UCLA Health System

Antimicrobial Susceptibility Summary 2018

Clinical Microbiology

Department of Pathology & Laboratory Medicine

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

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

Select “Antimicrobial Susceptibility Summary” 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.

These tables summarize susceptibility data obtained for organisms isolated in the UCLA Clinical Microbiology Laboratory in 2017.
Percent Susceptible Data (Tables 1-12)

Emerging Resistance Trends at UCLA (Tables 13-18)

Antimicrobial Testing and Reporting Policies (Tables 27–28)

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 antimicrobials without interpretive criteria (e.g. colistin & *enterobacteriaceae*), an interpretation of wild-type (no resistance genes/mutations) or non-wild-type (with resistance gene or mutation) may be reported. Consultation with Infectious Diseases strongly advised in these cases.

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

Organism	Location	No. Isolates	Penicillins			Cephalosporins				Carbapenems			Aminoglycosides			Fluoro-quinolone	Other	
			Ampicillin[6]	Ampicillin-sulbactam[6]	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone[1]	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Trimethoprim – sulfamethoxazole	Colistin[7]
Enterobacter cloacae	OP	102	R[2]	R	93	R	92	—[4]	—	91	98	99	99	96	98	99	90	82
	IP	69	R	R	90	R	90	—	—	91	99	99	99	96	96	97	90	81
	ICU	69	R	R	80	R	93	—	—	83	99	99	99	96	98	99	96	86
Escherichia coli	OP	416	—	—	94	55	83	83	81	97	98	98	99	83	84	64	65	99
	IP	257	—	—	94	50	77	78	73	98	99	99	98	82	82	58	60	99
	ICU	125	—	—	85	37	66	69	62	96	99	98	99	81	80	49	53	99
Klebsiella pneumoniae	OP	150	R	—	83	71	81	77	77	87	89	89	95	83	83	80	78	94
	IP	129	R	—	86	74	88	86	86	91	93	93	98	95	88	84	83	98
	ICU	128	R	—	82	69	82	80	81	88	92	92	95	86	83	80	77	98
Proteus mirabilis	OP	108	—	—	99	14	94	99	93	99	32	99	99	89	93	73	73	R
	IP	71	—	—	99	11	99	93	86	99	39	99	99	81	88	69	67	R
	ICU	28[5]	—	—	99	0	89	89	68	99	32	99	99	71	75	32	43	R
Pseudomonas aeruginosa	OP	505	R	R	77	R	79	81	R	R	74	77	94	87	94	73	R	99
	IP	261	R	R	73	R	76	81	R	R	72	77	93	88	93	72	R	99
	ICU	148	R	R	67	R	75	72	R	R	67	68	96	91	97	73	R	99

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

[1] Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae.*

[2] R = intrinsic resistance (inherent or innate antimicrobial resistance).

[3] — = Not routinely tested and/or not applicable.

[4] 3rd generation cephalosporins should not be used for serious infections.

[5] Calculated from fewer than the standard recommendation of 30 isolates.

[6] Data derived from Jan 1, 2016 to July 26, 2016. Ampicillin and Ampicillin-sulbactam testing were discontinued on July 26, 2016.

[7] There are no clinical breakpoints for Colistin and the Enterobacteriaceae. These data represent the % of wild-type isolates (below or equal the Epidemiological Cut-off Value or ECV). Wild-type (WT) isolates are those presumed to not have acquired or mutational resistance while the Non-Wild-Type (NWT) isolates are those with acquired or mutational resistance.

[8] For novel antimicrobials (i.e. Ceftolozane-tazobactam and Ceftazidime-avibactam) %S data, please refer to Table 8.

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

Organism	No. Isolates	Penicillins			Cephalosporins				Carbapenems			Aminoglycosides			Fluoro-quinolone	Other	
		Ampicillin[6]	Ampicillin-Sulbactam[6]	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone[1]	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Trimethoprim–sulfamethoxazole	Colistin[7]
Citrobacter freundii	48	R[2]	R	85	R	96	—[4]	—	98	99	99	99	98	99	93	82	99
Enterobacter aerogenes	114	R	R	86	R	96	—	—	94	93	96	99	99	99	97	97	98
Enterobacter cloacae	243	R	R	88	R	92	—	—	90	99	99	99	97	98	98	91	82
Escherichia coli	760	—	—	92	52	79	79	76	97	99	98	99	83	84	60	62	99
Klebsiella oxytoca	139	R	—	93	13	96	97	91	99	99	99	99	99	99	96	93	99
Klebsiella pneumoniae	384	R	—	85	73	85	83	83	90	93	92	97	88	86	81	79	96
Morganella morganii	68	R	R	99	R	98	—	—	98	—	98	99	76	97	70	60	R
Proteus mirabilis	194	—	—	99	25	96	95	87	99	—	99	99	86	90	68	67	R
Serratia marcescens	140	R	R	94	R	96	—	—	97	96	99	99	99	96	94	97	R
Acinetobacter baumannii	94	R	—	40	R	53	42	—	R	59	58	64	60	68	51	64	97
Pseudomonas aeruginosa	813	R	R	78	R	82	81	R	R	73	78	95	89	95	75	R	99
Stenotrophomonas maltophilia	87	R	R	R	R	—	30	R	R	R	R	R	R	R	—	99	73
Burkholderia cepacia complex	9[5]	R	R	R	R	R	25	R	R	R	25	R	R	R	44	75	R

[1] Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae.*

[2] R = intrinsic resistance.

