



**Antimicrobial
Susceptibility
Summary
2012**

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

Antimicrobial Susceptibility Summary

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Department of Pathology and
Laboratory Medicine**

UCLA Health System

2012

The information contained in this booklet can also
be found at:

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

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on left side of homepage

Preface

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

Antimicrobials (IV, PO):

These tables summarize susceptibility data obtained for organisms isolated in the UCLA Clinical Microbiology Laboratory in 2011.

Formulary Status and Cost Reference (Table 1)

Aerobic Bacteria Susceptible MIC Breakpoints (Tables 5A-B)

Percent Susceptible Data (Tables 6-15)

Empirical Antimicrobial Choices at UCLA (Tables 16-18)

Antimicrobial Testing and Reporting Policies

(Tables 2–3)

In order to provide the most meaningful information, the laboratory is selective in reporting antimicrobial susceptibility results (Table 3).

Reporting guidelines are based on:

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

Non-formulary drugs are not routinely reported and controlled formulary agents (Table 1) 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, or non-susceptible 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. A common rule of thumb is that antimicrobial concentrations at the site of infection should be at least 2–4 times the MIC.

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

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Frequently called numbers*:

Antimicrobial Testing Laboratory	310-794-2760
Antimicrobial Stewardship Hotline	310-267-7566
Infectious Diseases (Adult).....	310-825-7225
Infectious Diseases (Pediatric)	310-825-5235
Drug Information Center	310-267-8522
Infection Control (WWH).....	310-794-0187
Infection Control (SMH)	424-259-4454
Infectious Diseases Pharmacist (page 92528)	310-267-8510

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

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Table 1. Antimicrobials (IV, PO), Formulary Status and Cost Reference

Drug	Usual Dose	Usual Interval	(\$)*Per Day
Penicillins			
Ampicillin	1 gm/ 2 gm	q6h	31.10/38.30
Ampicillin- sulbactam	3 gm	q6h	32.85
Oxacillin	1 gm	q6h	53.85
Penicillin G	2x10 ⁶ units	q6h	37.90
Piperacillin-tazobactam	3.375 gm	q6h	77.50
Ampicillin (PO)	500 mg	q6h	0.40
Amoxicillin (PO)	250 mg/500 mg	q8h	0.25/0.30
Amoxicillin-clavulanic acid (PO)	250 mg/500 mg	q8h	11.50/2.30
Dicloxacillin (PO)	250 mg/500 mg	q6h	1.15/1.40
Cephalosporins			
Cefazolin	1 gm	q8h	17.05
Cefepime ^{1,2}	1 gm	q12h	24.15
Cefotaxime ^{1,3}	1 gm	q8h	18.40
Cefoxitin ^{1,4}	1 gm	q6h	33.80
Ceftriaxone	1 gm/ 2 gm	q24h	14.00/20.70
Cefuroxime	1.5 gm	q8h	23.25
Cephalexin (PO)	500 mg	q6h	0.85
Cefpodoxime (PO)	100 mg/ 200 mg	q12h	4.45/9.40
Other β-lactams/monobactam			
Aztreonam ^{1,5}	1 gm	q8h	88.85
Ertapenem	1 gm	q24h	65.30
Meropenem ^{1,6}	1 gm	q8h	93.95

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

¹ Use of "controlled" antimicrobials is RESTRICTED to UCLA Health System-approved criteria.

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

³ For neonatal use only

⁴ Restricted: surgical prophylaxis; refer to Pre-incisional Antimicrobial Recommendations.

⁵ Restricted: aerobic gram-negative infections (β-lactam allergic patients)

⁶ Restricted: organisms resistant to all other formulary agents or febrile neutropenic patients on Hematology-Oncology services.

Table 1. Antimicrobials (IV, PO), Formulary Status and Cost Reference (cont.)

Drug	Usual Dose	Usual Interval	(\$)*Per Day
Aminoglycosides			
Amikacin ^{1,7}	500 mg (7.5 mg/kg/dose)	q12h	16.30
Gentamicin	140 mg (1–2 mg/kg/dose)	q12h	11.75
Tobramycin ^{1,8}	140 mg (1–2 mg/kg/dose)	q12h	13.55
Others			
Azithromycin	500 mg	q24h	9.40
Ciprofloxacin	400 mg	q12h	13.80
Clindamycin	600 mg	q8h	51.05
Colistimethate	150 mg	q8h	95.35
Daptomycin ^{1,9}	500 mg	q24h	247.95
Doxycycline	100 mg	q12h	24.15
Levofloxacin ^{1,11}	500 mg/750 mg	q24h	17.70/16.90
Linezolid ^{1,12}	600 mg	q12h	201.50
Metronidazole	500 mg	q8h	18.20
Quin-dalfopristin ^{1,12} (7.5 mg/kg/dose)	500 mg	q8h	508.10
Rifampin ^{1,13}	600 mg	q24h	110.60
Tigecycline ^{1,9}	50 mg	q12h	135.40
Trimethoprim- sulfamethoxazole	320 mg TMP	q12h	21.45
Vancomycin	1 gm	q12h	17.60
Azithromycin (PO)	500 mg	q24h	19.05
Ciprofloxacin (PO)	500 mg	q12h	0.30
Clarithromycin (PO)	500 mg	q12h	2.40
Doxycycline (PO)	100 mg	q12h	0.15
Erythromycin (PO)	500 mg	q6h	7.00
Levofloxacin (PO) ^{1,11}	500 mg/750 mg	q24h	2.35/1.60
Linezolid (PO) ^{1,12}	600 mg	q12h	146.65
Metronidazole (PO)	500 mg	q8h	1.90
Nitrofurantoin (PO) (macrocrystal formulation)	50 mg/100 mg	q12h	0.70/1.25
Rifampin (PO)	600 mg	q24h	2.20
Tetracycline (PO)	500 mg	q6h	0.15
Trimeth-Sulfa (PO)	160 mg/800 mg	q12h	0.30
Vancomycin (PO)	125 mg	q6h	101.50

Table 1. Antimicrobials (IV, PO), Formulary Status and Cost Reference (cont.)

Drug	Usual Dose	Usual Interval	(\$)*Per Day
Antifungal Agents			
Amphotericin B	50 mg (avg)	q24h	14.55
Amphotericin B^{1, 9} Lipid Complex (ABLC)	350 mg	q24h	244.15
Caspofungin^{1, 9}	50 mg	q24h	95.45
Fluconazole	200 mg/400 mg	q24h	10.95/10.25
Voriconazole^{1, 10}	300 mg	q12h	467.55
Fluconazole (PO)	200 mg/400 mg	q24h	0.20/0.40
Flucytosine (PO)	2000 mg	q6h	663.85
Voriconazole (PO)^{1, 10}	200 mg	q12h	77.65

⁷ Restricted: organisms with suspected/documentated resistance to gentamicin and tobramycin.
⁸ Restricted: infections caused by organisms with suspected/documentated resistance to gentamicin.
⁹ Restricted to use by Adult or Pediatric Infectious Diseases Service approval.
¹⁰ 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.
¹¹ Restricted: all services, lower respiratory tract infections where RESISTANT organisms are suspected (e.g. penicillin- and cephalosporin-resistant *S. pneumoniae*).
¹² Restricted: suspected or documented VRE infection, documented allergy to vancomycin (not Redman's Syndrome). For Quinupristin-Dalfopristin, no activity against *E. faecalis*.
¹³ Injection: For use in patients unable to tolerate the oral formulation.

Table 2. Indications for Performing Routine Antimicrobial Susceptibility Tests – Aerobic Bacteria

Susceptibility tests will be performed as follows:

- 1. Blood—all isolates except:**
Bacillus spp.¹
Corynebacterium spp.¹
Coagulase-negative *Staphylococcus*^{1,2}
- 2. Urine**
>10⁵ CFU/ml of (1 or 2 species):
>50,000 CFU/ml of (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 (pediatric patients only):**
Salmonella spp.³
Shigella spp.
Yersinia spp.
Vibrio spp.

¹ Susceptibilities performed if isolated from multiple cultures

² Susceptibilities performed on all isolates of *S. lugdunensis*

³ Susceptibilities performed on all isolates of *S. Typhi* and *S. Paratyphi*

**Table 2. Indications for Performing Routine
(cont.) Antimicrobial Susceptibility Tests –
Aerobic Bacteria**

5. Wounds, abscesses and other contaminated body sites, ≤ 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 to determine if resistance has developed.
7. If isolate is from non-sterile body site, susceptibility testing will be performed on subsequent isolates from similar site(s) every 5 days to determine if resistance has developed.

