet.ucla.edu)



## Rapid Reference

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**Lab Info**

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**Antimicrobial  
Stewardship  
Program**

## Resources at UCLA through the Antimicrobial Stewardship Program (ASP)

The Antimicrobial Stewardship Program (ASP) has made resources available for the sole purpose of improving clinical outcomes of patients with infections. Questions and guidance on interpretation of culture reports (contaminant/pathogen), drug dosing, etc. are welcome. The ASP can be contacted numerous ways, depending on the urgency and clinical needs:

ASP helpdesk: (310) 267-7567

Email: [asp@ucla.edu](mailto:asp@ucla.edu)

Website: <http://www.asp.mednet.ucla.edu>

Note that the website has a **guidebook**, with detailed information about specific clinical syndromes, interpretation of microbiology reports, and guidelines for treatment.

eConsult: <http://www.asp.mednet.ucla.edu/pages/econsult>

We encourage you to reach out to the program with questions. The program is staffed by Dr. Daniel Uslan (ID), Dr. Jennifer Curello (Pharm – RR), and Dr. Meganne Kanatani (Pharm – RR).

## UCLA Form 3819 (6/15)