[3] — = Not routinely tested and/or not applicable.

[4] 3rd generation cephalosporins should not be used for serious infections.

[5] Calculated from fewer than the standard recommendation of 30 isolates.

[6] Data derived from Jan 1, 2016 to July 26, 2016. Ampicillin and Ampicillin-sulbactam testing were discontinued on July 26, 2016.

[7] There are no clinical breakpoints for Colistin and the Enterobacteriaceae. These data represent the % of wild-type isolates (below or equal the Epidemiological Cut-off Value or ECV). Wild-type (WT) isolates are those presumed to not have acquired or mutational resistance while the Non-Wild-Type (NWT) isolates are those with acquired or mutational resistance.

[8] For novel antimicrobials (i.e. Ceftolozane-tazobactam and Ceftazidime-avibactam) %S data, please refer to Table 8.

Table 3. 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[1]	Cefepime	Ceftriaxone[2]	Ertapenem	Imipenem	Meropenem	Gentamicin	Ciprofloxacin	Nitrofurantoin	Trimethoprim – sulfamethoxazole
Enterobacter cloacae	OP	173	R[3]	R	97	—[4,5]	95	99	99	97	97	40	79
	IP	45	R	R	93	—[5]	81	99	99	99	93	34	80
Escherichia coli	OP	7371	57	90	—	92	99	99	99	92	80	97	74
	IP	454	36	74	—	79	99	99	99	81	64	96	59
Klebsiella pneumoniae	OP	1198	R	90	—	90	98	98	98	95	93	34	84
	IP	157	R	82	—	85	96	96	97	91	87	27	80
Proteus mirabilis	OP	613	82	92	—	95	99	—	99	91	82	R	81
	IP	67	76	88	—	91	99	—	99	85	70	R	72
Pseudomonas aeruginosa[7]	OP	310	R	R	89	R	R	84	87	96	80	R	R
	IP	96	R	R	87	R	R	77	81	91	75	R	R

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

[1] Oral cephalosporins include cefpodoxime and cephalexin for treatment of uncomplicated urinary tract infections.

[2] Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae*

[3] R = intrinsic resistance.

[4] — = Not routinely tested and/or not applicable.

[5] 3rd generation cephalosporins should not be used for serious infections.

[6] Calculated from fewer than the standard recommendation of 30 isolates

[7] Ceftazidime: OP 91%, IP 85%, Piperacillin-tazobactam: OP 89%, IP 79%

Table 4. 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 [1]	Trimethoprim-sulfamethoxazole	Vancomycin	Ceftaroline
Staphylococcus aureus [2]	All	2486	—[3]	69	<10	—	—	64	72	99	98	51	99	99	99	99	99	100
Oxacillin-resistant *S. aureus* (MRSA) [2,4]	OP	546	—	R	R	—	—	19	66	99	98	13	99	99	98	99	99	100
	IP	212	—	R	R	—	—	16	52	99	98	11	99	99	98	98	99	100
	ICU	117	—	R	R	—	—	10	52	99	95	13	99	99	97	97	99	100
Oxacillin-susceptible *S. aureus* (MSSA)	OP	1335	—	100	<10	—	—	84	77	99	98	67	99	99	99	99	99	100
	IP	342	—	100	<10	—	—	85	77	99	99	66	99	99	98	99	99	100
	ICU	172	—	100	<10	—	—	89	78	99	99	74	99	99	99	99	99	100
Staphylococcus epidermidis	All	404	—	46	<10	—	—	50	62	99	88	36	99	99	98	61	99	—
Staphylococcus lugdunensis [10]	All	309	—	96	53	—	—	98	88	99	99	85	99	99	99	99	99	—
Staphylococcus pseudintermedius	All	37	—	78	<10	—	—	81	70	99	76	70	99	99	99	76	99	—
Coagulase-negative *Staphylococcus* [2, 5, 9]	All	143	—	60	<10	—	—	59	69	99	93	48	99	98	98	74	99	—
***Enterococcus* spp.**[4,6]	All	915	74	—	—	77	68	41	R	98	38	R	99	—	22	R	76	R
Enterococcus faecalis [4,7]	All	116	99	—	—	71	73	48	R	99	37	R	99	R	27	R	95	R
Enterococcus faecium [4,8]	All	104	11	—	—	95	43	5	R	90	48	R	98	86	7	R	19	R

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

[1] Rifampin should not be used as monotherapy.

[2] Staphylococcus resistant to oxacillin are resistant to cefazolin, cephalexin, ceftriaxone and all other beta-lactams except ceftaroline.

[3] — = Not routinely tested and/or not applicable.

[4] Serious Enterococcal infections need combination therapy with Ampicillin, Penicillin, or Vancomycin plus an Aminoglycoside.

[5] *S. saprophyticus* urinary tract infections respond to antibiotic concentrations achieved in urine with agents commonly used to treat acute uncomplicated UTIs

[6] Includes isolates tested from all body sites.

[7] 23% High-level resistance to both gentamicin and streptomycin. Includes isolates tested from sterile body sites only.