Additional notes:

- 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 3. Antimicrobial Agents Routinely Reported – Aerobic Bacteria

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s)
<i>E. coli</i> , <i>Klebsiella</i> spp., <i>P. mirabilis</i>	– Excludes urine isolates	
ampicillin	Resistant to ampicillin	ampicillin-sulbactam
cefazolin	Resistant to ceftazolin Resistant to ceftriaxone	ceftriaxone ciprofloxacin (>11 y.o.) ertapenem (>18 y.o.) or meropenem (≤18 y.o.)
gentamicin	Resistant to ertapenem (>18 y.o.)	meropenem
piperacillin-tazobactam	Resistant to gentamicin	amikacin, tobramycin
trimethoprim-sulfamethoxazole		
<i>E. coli</i> , <i>Klebsiella</i> spp., <i>P. mirabilis</i>	– Urine isolates	
ampicillin	Resistant to ceftazolin	ceftriaxone
cefazolin	Resistant to ceftazolin Resistant to ceftriaxone	ertapenem (>18 y.o.) or meropenem (≤18 y.o.)
ciprofloxacin (>11 y.o.)	Resistant to ertapenem (>18 y.o.)	meropenem
gentamicin	Resistant to gentamicin	amikacin, tobramycin
nitrofurantoin		
trimethoprim-sulfamethoxazole		
SPICE organisms¹ – Excludes urine isolates		
ampicillin		
ampicillin-sulbactam		
cefazolin		
cefepime (≤18 y.o.)	Resistant to ceftipime	meropenem, ciprofloxacin (>11 y.o.)
ertapenem (>18 y.o.)	Resistant to ertapenem	cefepime, ciprofloxacin, meropenem
gentamicin	Resistant to gentamicin	amikacin, tobramycin
piperacillin-tazobactam		
trimethoprim-sulfamethoxazole		
SPICE organisms¹ – Urine isolates		
ampicillin		
cefazolin		
cefepime (≤18 y.o.)	Resistant to ceftipime	meropenem
ciprofloxacin (>11 y.o.)	Resistant to ertapenem	meropenem
ertapenem (>18 y.o.)	Resistant to gentamicin	amikacin, tobramycin
meropenem (≤18 y.o.)		
gentamicin		
nitrofurantoin		
trimethoprim-sulfamethoxazole		

¹Enterobacteriaceae other than *E. coli*, *Klebsiella* spp., *P. mirabilis*, *Salmonella* spp., *Shigella* spp.

Table 3. Antimicrobial Agents Routinely Reported – Aerobic Bacteria
(cont.)

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s)
<i>Salmonella</i> spp., <i>Shigella</i> spp. (if stool isolates, performed on patients ≤ 18 y.o. only)		
ampicillin ciprofloxacin (>11 y.o.) trimethoprim-sulfamethoxazole	Non-fecal sources/resistant to all primary antimicrobials	ceftriaxone
<i>Pseudomonas aeruginosa</i>		
cefepime	Resistant to ceftazidime and piperacillin-tazobactam	meropenem
ciprofloxacin (>11 y.o.) gentamicin piperacillin-tazobactam	If gentamicin > 1ug/ml Resistant to ceftazidime and piperacillin-tazobactam	amikacin, tobramycin meropenem
<i>Acinetobacter</i> spp.		
ampicillin-sulbactam cefepime ceftazidime ciprofloxacin (>11 y.o.) gentamicin piperacillin-tazobactam trimethoprim-sulfamethoxazole	Resistant to ceftazidime Resistant to gentamicin	meropenem amikacin, tobramycin
<i>Stenotrophomonas maltophilia</i>- Sterile body site isolates <i>Burkholderia cepacia</i>		
ceftazidime levofloxacin (>11 y.o.) meropenem minocycline ticarcillin-clavulanate trimethoprim-sulfamethoxazole		

Table 3. Antimicrobial Agents Routinely Reported – Aerobic Bacteria
(cont.)

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

Table 3. Antimicrobial Agents Routinely Reported – Aerobic Bacteria (cont.)

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s)
<i>Staphylococcus</i> spp. clindamycin ² erythromycin ³ oxacillin penicillin vancomycin	clindamycin excluded from urine and CSF isolates erythromycin excluded from urine and sterile body site isolates Resistant to oxacillin (MRSA)	doxycycline, rifampin, trimethoprim-sulfamethoxazole; all beta-lactams reported as resistant
<i>Enterococcus</i> spp. ampicillin vancomycin	Urine isolates	ciprofloxacin, ⁴ nitrofurantoin, trimethoprim-sulfamethoxazole
<i>Streptococcus pneumoniae</i> amoxicillin, cefotaxime, ceftriaxone, erythromycin, ³ levofloxacin, ⁴ penicillin, tetracycline, trimethoprim-sulfamethoxazole, 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, ⁴ doxycycline, nitrofurantoin
Viridans group <i>Streptococcus</i> cefotaxime, ceftriaxone, penicillin, vancomycin		
beta-hemolytic streptococci clindamycin, ² erythromycin, ³ penicillin, vancomycin		
<i>Listeria monocytogenes</i> penicillin, trimethoprim-sulfamethoxazole		

² excluding urine and CSF isolates

³ excluding sterile body site isolates

⁴ patients >11 y.o.

Table 4. Special Antimicrobial Tests

Use Lab Request Form 2 for tests on fluids, cultures

Phones: x78100 option #1 Client Services, Specimen Information, and Reports
x42760 Antimicrobial Laboratory

Test Name	Specimen	Instruction/Notes	Description/Results
Antimicrobial Level *Time of specimen collection in relation to dosage is a critical factor	Blood: 0.4 ml red top tube (0.2 ml serum) Other body fluids: 1 ml Minimum amt: Contact Toxicology Laboratory: (310) 267-8141	Immediately place specimen on ice; write date and time drawn on both specimen label and request form. See Toxicology section of Clinical Laboratories Reference Manual for gentamicin, tobramycin, amikacin, and vancomycin levels. (Toxicology: 310-267-8141) Specify antimicrobials to be tested.	Quantitative measure of antimicrobial concentration (µg/ml) in serum or body fluid. Results available within 24 h; for serum, 7 days for fluids
MIC/MBC Minimal Inhibitory Concentration (MIC) Minimal Bactericidal Concentration (MBC)	Patient's bacterial isolate		Determination of the inhibitory and bactericidal activity of specific antimicrobials against a bacterial isolate. Results available in 48–96 h.

*The following guidelines are suggested for blood specimens: Peak and Trough levels should be drawn at steady state, i.e. around 4th dose of regimen, unless otherwise indicated

Aminoglycosides (Gentamicin, Tobramycin, Amikacin)

Trough specimen Obtain 30 min prior to administration of the next dose.

Peak specimen

1. Obtain 60 min after IM injection.
2. Obtain 30 min after completion of 30 min IV infusion or 60 min IV infusion

or

Extended Interval Obtain 6–14 h after start of a 60 min infusion; level may be drawn after the 1st dose

Vancomycin

Obtain Trough specimen only

Table 5A. Susceptible MIC ($\mu\text{g/ml}$) Breakpoints for Aerobic Gram-negative Bacteria

Organism	Penicillins				Cephalosporins				Carbapenems		Aminoglycosides			Fluoroquinolones		Other			
	Ampicillin	Ampicillin-subactam	Piperacillin-tazobactam	Ticarcillin-clavulanate	Cefazolin	Cefepime	Cefotaxime	Ceftazidime	Ceftroxone	Ertapenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Levofloxacin	Trimethoprim-sulfamethoxazole	Nitrofurantoin	Mincycline
ENTEROBACTERIACEAE¹	≤ 8	≤ 8	≤ 16	-	≤ 8	≤ 8	≤ 8	≤ 8	≤ 8	≤ 5	≤ 1	≤ 16	≤ 4	≤ 4	≤ 1	≤ 2	$\leq 2/40$	≤ 32	-
NONFERMENTERS																			
<i>Acinetobacter baumannii</i>	-	≤ 8	≤ 16	-	-	≤ 8	≤ 8	≤ 8	-	≤ 4	≤ 16	≤ 4	≤ 4	≤ 1	≤ 2	$\leq 2/40$	-	-	-
<i>Burkholderia cepacia</i>	-	-	≤ 16	-	-	≤ 8	≤ 8	-	-	≤ 4	-	-	≤ 4	≤ 1	≤ 2	$\leq 2/40$	-	-	≤ 4
<i>Pseudomonas aeruginosa</i>	-	-	≤ 16	-	-	≤ 8	≤ 8	-	-	≤ 4	≤ 16	≤ 4	≤ 4	≤ 1	≤ 2	$\leq 2/40$	-	-	-
<i>Stenotrophomonas maltophilia</i>	-	-	-	≤ 16	-	-	≤ 8	-	-	≤ 4	-	-	-	-	≤ 2	$\leq 2/40$	-	-	≤ 4
Other nonfermenters	-	-	≤ 16	-	-	≤ 8	≤ 8	≤ 8	-	≤ 4	≤ 16	≤ 4	≤ 4	≤ 1	≤ 2	$\leq 2/40$	-	-	-

¹ Enterobacteriaceae: *Citrobacter freundii*, *Enterobacter* spp., *Escherichia coli*, *Klebsiella* spp., *Morganella morganii*, *Proteus mirabilis*, *Salmonella* spp., *Serratia* spp., *Shigella* spp.

Table 5B. Susceptible MIC ($\mu\text{g/ml}$) Breakpoints for Aerobic Gram-positive Cocci

Organism	Penicillins			Aminoglycosides			Fluoroquinolone	Other									
	Ampicillin	Oxacillin	Penicillin	Gentamicin	Gentamicin synergy	Streptomycin synergy		Ciprofloxacin	Cindamycin	Daptomycin	Doxycycline	Erythromycin	Linezolid	Nitrofurantoin	Quinupristin-dalfopristin	Rifampin	Trimethoprim-sulfamethoxazole
<i>Staphylococcus aureus</i>	•	≤ 2	$\leq 12^*$	≤ 4	•	•	≤ 1	≤ 5	≤ 1	≤ 4	≤ 5	≤ 4	≤ 32	≤ 1	≤ 1	$\leq 2/40$	≤ 2
<i>Staphylococcus lugdunensis</i>	•	≤ 25	$\leq 12^*$	≤ 4	•	•	≤ 1	≤ 5	≤ 1	≤ 4	≤ 5	≤ 4	≤ 32	≤ 1	≤ 1	$\leq 2/40$	≤ 4
Coagulase-negative <i>Staphylococcus</i> spp.	•	≤ 8	•	•	≤ 500	≤ 1000	≤ 1	•	≤ 4	•	•	≤ 2	≤ 32	≤ 1	≤ 1	•	≤ 4

* beta-lactamase negative

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

Table 6. Ronald Reagan UCLA Medical Center: Gram-negative Bacteria – Excludes Urine Isolates, Percent Susceptible

Organism	No. Isolates	Penicillins			Cephalosporins				Carbapenems		Aminoglycosides			Fluoroquinolone	Other
		Ampicillin	Ampicillin-sulbactam	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftaxone	Ertapenem	Meropenem	Amikacin	Gentamicin	Tobramycin		
<i>Citrobacter freundii</i>	42	R ¹	R	71	R	98	69	69	93	100	98	83	83	88	62
<i>Enterobacter aerogenes</i>	65	R	R	71	R	100	72	72	92	96	100	100	100	99	99
<i>Enterobacter cloacae</i>	155	R	R	79	R	98	75	76	90	100	100	97	97	97	86
<i>Escherichia coli</i>	399	35	43	88	74	82	82	82	99	100	99	83	83	65	57
<i>Klebsiella oxytoca</i>	77	R	49	82	60	81	81	81	97	97	100	90	88	94	84
<i>Klebsiella pneumoniae</i>	237	R	71	89	87	92	92	92	97	97	96	96	93	90	82
<i>Morganella morganii</i> ²	29	R	R	97	R	100	93	97	100	100	100	83	93	69	62
<i>Proteus mirabilis</i>	81	61	76	100	78	85	85	85	100	100	100	78	85	61	56
<i>Serratia marcescens</i>	132	R	R	95	R	100	97	94	97	100	99	97	92	89	96
<i>Acinetobacter baumannii</i>	54	R	63	54	R	56	56	28	R	63	61	59	57	52	61
<i>Pseudomonas aeruginosa</i>	479	R	R	83	R	85	86	R	R	88	95	89	92	79	R
<i>Stenotrophomonas maltophilia</i>	73	R	R	R	R	—	34	R	R	R	R	R	R	—	99

¹ R = intrinsic resistance (inherent or innate antimicrobial resistance).
² Calculated from fewer than the standard recommendation of 30 isolates.

Table 7. Ronald Reagan UCLA Medical Center: Five Most Common Gram-negative Bacteria – Excludes Urine Isolates, Percent Susceptible

Organism	Source	No. isolates	Penicillins			Cephalosporins			Carbapenems		Aminoglycosides		Fluoroquinolone	Other		
			Ampicillin	Ampicillin-sulbactam	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftazoxone	Ertapenem	Meropenem	Amikacin			Gentamicin	Tobramycin
<i>Enterobacter cloacae</i>	OP	48	R ¹	R	92	R	100	87	90	94	100	100	94	94	98	79
	IP	44	R	R	75	R	96	74	75	86	100	100	96	96	96	84
	ICU	70	R	R	71	R	97	64	64	90	100	100	97	97	97	87
<i>Escherichia coli</i>	OP	203	39	49	96	83	87	86	86	100	100	99	86	85	69	62
	IP	116	32	38	85	65	74	74	74	100	100	98	74	75	55	57
	ICU	108	28	34	75	62	77	78	78	97	100	99	82	82	61	46
<i>Klebsiella pneumoniae</i>	OP	86	R	83	93	91	95	95	95	99	100	99	99	97	95	86
	IP	79	R	71	89	86	91	91	91	95	98	98	96	95	89	86
	ICU	86	R	55	80	80	87	85	87	94	94	92	92	87	84	74
<i>Proteus mirabilis</i>	OP	52	73	84	100	86	92	92	92	100	100	100	84	88	77	69
	IP	17 ²	53	77	100	77	82	81	82	100	100	100	65	77	35	41
	ICU	14 ²	29	43	100	36	50	50	50	100	100	100	57	86	29	21
<i>Pseudomonas aeruginosa</i>	OP	275	R	R	88	R	88	90	R	R	92	92	89	92	80	R
	IP	122	R	R	73	R	79	77	R	R	80	96	88	90	74	R
	ICU	139	R	R	69	R	81	73	R	R	77	96	91	91	72	R

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

¹ R = intrinsic resistance (inherent or innate antimicrobial resistance).

² Calculated from fewer than the standard recommendation of 30 isolates

Table 8. Ronald Reagan UCLA Medical Center: Gram-negative Bacteria – Urine Isolates, Percent Susceptible

Organism	Source	No. Isolates	Penicillin			Cephalosporins			Carba- penem	Amino- glycoside	Fluoroquin- olone	Other	
			Ampicillin	Cefazolin	Cefepime	Cefotaxime ²	Meropenem	Gentamicin				Ciprofloxacin	Nitrofurantoin
<i>Enterobacter cloacae</i>	OP	86	R	R	98	84	97	94	97	97	34	76	
	IP	42	R	R	100	64	93	88	93	93	41	64	
<i>Escherichia coli</i>	OP	3246	53	89	95	94	99	90	80	80	97	73	
	IP	406	37	72	83	82	99	78	60	60	96	59	
<i>Klebsiella pneumoniae</i>	OP	500	R	95	95	97	99	97	96	96	41	86	
	IP	112	R	85	84	88	97	96	88	88	33	83	
<i>Proteus mirabilis</i>	OP	258	84	94	94	100	100	93	82	82	R	76	
	IP	50	78	90	96	100	100	86	74	74	R	70	
<i>Pseudomonas aeruginosa</i> ³	OP	168	R	R	—	R	86	89	72	72	R	R	
	IP	118	R	R	—	R	84	88	72	72	R	R	

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

¹ R = intrinsic resistance (inherent or innate antimicrobial resistance)

² Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae*

³ Ceftazidime: OP 86%, IP 81%, Piperacillin-tazobactam: OP 80%, IP 75%

Table 9. Ronald Reagan UCLA Medical Center: *Pseudomonas aeruginosa* – Percent Susceptible to One or Two Antimicrobials

Information provided for two drugs does NOT imply synergism, antagonism or likely activity in vivo; 715 patients, included the most resistant result for each drug if patient had >1 isolate

	Amikacin (94) ¹	Gentamicin (87)	Tobramycin (90)	Ciprofloxacin (72)
Cefepime (87)	99 ²	96	96	93
Meropenem (84)	99	97	97	93
Piperacillin-tazobactam (76)	99	95	95	92
Ciprofloxacin (72)	99	94	94	–

¹ Percent susceptible for individual drug in parenthesis

² Percent susceptible for either or both drugs (e.g. %S to amikacin and/or ceftazidime)

Table 10. Ronald Reagan UCLA Medical Center: Gram-positive Cocci, Percent Susceptible