[8] 4% High-level resistance to both gentamicin and streptomycin. Includes isolates tested from sterile body sites only.

[9] Excluding *S. epidermidis*, *S. lugdunensis* and *S. pseudintermedius*.

[10] *S. lugdunensis* is best treated with a Beta-lactam agent.

Table 4. 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	Tetracycline	Vancomycin
Streptococcus pneumoniae	49	94			—[2]	76	80	71	99	82	—	100
Meningitis [3]		—	78	86	88	—	—	—	—	—	—	—
Non-meningitis [4]		—	94	96	96	—	—	—	—	—	—	—
Viridans group *Streptococcus spp.* [6]	90	—	67[5]	93	94	—	—	—	—	—	—	100
Streptococcus anginosus	80	—	96	100	100	—	—	—	—	—	—	99
Streptococcus agalactiae **(Group B streptococci)**	119	—	100	—	—	61	—	—	—	—	—	100
Streptococcus pyogenes **(Group A streptococci)**	16[1]	—	100	—	—	71	—	56	—	—	50	100

[1] Calculated from fewer than the standard recommendation of 30 isolates.
[2] — = Not routinely tested and/or not applicable.
[3] % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients with meningitis.
[4] % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients without meningitis.
[5] Resistant (R) includes **28%** Intermediate (MIC 0.25-2 µg/ml) and **2%** High-level (MIC >2 µg/ml) resistance
[6] Excluding *Streptococcus anginosus*

Table 5. Miscellaneous Gram-negative Bacteria

Organism	No. Isolates	% beta-lactamase positive[1]
Haemophilus influenzae	**98 (pts. >21 y.o)** **29 (pts. ≤21 y.o.)**	**35** **31**
Moraxella catarrhalis	**23 (pts. >21 y.o)** **9 (pts. ≤21 y.o.)**	**96** **100**
Neisseria gonorrhoeae	The current therapy recommendation is ceftriaxone in combination with azithromycin. Culture and susceptibility testing should be performed in cases of treatment failure. See http://www.cdc.gov/std/Gonorrhea/treatment.htm CDC recommends *dual therapy*, or using two drugs, to treat gonorrhea – a single dose of 250mg of intramuscular ceftriaxone AND 1g of oral azithromycin. It is important to take all of the medication prescribed to cure gonorrhea.	
Neisseria meningitidis	*Neisseria meningitidis* 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. **Sanford guide 2017** Recommended: Ceftriaxone Alternative: Meropenem, Chloramphenicol	

[1] Resistant to ampicillin, amoxicillin, and penicillin

Table 6. *Pseudomonas aeruginosa* - %Susceptible to One or Two Antimicrobials

Information provided for two drug combination does NOT imply synergism, antagonism or likely activity in vivo; 1278 patients, includes the most resistant result for each drug if patient had >1 isolate

	Amikacin (97)[1]	Gentamicin (91)	Tobramycin (95)	Ciprofloxacin (78)
Cefepime (86)	98[2]	96	97	91
Meropenem (82)	99	96	97	90
Piperacillin-tazobactam (80)	99	96	97	90
Ciprofloxacin (78)	98	95	97	–

*Includes pediatrics and adults

[1] Percent susceptible for individual drug in parenthesis

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

Table 7. *Stenotrophomonas maltophilia* - % Susceptible to One or Two Antimicrobials

Information provided for two drug combination does NOT imply synergism, antagonism or likely activity in vivo; 132 patients, includes pediatrics and adults

	Ceftazidime (29)[1]	Minocycline (99)	Levofloxacin (61)	Trimethoprim-Sulfamethoxazole (97)	Tigecycline (80)	Colistin (80)
Ceftazidime (29)	—	95[2]	72	98	85	86
Minocycline (99)	95	—	96	99	—	99
Levofloxacin (61)	72	96	—	99	80	92
Trimethoprim-Sulfamethoxazole (97)	98	99	99	—	99	100
Tigecycline (80)	85	—	80	99	—	95
Colistin (80)	86	99	92	100	95	—

* Colistin interpreted according to *Pseudomonas* breakpoint. Tigecycline by ≤2 ug/mL.
† Includes pediatrics and adults.
[1] Percent susceptible for individual drug in parenthesis
[2] Percent susceptible for either or both drugs (e.g. %S to ceftazidime and/or minocycline)

Table 8. Most Resistant Gram-negative Bacteria – Non-Urine Isolates, % Susceptible

Organism	No Isolates	Amikacin	Tigecycline[3]	Colistin[1]	Ceftolozane-Tazobactam[2]	Ceftazidime-Avibactam[2]
Carbapenem Resistant Enterobacteriaceae (CRE)	**124**	**82**	**81**	**80**	**21**	**96**

Organism	No isolates	Amikacin	Ciprofloxacin	Piperacillin-Tazobactam	Cefepime	Ceftazidime	Ceftolozane-Tazobactam[2]	Ceftazidime-Avibactam[2]	Colistin
***Pseudomonas aeruginosa* (Imipenem or Meropenem resistant)**	**376**	**90**	**37**	**35**	**45**	**45**	**86**	**81**	**98**
***Pseudomonas aeruginosa* (Imipenem and Meropenem resistant)**	**281**	**87**	**41**	**20**	**33**	**34**	**82**	**78**	**98**

* Include pediatrics and adults.

[1] There are no clinical breakpoints for Colistin and the Enterobacteriaceae. These data represent the % of wild-type isolates (below or equal the Epidemiological Cut-off Value or ECV). Wild-type (WT) isolates are those presumed to not have acquired or mutational resistance while Non-Wild-type (NWT) isolates are those with acquired or mutational resistance.

[2] Restricted formulary ID consult required. Ceftolozane-tazobactam and Ceftazidime-avibactam interpretation are based on CLSI breakpoints.

Table 9. Pediatrics (≤ 21 y.o.) Gram-negative Bacteria - Non-urine Isolates % Susceptible

Organism	No. Isolates	Penicillins			Cephalosporins				Carbapenems			Aminoglycosides			Fluoroquinolone	Other
		Ampicillin	Ampicillin-sulbactam	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone[1]	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin[2]	Trimethoprim – sulfamethoxazole
Enterobacter cloacae	32	R[4]	R	81	R	97	—[5]	—[5]	79	99	99	99	99	99	99	99
Escherichia coli	87	—	—	96	59	94	95	94	99	99	99	99	87	92	82	59
Klebsiella pneumoniae	43	R	—	93	77	91	93	88	99	99	99	97	95	98	93	77
Serratia marcescens	25[3]	R	R	96	R	99	—[5]	—[5]	96	84	99	96	96	92	96	96
Pseudomonas aeruginosa	92	R	R	82	R	88	86	R	R	86	88	97	94	97	87	R

[1] Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae*.
[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.
[4] R = intrinsic resistance (inherent or innate antimicrobial resistance).
[5] 3rd generation cephalosporins should not be used for serious infections.
[6] Data derived from Jan 1, 2016 to July 26, 2016. Ampicillin and Ampicillin-sulbactam testing were discontinued on July 26, 2016.

Table 10. Pediatrics (≤ 21 y.o.) Gram-negative Bacteria - Urine Isolates % Susceptible

Organism	No. Isolates	Penicillins		Cephalosporins				Carbapenems			Aminoglycosides			Fluoroquinolone	Other	
		Ampicillin[6]	Ampicillin-sulbactam[6]	Oral Cephalosporins[7]	Cefepime	Ceftazidime	Ceftriaxone[1]	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin[2]	Trimethoprim – sulfamethoxazole	Nitrofurantoin
Enterobacter cloacae	15[3]	R[4]	R	R	93	—[5]	—	80	99	99	99	99	—	99	93	67
Escherichia coli	797	57	64	93	—	—	94	99	99	99	99	92	—	90	74	99
Klebsiella pneumoniae	77	R	81	96	—	—	97	99	99	99	99	99	—	96	88	30
Proteus mirabilis	100	87	96	98	—	—	99	99	ND	99	99	99	—	99	85	R
Pseudomonas aeruginosa	31	R	R	R	93	93	R	R	93	93	99	99	96	99	R	R

[1] Cefotaxime and ceftriaxone have comparable activity against *Enterobacteriaceae.*
[2] Ciprofloxacin is associated with arthropathy and histological changes in weight-bearing joints of juvenile animals and is not FDA approved for pediatric use.
[3] Calculated from fewer than the standard recommendation of 30 isolates.
[4] R = intrinsic resistance (inherent or innate antimicrobial resistance).
[5] — = Not routinely tested and/or not applicable.
[6] Data derived from Jan 1, 2016 to July 26, 2016. Ampicillin and Ampicillin-sulbactam testing were discontinued on July 26, 2016.
[7] Oral Cephalosporins include Cefpodoxime and Cephalexin for treatment of uncomplicated urinary tract infections.
[8] For novel antimicrobials (i.e. Ceftolozane-tazobactam and Ceftazidime-avibactam) %S data, please refer to Table 8.

Table 11. 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 [1]	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Linezolid	Quinupristin-dalfopristin	Rifampin [2]	Trimethoprim-sulfamethoxazole	Vancomycin	Ceftaroline
***Staphylococcus aureus* (All) [3]**	OP	362	—[4]	77	<10	—	—	—	—	77	80	99	98	57	99	99	99	99	99	100
	IP	135	—	77	<10	—	—	—	—	78	76	99	98	63	99	99	98	99	99	99
Oxacillin-resistant *S. aureus* (MRSA)[3]	OP	84	—	R[6]	R	R	R	—	—	39	86	99	99	20	99	99	99	99	99	100
	IP	31	—	R	R	R	R	—	—	29	77	99	91	29	99	99	97	99	99	98
Oxacillin-susceptible *S. aureus* (MSSA)	OP	280	—	100	<10	—	—	—	—	88	78	99	98	68	99	99	99	99	99	100
	IP	104	—	100	<10	—	—	—	—	93	80	99	99	74	99	99	98	99	99	100
Coagulase negative *Staphylococcus* (sterile body sites)[7]	All	32	—	37	<10	—	—	—	—	77	70	97	99	40	97	99	93	63	99	—
	OP	11[5]	—	64	<10	—	—	—	—	73	73	91	99	45	91	99	91	73	99	—
	IP	21[5]	—	33	<10	—	—	—	—	80	67	99	99	24	99	99	95	62	99	—
Staphylococcus epidermidis	All	53	—	23	<10	—	—	—	—	67	53	99	91	17	99	99	94	64	99	—
Staphylococcus lugdunensis	All	32	—	97	<10	—	—	—	—	99	91	99	97	91	99	99	99	99	99	—
***Enterococcus* spp.[8]**	All	83	89	—	—	R	R	81	86	66	R	98	52	R	99	—	27	R	94	—
***Enterococcus faecalis* [9]**	All	10[5]	99	—	—	R	R	80	99	70	R	99	50	R	99	R	30	R	99	—
***Enterococcus faecium* [9]**	All	1[5]	0	—	—	R	R	99	100	0	R	100	0	R	99	99	0	R	99	—