Organism	Source	No. Isolates	Penicillins			Amino-glycosides			Other									
			Ampicillin	Oxacillin	Penicillin	Gentamicin	Gentamicin synergy	Streptomycin synergy	Ciprofloxacin	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Linezolid	Quinupristin-dalfopristin	Rifampin	Trimethoprim-sulfamethoxazole	Vancomycin
<i>Staphylococcus aureus</i> ¹	All	1435	—	65	<10	97	—	—	59	75	99	98	49	99	99	98	98	99
Oxacillin-resistant <i>S. aureus</i> (MRSA) ¹	OP	364	—	0	0	96	—	—	13	73	99	98	11	99	99	99	98	99
	IP	108	—	0	0	94	—	—	5	51	99	95	8	99	99	95	99	99
	ICU	79	—	0	0	94	—	—	6	49	99	99	17	99	99	91	96	99
Oxacillin-susceptible <i>S. aureus</i> (MSSA)	OP	680	—	100	<10	98	—	—	84	80	99	98	68	99	99	99	98	100
	IP	142	—	100	<10	98	—	—	85	81	99	99	67	99	99	99	98	100
	ICU	163	—	100	<10	99	—	—	85	79	99	99	72	99	99	98	99	100
Coagulase-negative <i>Staphylococcus</i> ^{1,2}	All	573	—	36	<10	67	—	—	43	53	99	91	32	98	99	94	57	100
<i>Enterococcus</i> spp. ³	All	874	67	—	—	—	74	59	41	—	99	41	8	99	39	33	—	70
<i>Enterococcus faecalis</i> ⁴	All	71	99	—	—	—	70	63	65	—	99	31	10	99	—	39	—	99
<i>Enterococcus faecium</i> ⁵	All	88	5	—	—	—	80	40	2	—	98	63	2	97	93	5	—	16

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

- ¹ *Staphylococcus* resistant to oxacillin are resistant to cefazolin, cephalixin, ceftriaxone and all other beta-lactams
- ² *S. saprophyticus* urinary tract infections respond to antibiotic concentrations achieved in urine with agents commonly used to treat acute uncomplicated UTIs
- ³ Includes isolates identified to genus only (non-sterile sites) and those identified to species (sterile sites)
- ⁴ Sterile sites: 19% High-level resistance to both gentamicin and streptomycin
- ⁵ Sterile sites: 10% High-level resistance to both gentamicin and streptomycin

Table 10. Ronald Reagan UCLA Medical Center: Gram-positive Cocci, Percent Susceptible (cont.)

Organism	No. Isolates	Penicillins		Cephalosporins		Other					
		Amoxicillin	Penicillin	Cefotaxime	Ceftriaxone	Clindamycin	Erythromycin	Levofloxacin	Tetracycline	Trimethoprim - sulfamethoxazole	Vancomycin
<i>Streptococcus pneumoniae</i>	66	86	—	—	—	78	55	99	72	73	100
Meningitis ¹		—	59	82	82	—	—	—	—	—	—
Non-meningitis ²		—	87	92	97	—	—	—	—	—	—
Viridans group <i>Streptococcus</i>	69	—	67 ³	90	93	—	42	—	—	—	100
beta-hemolytic group <i>Streptococcus</i> spp.	All remain predictably susceptible to penicillin; resistance rates nationwide for Group B streptococci (<i>S. agalactiae</i>) are approximately 30% for erythromycin and 15% for clindamycin. Resistance rates for Group A streptococci (<i>S. pyogenes</i>) can be as high as 25% for erythromycin, 5% for clindamycin and 20% for tetracyclines.										

¹ % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients with meningitis.

² % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients without meningitis.

³ Resistant (R) includes 24% Intermediate (MIC 0.25-2 µg/ml)—and 9% High-level (MIC >2 µg/ml) R.

Table 11. Ronald Reagan UCLA Medical Center: Miscellaneous Gram-negative Bacteria

Organism	No. Strains	Percent beta-lactamase positive ¹
<i>Haemophilus influenzae</i>	110	26
<i>Moraxella catarrhalis</i>	47	96
<i>Neisseria gonorrhoeae</i>	Because of increasing incidence of fluoroquinolone (e.g. ciprofloxacin) resistance and concerns for cefixime resistance in California, the current therapy recommendation is ceftriaxone and azithromycin. Routine susceptibility testing not performed due to low incidence of ceftriaxone resistance. However, culture and susceptibility testing should be performed in cases of treatment failure.	
<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.	

¹ Resistant to ampicillin, amoxicillin, and penicillin

**Table 12A. Ronald Reagan UCLA Medical Center: Pediatrics (Patients ≤ 21 y/o)
Gram-negative Bacteria – Excludes Urine Isolates, Percent Susceptible**

Organism	No. Isolates	Penicillins			Cephalosporins				Carba- penem	Aminoglycosides		Fluoroquin- olone	Other
		Ampicillin	Ampicillin- sulbactam	Piperacillin- tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftroxone	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin ²
<i>Enterobacter cloacae</i>	39	R ¹	R	74	R	95	68	72	100	100	87	100	80
<i>Escherichia coli</i>	58	32	35	90	68	70	69	69	100	100	78	74	47
<i>Klebsiella pneumoniae</i>	42	R	71	93	88	95	95	95	100	100	100	98	86
<i>Acinetobacter baumannii</i> ³	14	R	93	93	R	93	93	50	100	86	93	79	93
<i>Pseudomonas aeruginosa</i>	80	R	R	89	R	91	89	R	93	95	91	95	R

¹ R = Intrinsic resistance (inherent or innate antimicrobial resistance).

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

³ Calculated from fewer than the standard recommendation of 30 isolates

**Table 12B. Ronald Reagan UCLA Medical Center: Pediatrics (Patients ≤ 21 y/o)
Gram-negative Bacteria – Urine Isolates, Percent Susceptible**

Organism	No. Isolates	Penicillins			Cephalosporins				Carba- penem	Aminoglycosides			Fluoroqui- none	Other	
		Ampicillin	Ampicillin- sulbactam	Piperacillin- tazobactam	Cefazolin	Cefepime	Ceftazidime	Cefotaxime ²	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin ³	Trimethoprim - sulfamethoxazole	Nitrofurantoin
<i>Enterobacter cloacae</i> ⁴	19	R ¹	R	62	R	100	62	67	100	100	79	79	100	53	50
<i>Escherichia coli</i>	328	47	57	98	85	94	93	95	100	99	90	91	90	68	95
<i>Klebsiella pneumoniae</i>	43	R	67	96	91	94	89	96	100	100	100	98	100	79	35
<i>Proteus mirabilis</i>	30	93	100	100	97	100	100	100	100	100	97	100	97	77	R
<i>Pseudomonas aeruginosa</i>	36	R	R	83	R	89	86	R	92	100	97	97	86	R	R

¹ R = intrinsic resistance (inherent or innate antimicrobial resistance).

² Ceftriaxone and ceftazidime have comparable activity against *Enterobacteriaceae*.

³ Ciprofloxacin is associated with arthropathy and histological changes in weight-bearing joints of juvenile animals and is currently not FDA approved for pediatric use.

⁴ Calculated from fewer than the standard recommendation of 30 isolates.

**Table 13. Ronald Reagan UCLA Medical Center: Pediatrics (Patients ≤ 21 y/o)
Gram-positive Cocci, Percent Susceptible**

Organism	Source	No. Isolates	Penicillins			Aminoglycosides		Other										
			Ampicillin	Oxacillin	Penicillin	Gentamicin synergy	Streptomycin synergy	Ciprofloxacin ¹	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Linezolid	Quinupristin-dalfopristin	Ritampin	Trimethoprim-sulfamethoxazole	Vancomycin	
<i>Staphylococcus aureus</i> (All) ²	OP	153	-	71	<10	-	-	68	82	99	99	52	100	100	99	98	100	
	IP	84	-	83	<10	-	-	86	83	99	99	67	99	100	99	99	100	
Oxacillin-resistant <i>S. aureus</i> (MRSA) ²	OP	45	-	0	0	-	-	20	87	99	99	16	100	100	98	98	100	
	IP	15 ³	-	0	0	-	-	27	87	99	100	27	100	100	100	100	100	
Oxacillin-susceptible <i>S. aureus</i> (MSSA)	OP	110	-	100	<10	-	-	87	79	99	99	66	100	100	99	97	100	
	IP	72	-	100	<10	-	-	99	81	99	99	74	99	100	99	99	100	
<i>Enterococcus</i> spp. ⁴	All	112	76	-	-	-	76	74	58	-	99	43	-	96	34	29	-	79
<i>Enterococcus faecalis</i> ⁵	All	27 ⁵	100	-	-	-	82	78	78	-	99	44	-	100	-	19	-	100
<i>Enterococcus faecium</i> ⁶	All	10 ⁶	11	-	-	-	56	67	0	-	88	56	-	78	100	0	-	30

OP, outpatient (includes EMC); IP, inpatient (includes ICU)
¹ Ciprofloxacin is associated with arthropathy and histological changes in weight bearing joints of juvenile animals and is currently not FDA approved for pediatric use.