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 not FDA approved for pediatric use.

[2] Rifampin should not be used as monotherapy.

[3] *Staphylococcus* resistant to oxacillin are resistant to cefazolin, cephalexin, ceftriaxone and all other beta-lactams except Ceftaroline.

[4] — = Not routinely tested and/or not applicable.

[5] Calculated from fewer than the standard recommendation of 30 isolates.

[6] R = intrinsic resistance

[7] Excludes *S. epidermidis* and *S. lugdunensis*

[8] Includes isolates tested from all body sites.

[9] Sterile Sites: 0% High-level resistance to both gentamicin and streptomycin. Includes isolates tested from sterile body sites only.

Table 11. (cont) Pediatrics (≤ 21 y.o.) Gram-positive Cocci, % Susceptible

Organism	No. Isolates	Penicillins		Cephalosporins		Other				
		Amoxicillin	Penicillin	Cefotaxime	Ceftriaxone	Clindamycin	Doxycycline	Erythromycin	Trimethoprim – sulfamethoxazole	Vancomycin
Viridans group Streptococcus (sterile body sites)	13[1]	—[2]	54	69	69	—	—	—	—	100
Streptococcus anginosus	11[1]	—	100	100	100	—	—	—	—	100
Streptococcus pneumoniae	10[1]	90		—	—	80	80	70	90	100
Meningitis[3]		—	80	83	90	—	—	—	—	—
Non-meningitis[4]		—	100	92	100	—	—	—	—	—

[1] Calculated from fewer than standard recommendation of 30 isolates

[2] — = Not routinely tested and/or not applicable.

[3] % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients with meningitis.

[4] % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients without meningitis.

Table 12. Yeasts, % Susceptible, 2014-2016

- 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.
- Isolation of Candida in respiratory specimens of immunocompetent patients should be interpreted as airway colonization.

Organism	No. Isolates[2]	Percent Susceptible/Dose Dependent/Resistant at Breakpoints [1](µg/ml)						
		Fluconazole			Caspofungin	Voriconazole		
		≤ 8 S	16-32 S-DD	≥64 R	≤ 2 S	≤ 1 S	2 S-DD	≥4 R
C. albicans	275	98	1	1	100	100	0	0
C. glabrata	224	54	28	18	98	86	8	6
C. parapsilosis	92	96	1	3	100	99	0	1
C. tropicalis	52	96	4	0	98	100	0	0
C. krusei	28[3]	R[4]	R	R	100	92	8	0
C. lusitaniae	23[3]	87	0	13	100	96	4	0
C. dubliniensis	14[3]	100	0	0	100	100	0	0
Other Candida spp.	25	76	16	8	100	100	0	0

[1] S = Susceptible. S-DD = Susceptible dose dependent; susceptibility dependent on achieving maximal possible blood level; no dose dependent category for caspofungin. R = Resistant
[2] Not all isolates were tested against all four antifungal agents.
[3] Calculated from fewer than the standard recommendation of 30 isolates
[4] R = intrinsic resistance (inherent or innate antimicrobial resistance).

Table 13. 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.

Organism	Resistant to:	Percent Resistant:	Therapeutic Options	Comments
Staphylococcus aureus	oxacillin (MRSA)	Adults (>21 y.o.) Inpatients (n=329) 39% Outpatients (n=546) 29% Pediatrics (<21 y.o.) Inpatients (n=31) 23% Outpatients (n=84) 30%	vancomycin ceftaroline daptomycin	MRSA are clinically resistant to all ß-lactams, ß-lactam / ß-lactamase inhibitor combinations and carbapenems, excluding ceftaroline.[1] MRSA are also typically resistant to fluoroquinolones
Streptococcus pneumoniae (non-meningitis)	penicillin (MIC > 2 µg/ml)	All isolates (n = 62) 5%	ceftriaxone or cefotaxime or vancomycin	If susceptible (MIC ≤2.0 µg/ml), high dose penicillin has been shown to be effective for infections other than meningitis.[1]
Streptococcus pneumoniae (non-meningitis)	cefotaxime, ceftriaxone (penicillin resistant always)	All isolates (n = 62) low level R 2% high level R 2%	vancomycin levofloxacin	If low-level resistance (MIC=2.0 µg/ml), high dose cefotaxime or ceftriaxone may be effective for infections other than meningitis.[1]

Table 13. (cont.) 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.

Organism	Resistant to:	Percent Resistant:	Therapeutic Options	Comments
Viridans group *Streptococcus*	penicillin	Blood isolates (n = 80) low level R 17% high level R 3%	vancomycin or penicillin + aminoglycoside	Level of penicillin resistance is particularly useful in guiding therapy for endocarditis.[1] For low level resistance, MICs are 0.25–2.0 µg/ml; for high level, MICs are >2.0 µg/ml.[2]
Enterococcus spp.	vancomycin (VRE)	Blood isolates *E. faecium* (n = 88) 78% *E. faecalis* (n = 60) 5%	Check in vitro susceptibility results and contact Infectious Diseases.	Vancomycin-resistant *Enterococcus* (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 *E. faecium* (n = 88) GENT 4% STR 57% *E. faecalis* (n = 60) GENT 30% STR 23%	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 13. Emerging Resistance Concerns (cont.)

Organism	Resistant to:	Percent Resistant:	Therapeutic Options	Comments
Klebsiella spp. *E. coli*	ceftriaxone or other 3rd generation cephalosporin	Blood isolates: *Klebsiella* spp. (n=153) 20% *E. coli* (n =316) 28%	ertapenem ciprofloxacin	In vitro resistance to 3rd generation cephalosporins suggests the strain is producing extended-spectrum ß-lactamases (ESBL), or AmpC
K. pneumoniae and other *Enterobacteriaceae*	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.
Citrobacter freundii *Enterobacter* spp. *Providencia* spp. / *Proteus* spp. (except *P. mirabilis*) *Serratia marcescens*	3rd generation cephalosporins (e.g. ceftriaxone)	See comments	aminoglycoside ciprofloxacin ertapenem meropenem trimethoprim-sulfamethoxazole	Organisms listed typically produce inducible ß-lactamases. Isolates that appear susceptible to 3rd generation cephalosporins may develop resistance during therapy.[1]
Pseudomonas aeruginosa	cefepime and/or piperacillin-tazobactam	All isolates: (n=1278) 18%	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.
Acinetobacter baumannii	amikacin, cefepime, ceftazidime, ciprofloxacin, meropenem, piperacillin-tazobactam, trimethoprim-sulfamethoxazole	All isolates: (n=122) 21%	Check in vitro susceptibility results and contact Infectious Diseases.	Therapeutic management must be determined on a case by case basis.

Table 13. Emerging Resistance Concerns (cont.)

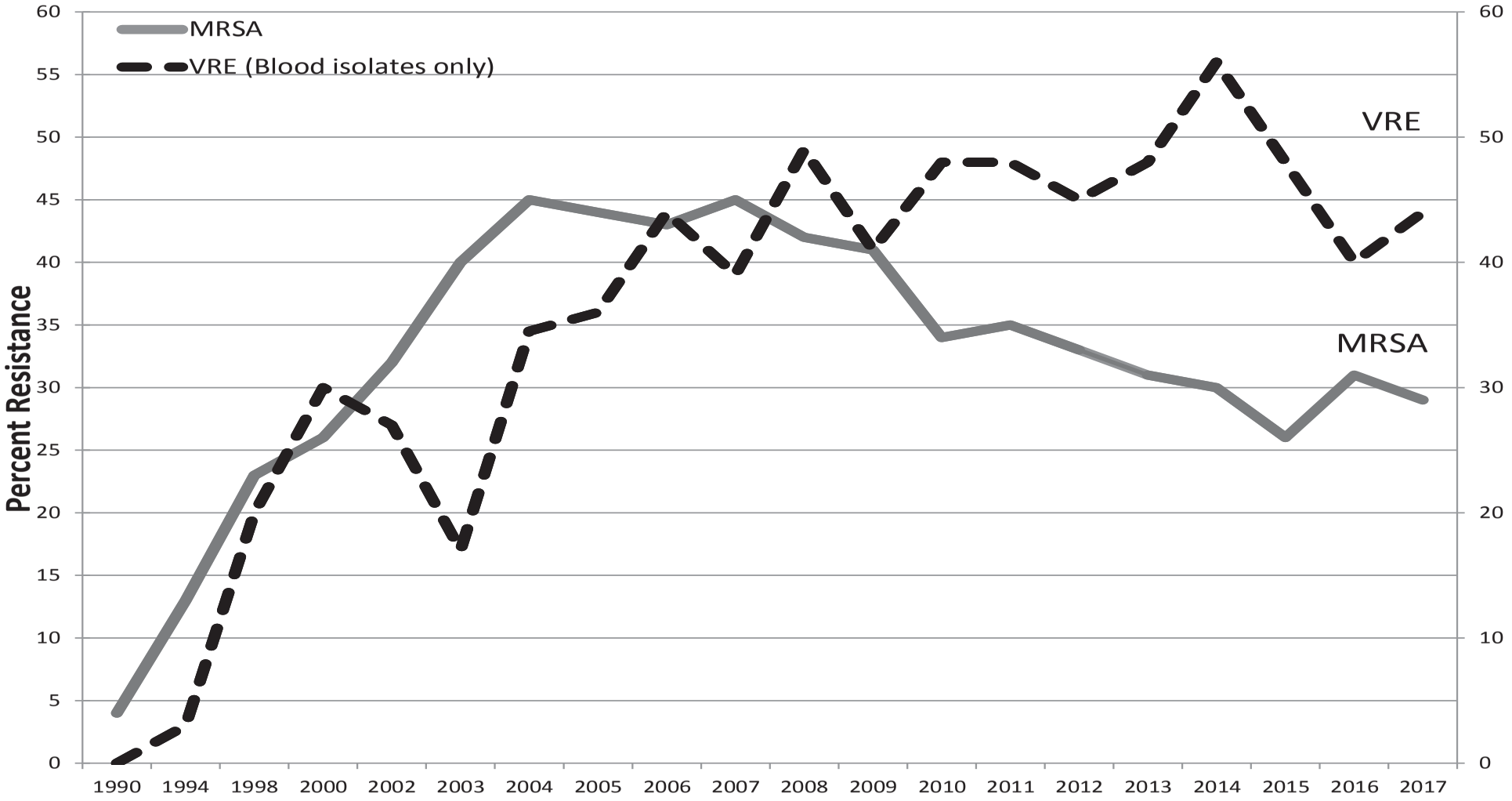
When specific antimicrobial resistance (R) is detected, an Infectious Disease (ID) consult is strongly suggested.