² *Staphylococcus* resistant to oxacillin are resistant to cefazolin, cephalixin, ceftiofloxacin, ceftazidime, ceftazidime/avopivoxin and all other beta-lactams

³ Calculated from fewer than the standard recommendation of 30 isolates.

⁴ Includes isolates identified to genus only (non-sterile body sites) and those identified to species (sterile body sites).

⁵ Sterile sites; 8% High-level resistance to both gentamicin and streptomycin.

⁶ Sterile sites; 10% High-level resistance to both gentamicin and streptomycin.

**Table 13. Ronald Reagan UCLA Medical Center: Pediatrics (Patients ≤ 21 y/o)
Gram-positive Cocci, Percent Susceptible**

Organism	No. Isolates	Penicillins		Cephalosporins		Other			
		Amoxicillin	Penicillin	Cefotaxime	Ceftriaxone	Clindamycin	Erythromycin	Trimethoprim - sulfamethoxazole	Vancomycin
<i>Streptococcus pneumoniae</i>	26 ¹	83	—	—	—	75	54	79	100
Meningitis ²	—	—	56	76	92	—	—	—	—
Non-meningitis ³	—	—	80	88	76	—	—	—	—

¹ Calculated from fewer than standard recommendation of 30 isolates

² % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients with meningitis.

³ % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients without meningitis.

Table 14. Ronald Reagan UCLA Medical Center: Yeasts, Percent Susceptible, 2010–2011

- When antifungal therapy is necessary, most yeast infections can be treated empirically. Antifungal testing of yeasts may be warranted for the following:
 - oropharyngeal infections due to *Candida* spp. in patients who appear to be failing therapy
 - 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 2009;48, 503. Clinical Practice Guidelines for the Management of Candidiasis: 2009
- Yeast isolates from sterile body sites are tested every 7 days; isolates from other sources are tested upon special request.
- Only fluconazole is reported unless fluconazole resistance is detected.

Organism	No. Isolates ²	Percent Susceptible/Dose Dependent/Resistant at Breakpoints ¹ (µg/ml)							
		Fluconazole		Caspofungin	Voriconazole		Flucytosine		
		≤ 8 S	16-32 S-DD		≥64 R	≤ 2 S	≤ 1 S	2 S-DD	≥4 R
<i>C. albicans</i> ³	162	97	0	3	99	98	0	2	96
<i>C. glabrata</i>	136	60	6	34	100	85	1	14	100
<i>C. parapsilosis</i>	38	92	0	8	100	97	0	3	100
<i>C. tropicalis</i>	35	88	0	12	100	91	0	9	94
<i>C. krusei</i> ⁴	14	R	R	R	100	100	0	0	25

¹ S = susceptible. S-DD = Susceptible dose dependent; susceptibility dependent on achieving maximal possible blood level; no dose dependent

² Not all isolates were tested against all four antifungal agents.

³ *C. albicans* usually susceptible to fluconazole, but may develop resistance during prolonged therapy

⁴ Calculated from fewer than the standard recommendation of 30 isolates

Table 15. Ronald Reagan UCLA Medical Center: Yeasts, Cumulative Percent Susceptible at MIC, 2010–2011

Organism	No. Isolates	Fluconazole (µg/ml)							
		≤1	2.0	4.0	8.0	16.0	32.0	64.0	>64
<i>C. albicans</i>	162	93	94	96	97	97	97	98	100
<i>C. glabrata</i>	83	6	19	36	59	61	65	69	100
<i>C. parapsilosis</i>	36	87	90	90	93	93	93	93	100
<i>C. tropicalis</i>	35	48	72	87	87	87	87	87	100
<i>C. krusei</i>	-	intrinsically resistant to fluconazole							

Organism	No. Isolates	Voriconazole (µg/ml)						
		≤0.12	0.25	0.5	1.0	2.0	4.0	8
<i>C. albicans</i>	162	93	94	95	98	98	98	98
<i>C. glabrata</i>	118	30	58	78	85	86	96	100
<i>C. parapsilosis</i>	34	97	97	97	97	97	97	100
<i>C. tropicalis</i>	35	63	77	88	91	91	94	100
<i>C. krusei</i>	14 ¹	21	71	100	-	-	-	-

Organism	No. Isolates	Caspofungin (µg/ml)						
		≤0.25	0.5	1.0	2.0	>2.0		
<i>C. albicans</i>	162	83	97	99	99	100		
<i>C. glabrata</i>	119	71	87	99	100	-		
<i>C. parapsilosis</i>	35	9	55	92	100	-		
<i>C. tropicalis</i>	34	59	68	74	74	100		
<i>C. krusei</i>	14 ¹	14	71	100	-	-		

¹ Calculated from fewer than the standard recommendation of 30 isolates

Table 16. Mycobacteria Antimicrobial Susceptibility Testing

1. *Mycobacterium tuberculosis*:

Performed on first isolate per patient; performed on additional isolates recovered after 3 months, testing performed at reference lab.

Primary agents	Secondary agents
ethambutol	amikacin
isoniazid (INH)	capreomycin
pyrazinamide	ciprofloxacin
rifampin	ethionamide
streptomycin	p-aminosalicylic acid

In 2010, 25 (1.1%) of 2,329 *M. tuberculosis* cases in the State of California were MDR TB (resistant to at least INH and rifampin).

2. *Mycobacterium avium* complex:

Performed by physician request, 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. (*M. abscesses*, *M. chelonae*, *M. fortuitum* and *M. mucogenicum*):

Performed on one isolate per patient, testing performed inhouse.

Agents routinely reported	Agents conditionally reported
amikacin	linezolid
cefoxitin	meropenem
ciprofloxacin	moxifloxacin
clarithromycin (inducible)	tobramycin
doxycycline	
imipenem	
trimethoprim-sulfamethoxazole	

4. Other Nontuberculous Mycobacteria (NTM):

M. kansasii – Performed on one isolate per patient.
Other NTM by physician request.

Table 17. Mycobacteria, One Isolate per Patient per Source, 2011

	# Patients By Source*		
	respiratory	blood	abscess/wound/ tissue/other
Mycobacterium tuberculosis	10	1	5
<i>M. bovis</i>	0	0	0
Mycobacterium avium complex			
<i>M. avium</i>	50	0	4
<i>M. goodii</i>	32	0	0
<i>M. kansasii</i>	2	0	0
<i>M. simiae</i>	2	0	0
Rapid growers			
<i>M. abscessus</i>	7	0	2
<i>M. fortuitum</i>	4	0	3
<i>M. chelonae</i>	1	0	0
<i>M. mucogenicum</i>	1	1	0
Total mycobacteria	109	2	14

* Some patients have isolates in more than one source

Table 18. Treatment Suggestions For Organisms For Which Susceptibility Testing is Not Routinely Performed

Organism	First-line treatment	Alternate treatment
<i>Bordetella pertussis</i>	Macrolide	Trimethoprim-sulfamethoxazole
<i>Campylobacter jejuni</i>	Erythromycin, azithromycin	Doxycycline, fluoroquinolone, gentamicin
<i>Chlamydophila pneumoniae</i>	Doxycycline, macrolide	Fluoroquinolone, tigecycline
<i>Legionella</i>	Levofloxacin, azithromycin +/- rifampin	Clarithromycin OR doxycycline OR trimethoprim-sulfamethoxazole +/- rifampin
<i>Mycoplasma pneumoniae</i>	Azithromycin	Doxycycline, fluoroquinolone
<i>Ureaplasma</i>	Macrolide, doxycycline	

For additional information, refer to the Antimicrobial Stewardship website, www.asp.mednet.ucla.edu

Table 19. Antimicrobial Stewardship

- 1) Treatment of asymptomatic bacteriuria
 - a. A urine culture must ALWAYS be interpreted in the context of the urinalysis and patient symptoms
 - 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

**Table 20. Ronald Reagan UCLA Medical Center: Emerging Resistance Concerns
(Percent Resistant)**

When specific antimicrobial resistance (R) is detected, an Infectious Disease consult is strongly suggested. The consult can help optimize therapy and reduce nosocomial transmission of resistant organisms.