Organism	If Resistant to:	Therapeutic Options	Comments
Candida krusei	caspofungin	voriconazole[3] amphotericin[4]	Typically susceptible to caspofungin. Breakthrough infections have been reported.[5]
	voriconazole	caspofungin[6] amphotericin[4, 7]	Intrinsically resistant to fluconazole.[8, 9] Typically susceptible to voriconazole.[8, 9]
Candida glabrata	caspofungin	fluconazole[10] voriconazole[3] amphotericin[4, 7]	Caspofungin resistance may be emerging.[8]
	fluconazole	voriconazole[3] caspofungin[6] amphotericin[4, 7]	Typically resistant to fluconazole.[8, 9]
Candida albicans	caspofungin	fluconazole[10] amphotericin[4, 7]	Typically susceptible to caspofungin.[8, 9]
	fluconazole	caspofungin[6] amphotericin[4, 7]	Typically susceptible to fluconazole but resistance can develop during therapy.[8, 9]

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.

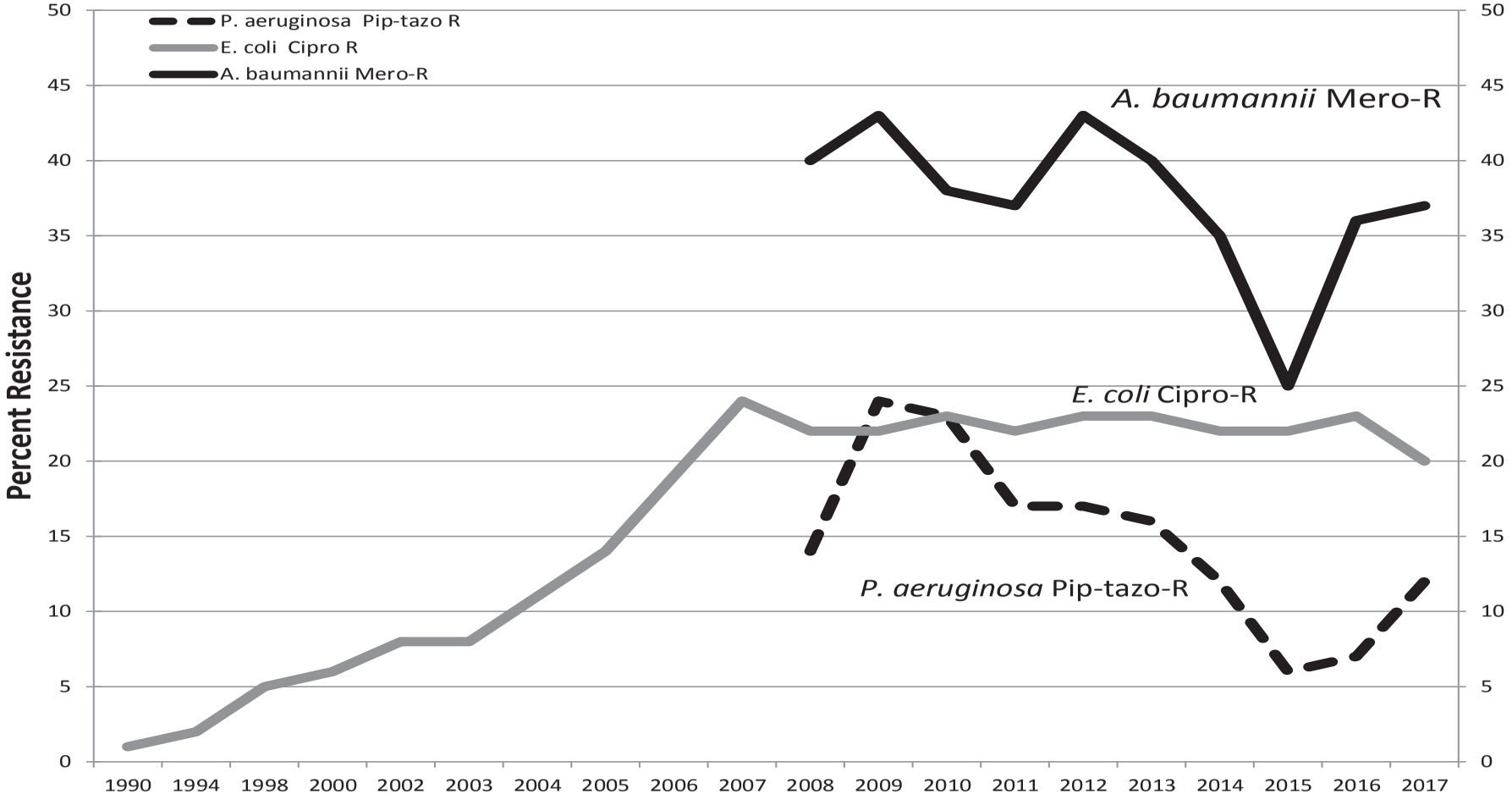
1 The Sanford Guide. 2017
2 Circulation. 2015;132:1435-1486
3 Voriconazole has poor penetration in urine.
4 Amphotericin has poor penetration in urine.
5 Bone Marrow Transplantation. 2015;50:158-160.
6 Caspofungin may not reach therapeutic concentration in the CSF, vitreous fluid or urine.
7 Among patients 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 14. Resistance Trends: 1990-2017