Organism	Resistant to:	UCLA Percent Resistant:	Therapeutic Options	Comments
<i>Staphylococcus aureus</i>	oxacillin (MRSA)	Inpatients (n=492) 38% Outpatients (n=1044) 35%	vancomycin	Oxacillin-resistant <i>S. aureus</i> are clinically resistant to all β -lactams including β -lactam / β -lactamase inhibitor combinations and carbapenems. ^{1,2} Fluoroquinolones are usually inactive also.
<i>Streptococcus pneumoniae</i> (non-meningitis)	penicillin (MIC > 2 μ g/ml)	All isolates (n = 66) 21%	ceftriaxone or cefotaxime or vancomycin	If susceptible (MIC \leq 2.0 μ g/ml), high dose penicillin has been shown to be effective for infections other than meningitis. ^{1, 2}
<i>Streptococcus pneumoniae</i> (non-meningitis)	cefotaxime, ceftriaxone (penicillin resistant always)	All isolates (n = 66) low level R 6% high level R 8%	vancomycin levofloxacin	If low-level resistance (MIC=2.0 μ g/ml), high dose cefotaxime or ceftriaxone may be effective for infections other than meningitis. ^{1, 2}

Table 20. Ronald Reagan UCLA Medical Center: Emerging Resistance Concerns (cont.) (Percent Resistant)

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

Organism	Resistant to:	UCLA Percent Resistant:	Therapeutic Options	Comments
Viridans group <i>Streptococcus</i>	penicillin	Blood isolates (n = 45) low level R 23% high level R 6%	penicillin + aminoglycoside or vancomycin	Level of penicillin resistance is particularly useful in guiding therapy for endocarditis. ³ For low level resistance, MICs are 0.25–2.0 µg/ml; for high level, MICs are >2.0 µg/ml.
<i>Enterococcus</i> spp.	vancomycin (VRE)	Blood isolates <i>E. faecium</i> (n = 81) 83% <i>E. faecalis</i> (n = 62) 2%	Check in vitro susceptibility results and contact ID.	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 = 81) GENT 21% STR 57% <i>E. faecalis</i> (n = 62) GENT 29% STR 34%	Check in vitro susceptibility results and contact ID.	Both aminoglycoside and cell wall active agent (ampicillin, penicillin, or vancomycin) must be susceptible for synergistic interaction.

Table 20. Ronald Reagan UCLA Medical Center: Emerging Resistance Concerns (cont.) (Percent Resistant)

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

Organism	Resistant to:	UCLA Percent Resistant:	Therapeutic Options	Comments
<i>Klebsiella</i> spp. <i>E. coli</i>	ceftazidime or other 3rd generation cephalosporin	Blood isolates: <i>Klebsiella</i> spp. (n=74) 7% <i>E. coli</i> (n=107) 30%	ertapenem aminoglycoside ciprofloxacin	In vitro resistance to 3rd generation cephalosporins suggests the strain is producing extended-spectrum β -lactamases (ESBL), which confers resistance to all penicillins, cephalosporins and aztreonam.
<i>K. pneumoniae</i> and other <i>Enterobacteriaceae</i>	carbapenem	All isolates: <1%	Check in vitro susceptibility results and contact ID.	Decreased susceptibility to carbapenems is increasing primarily among ICU patients' isolates. These isolates may be resistant to all available antimicrobial agents.
<i>Acinetobacter</i> spp. <i>Citrobacter freundii</i> <i>Enterobacter</i> spp. <i>Providencia</i> / <i>Proteus</i> (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 β -lactamases. Isolates that appear susceptible to 3rd generation cephalosporins may develop resistance during therapy. ^{1,2} Judicious use of 3rd generation cephalosporins is needed to curtail the increase in cephalosporin-resistant <i>Enterobacteriaceae</i> . (i.e. ceftazidime should be reserved for highly suspected or documented pseudomonal infections).
<i>Pseudomonas aeruginosa</i>	cefepime and/or piperacillin-tazobactam	All isolates: (n=715) 17%	Check in vitro susceptibility results and contact ID.	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=63) 24%	Check in vitro susceptibility results and contact ID.	Therapeutic management must be determined on a case by case basis.

Table 20. Ronald Reagan UCLA Medical Center: Emerging Resistance Concerns (cont.) (Percent Resistant)

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

Organism	Resistant to:	Therapeutic Options	Comments
<i>Candida krusei</i>	fluconazole	casposfungin amphotericin voriconazole	Typically resistant to fluconazole. ^{4,5}
<i>Candida glabrata</i>	fluconazole	casposfungin amphotericin voriconazole	Typically resistant to fluconazole. ^{4,5} Caspofungin resistance may be emerging.
<i>Candida albicans</i>	fluconazole	casposfungin amphotericin	Typically susceptible to fluconazole but resistance can develop during therapy. Amphotericin is the drug of choice for systemic infections in patients without baseline renal dysfunction. ^{4,5}

For additional resistance data, see tables

- 1 Treatment Guidelines from the Med. Letter-Choice of Antibacterial Drugs. 2007. 5:33–50
- 2 The Sanford Guide. 2012
- 3 Circulation. 2005. 23:e394
- 4 Clin. Infect. Dis. 2006. 42:244–251
- 5 Treatment Guidelines from the Med. Letter-Antifungal Drugs. 2009. 7:1–10

Table 21A. Ronald Reagan UCLA Medical Center: Resistance Trends, 1990–2011

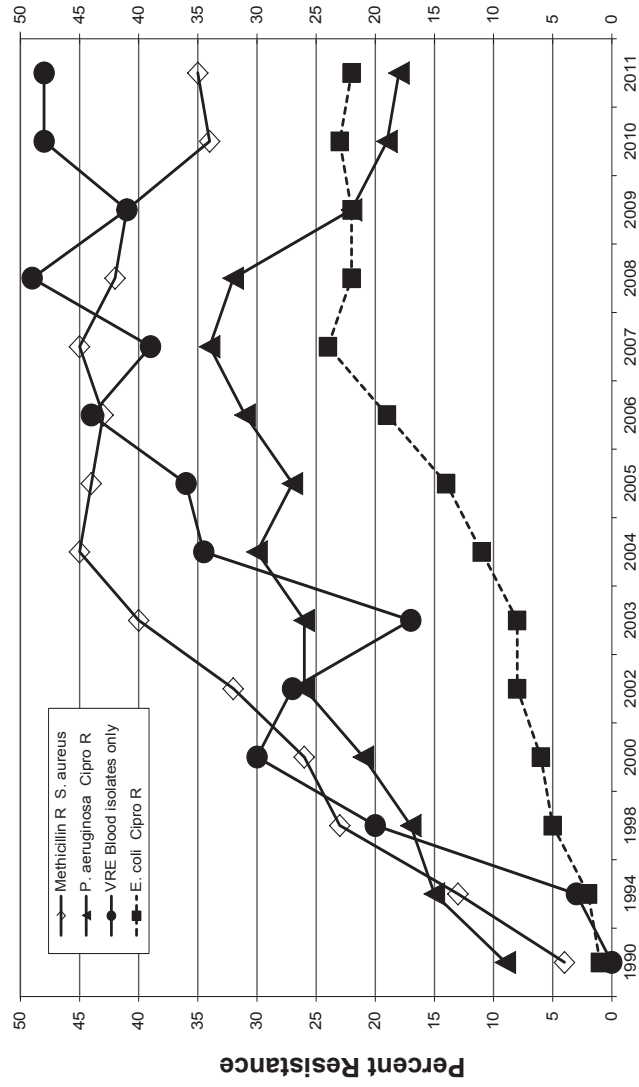


Table 21B. Carbapenem-resistant *Enterobacteriaceae*: RRUMC and SMH-UCLA, 2009–2011

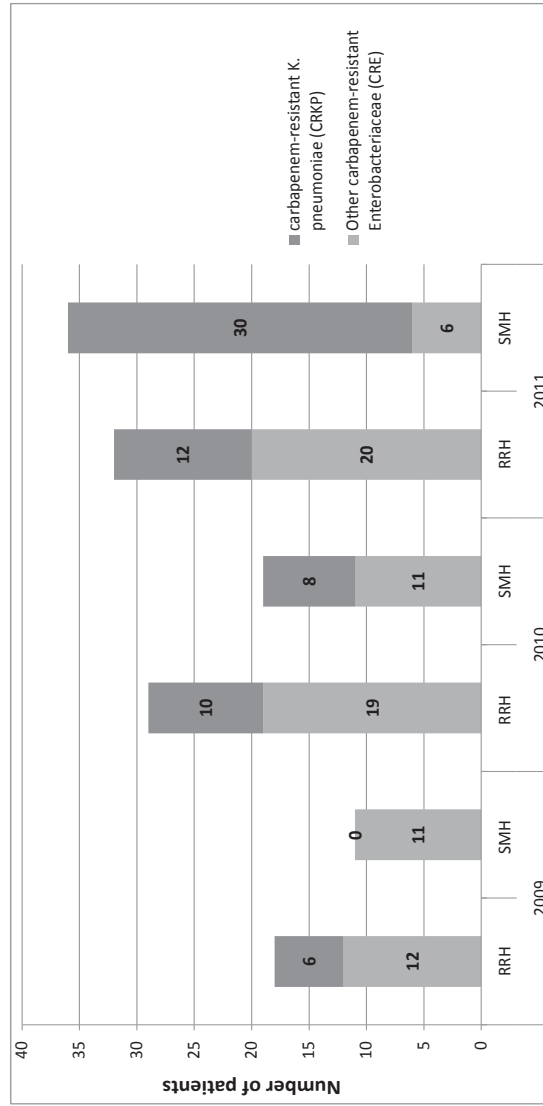


Table 21C. Daptomycin Non-susceptible Gram-positive Cocci: RRUMC and SMH-UCLA, 2009–2011

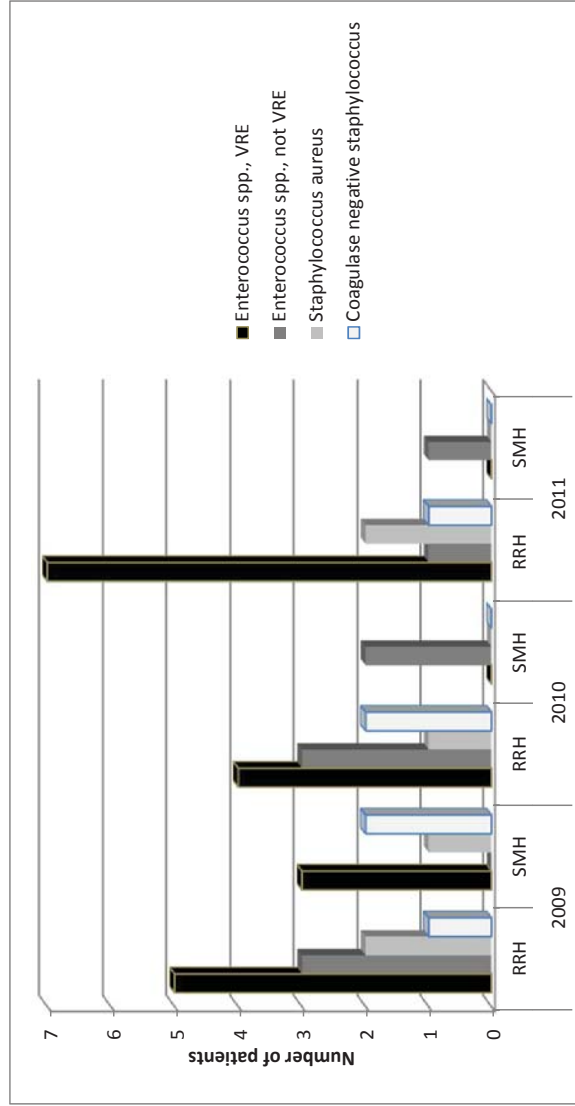
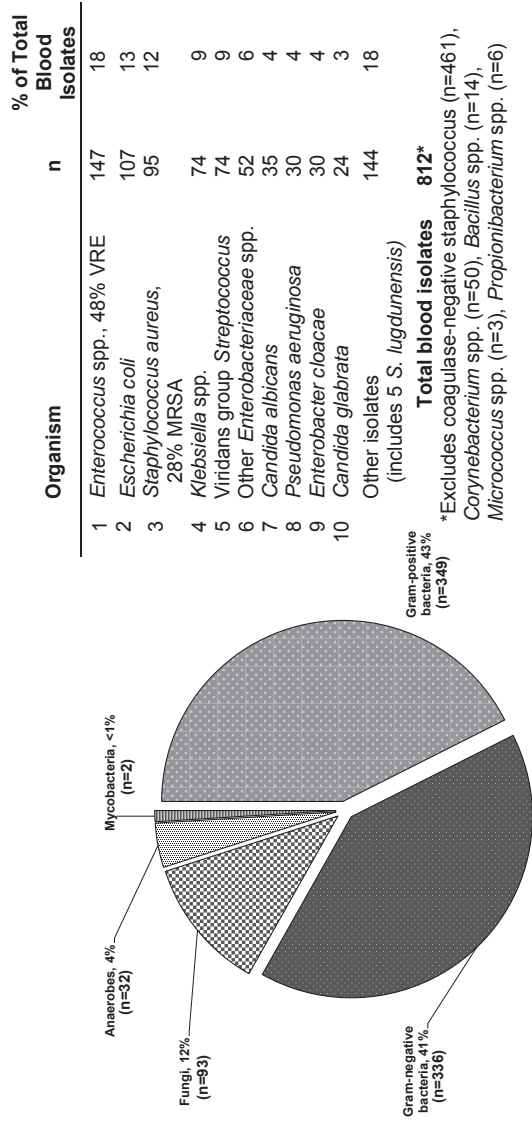


Table 22. Ronald Reagan UCLA Medical Center: Blood, One Isolate per Patient, 2011



Organism	n	% of Total Blood Isolates
1 <i>Enterococcus</i> spp., 48% VRE	147	18
2 <i>Escherichia coli</i>	107	13
3 <i>Staphylococcus aureus</i> , 28% MRSA	95	12
4 <i>Klebsiella</i> spp.	74	9
5 Viridans group <i>Streptococcus</i>	74	9
6 Other <i>Enterobacteriaceae</i> spp.	52	6
7 <i>Candida albicans</i>	35	4
8 <i>Pseudomonas aeruginosa</i>	30	4
9 <i>Enterobacter cloacae</i>	30	4
10 <i>Candida glabrata</i>	24	3
Other isolates (includes 5 <i>S. lugdunensis</i>)	144	18

Total blood isolates 812*

*Excludes coagulase-negative staphylococcus (n=461), *Corynebacterium* spp. (n=50), *Bacillus* spp. (n=14), *Micrococcus* spp. (n=3), *Propionibacterium* spp. (n=6)

Table 22. Ronald Reagan UCLA Medical Center: Blood, One Isolate per Patient, 2011
(cont.)

By Organism Group

Gram-positive Bacterial Isolates	n	% of Gram-positive Isolates	Fungal Isolates	n	% of Fungal Isolates
<i>Enterococcus</i> spp., 48% VRE	147	40	<i>Candida albicans</i>	35	38
<i>Staphylococcus aureus</i> , 28% MRSA	95	27	<i>Candida glabrata</i>	24	26
Viridans group <i>Streptococcus</i>	74	17	<i>Candida parapsilosis</i>	8	9
Beta-hemolytic <i>Streptococcus</i>	11	5	<i>Candida tropicalis</i>	12	13
<i>Streptococcus pneumoniae</i>	7	3	<i>Candida lusitanae</i>	4	4
Other gram-positives	15	8	<i>Candida krusei</i>	6	6
Total	349		<i>Candida dubliniensis</i>	1	1
			Other fungi (mold)	3	3
			Total	93	
<small>(excludes coagulase –negative staphylococcus, <i>Corynebacterium</i> spp., <i>Bacillus</i> spp., <i>Micrococcus</i> spp.)</small>					
Gram-negative Bacterial Isolates	n	% of Gram-negative Isolates	Anaerobic Bacterial Isolates	n	% of Anaerobic Bacterial Isolates
<i>Escherichia coli</i>	107	27	<i>Prevotella</i> spp.	12	37
<i>Klebsiella</i> spp.	74	20	<i>Bacteroides</i> spp.	7	22
<i>Enterobacter cloacae</i>	30	7	<i>Clostridium</i> spp.	5	16
Other <i>Enterobacteriaceae</i> spp.	52	11	Other anaerobes	8	25
<i>Pseudomonas aeruginosa</i>	30	8	Total	32	
<i>Acinetobacter</i> spp.	12	3			% of
<i>Stenotrophomonas maltophilia</i>	11	3	Mycobacterial Isolates	n	Mycobacterial Isolates
Other gram-negatives	20	21	<i>Mycobacterium mucogenicum</i>	1	50
Total	336		<i>Mycobacterium tuberculosis</i>	1	50

Table 23. Ronald Reagan UCLA Medical Center: CSF, One Isolate per Patient, 2011

	n = 35	Number of CSF Isolates
• Gram positives (24)		
Coagulase-negative <i>Staphylococcus</i>		8
<i>Enterococcus</i> spp.		6
<i>Staphylococcus aureus</i>		4
<i>Propionibacterium / Corynebacterium / Bacillus</i> spp.		3
<i>Streptococcus pneumoniae</i>		2
Viridans group <i>Streptococcus</i>		2
• Gram negative bacteria (6)		
Enterobacteriaceae		3
<i>Pseudomonas aeruginosa</i>		1
<i>Neisseria meningitidis</i>		1
<i>Acinetobacter baumannii</i>		1
• Fungi (5)		
<i>Cryptococcus neoformans</i>		2
<i>C. gattii</i>		2
<i>C. albicans</i>		1

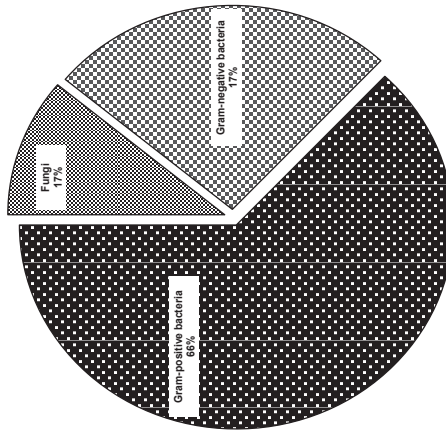


Table 24. Anaerobic Bacteria, Percent Susceptible

Gram-negative anaerobic bacteria – antimicrobials listed in alphabetical order within percent susceptible categories¹

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

¹ Adapted from West Los Angeles VA Medical Center and CLSI tables.

² *B. fragilis* group includes ssp. *disseminis*, *uniformis*, *vulgatus*, *ovatus*, and *theletoiatoamicon*.

Table 24. Anaerobic Bacteria, Percent Susceptible
(cont.)

Gram-positive anaerobic bacteria – antimicrobials listed in alphabetical order within percent susceptible categories

Percent Susceptible	<i>Clostridium difficile</i>	<i>Clostridium perfringens</i>	Other <i>Clostridium</i> spp.	<i>Propionibacterium acnes</i>	Anaerobic gram positive cocci
>95	ampicillin sulbactam, meropenem, metronidazole ¹ , piperacillin tazobactam	ampicillin, ampicillin-sulbactam, cefotixin, clindamycin, ertapenem, meropenem, metronidazole, moxifloxacin, penicillin, piperacillin tazobactam	ampicillin-sulbactam, ertapenem, metronidazole, piperacillin-tazobactam	clindamycin, moxifloxacin	ampicillin, ampicillin sulbactam, cefotixin, ertapenem, meropenem, metronidazole, penicillin, piperacillin-tazobactam
85–95 70–84			ampicillin, moxifloxacin, penicillin	penicillin	clindamycin, moxifloxacin
50–69			clindamycin	metronidazole	
<50	ampicillin, clindamycin, cefotixin,		cefotixin		

¹ Oral therapy. In cases of extraintestinal infection. Infectious Disease Consultation strongly recommended.

Table 25. Santa Monica UCLA Hospital: Urine Gram-negative Bacteria, Percent Susceptible

Organism	Source	No. isolates	Penicillins			Cephalosporins			Carbapenems		Aminoglycosides		Fluoro-quinolone	Other		
			Ampicillin	Piperacillin-tazobactam	Cefazolin	Cefepime	Cefotaxime ²	Ceftazidime	Ertapenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Nitrofurantoin	Trimethoprim-sulfamethoxazole
<i>Escherichia coli</i>	OP	666	46	98	87	-	92	91	99	100	99	90	89	74	96	68
	IP	188	38	99	80	-	91	89	100	100	100	82	82	52	95	67
<i>Klebsiella pneumoniae</i>	OP	84	R ¹	84	82	-	83	80	87	88	95	91	89	88	34	80
	IP	63	R	80	75	-	84	80	83	83	91	92	77	79	43	78
<i>Proteus mirabilis</i>	OP	105	77	98	88	-	93	94	100	100	100	85	85	50	R	58
	IP	44	66	96	77	-	96	92	99	99	100	80	86	39	R	57
<i>Pseudomonas aeruginosa</i>	OP	62	R	76	R	77	R	76	R	82	100	82	86	59	R	R
	IP	36	R	64	R	75	R	69	R	75	97	81	83	47	R	R

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

¹ R = intrinsic resistance (inherent or innate antimicrobial resistance).

² Cefotaxime and ceftioxime have comparable activity against *Enterobacteriaceae*

Table 26. Santa Monica UCLA Hospital: Non-Urine Gram-negative Bacteria, Percent Susceptible

Outpatients		No. Isolates	Penicillins			Cephalosporins			Carbapenems		Aminoglycosides		Fluoro-quinolone	Other
			Ampicillin	Ampicillin-sulbactam	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftroxone ²	Ertapenem	Meropenem	Amikacin	Gentamicin	Tobramycin
Organism														
<i>Escherichia coli</i>	78	41	45	95	78	83	83	100	100	99	87	81	68	53
<i>Pseudomonas aeruginosa</i>	41	R ¹	R	73	R	73	R	R	R	100	93	93	73	R
Inpatients														
Organism														
<i>Enterobacter cloacae</i> ³	20	R	R	80	R	75	70	95	100	100	85	85	95	80
<i>Escherichia coli</i>	90	41	49	94	77	80	80	100	100	99	84	78	52	57
<i>Klebsiella pneumoniae</i>	85	R	52	72	58	59	59	81	82	73	77	60	60	69
<i>Proteus mirabilis</i>	60	52	62	97	67	75	75	100	100	100	73	83	33	45
<i>Serratia marcescens</i>	39	R	R	77	R	85	82	95	100	95	97	69	82	100
<i>Pseudomonas aeruginosa</i>	131	R	R	60	R	69	R	R	R	77	98	83	49	R

¹ R = intrinsic resistance (inherent or innate antimicrobial resistance).

² Cefotaxime and ceftroxone have comparable activity against *Enterobacteriaceae*

³ Calculated from fewer than the standard recommendation of 30 isolates

Table 27. Santa Monica UCLA Hospital: Gram-positive Cocci Bacteria (Inpatient), Percent Susceptible

Organism	No. Isolates	Penicillins			Cephalo- sporin	Fluoroquin- olones		Tetracyc- lines		Other								
		Ampicillin	Oxacillin	Penicillin		Ceftriaxone	Ciprofloxacin	Levofloxacin	Doxycycline	Tetracycline	Clindamycin	Daptomycin	Erythromycin	Nitrofurantoin	Linezolid	Quinupristin- dalopristin	Rifampin	Trimethoprim- sulfamethoxazole
<i>Staphylococcus aureus</i> (All)	292	—	43	<10	—	35	—	98	—	56	99	31	—	99	99	99	96	100
oxacillin-resistant (MRSA) ¹	170	—	—	—	—	4	—	98	—	47	99	5	—	99	99	98	96	100
oxacillin-susceptible (MSSA)	127	—	100	<10	—	76	—	99	—	68	99	63	—	99	99	99	96	100
<i>Staphylococcus</i> coagulase negative ²	65	—	26	<10	—	26	—	92	—	51	99	30	—	97	98	99	59	100
<i>Enterococcus</i> spp. (all) ^{3,4}	171	64	—	—	—	—	—	40	—	—	99	—	—	98	41 ⁵	—	—	63
<i>Enterococcus</i> spp. (urine)	102	65	—	—	—	32	—	—	—	—	—	—	—	74	—	—	—	64
<i>Streptococcus pneumoniae</i> (all)	16 ⁶	—	—	75	94	—	100	—	88	—	—	75	—	—	—	—	88	100
meningitis	—	—	—	84	100	—	—	—	—	—	—	—	—	—	—	—	—	—
non-meningitis	—	—	—	100	100	—	—	—	—	—	—	—	—	—	—	—	—	—
Viridans group	3 ⁵	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Streptococcus</i> (blood)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

¹ *Staphylococcus* resistant to oxacillin are resistant to ceftazidim, cephalixin, ceftriaxone and all other beta-lactams
² *S. saprophyticus* urinary tract infections respond to antibiotic concentrations achieved in urine with agents commonly used to treat acute uncomplicated UTIs
³ Includes 18 *E. faecalis*, 7 *E. faecium*, and 145 isolates not identified to species level
⁴ Gentamicin synergy 63% susceptible, streptomycin synergy 57% susceptible
⁵ Only *E. faecium* are susceptible
⁶ Calculated from fewer than the standard recommendation of 30 isolates
⁷ Amoxicillin 80% susceptible

Table 28. Santa Monica UCLA Hospital: Emerging Resistance Concerns

Incidence of Resistant Organisms, 2011				Beta-lactamase Results for Respiratory Pathogens		
Organism	No. Isolates	Resistant to:	% Resistant	Organism	No. Isolates	% beta-lactamase Positive ¹
<i>Staphylococcus aureus</i>	402	Methicillin (MRSA)	43	<i>Haemophilus influenzae</i>	21 ²	24
• Outpatient	292		43			
• Inpatient				<i>Moraxella catarrhalis</i>	16 ²	94
<i>Enterococcus</i> spp. (blood isolates only)	38	Vancomycin (VRE)	66			

¹ Resistant to ampicillin, amoxicillin, penicillin

² Calculated from fewer than the standard recommendation of 30 isolates

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

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 and Dr. Meganne Kanatani.

UCLA Form 3819 (7/12)