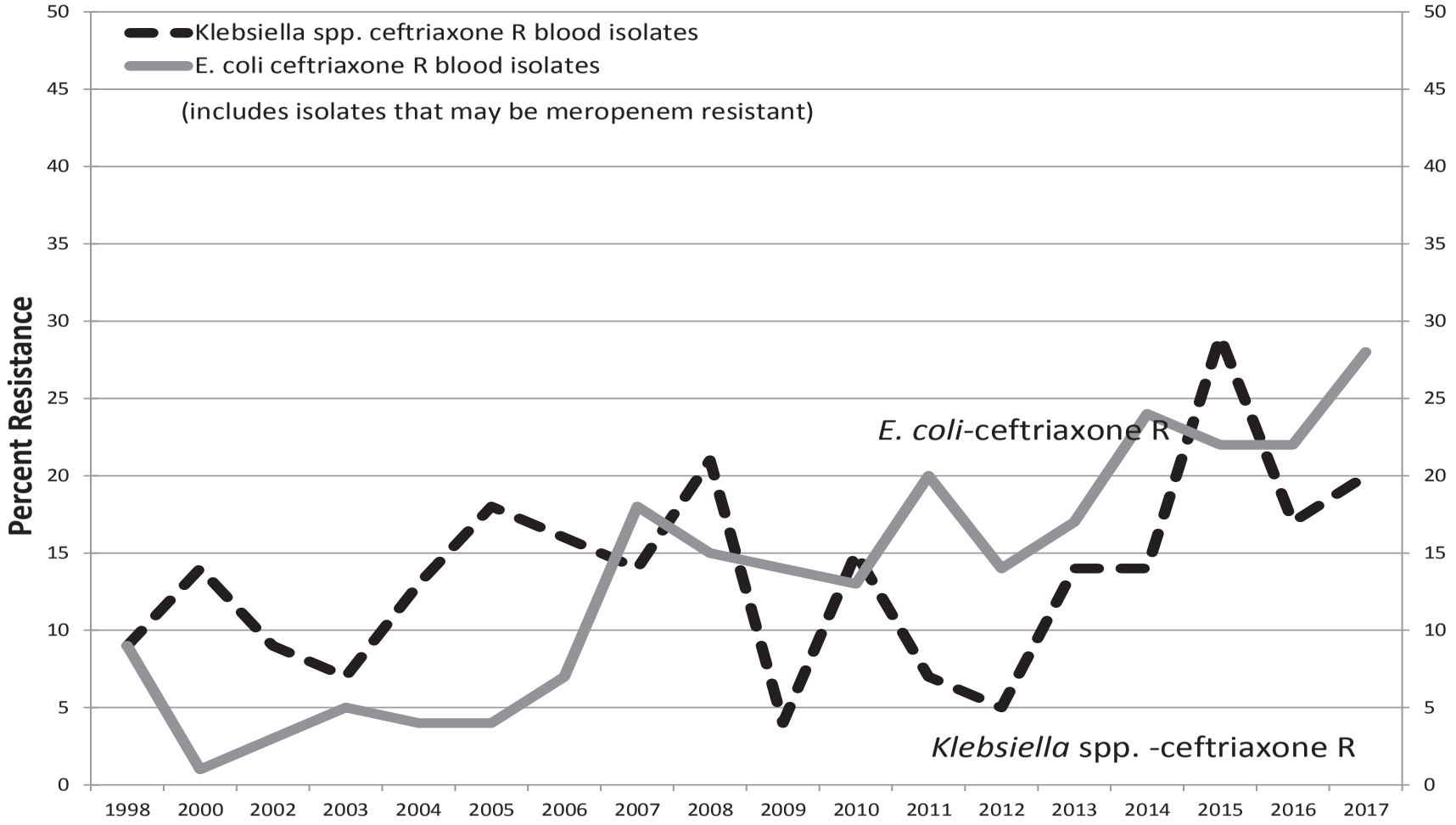
NOTE:
1990-2015: Derived from RRH data
2016-2017: Combined data from RRH and SMH

Table 14. Resistance Trends: 1990-2017 (cont.)



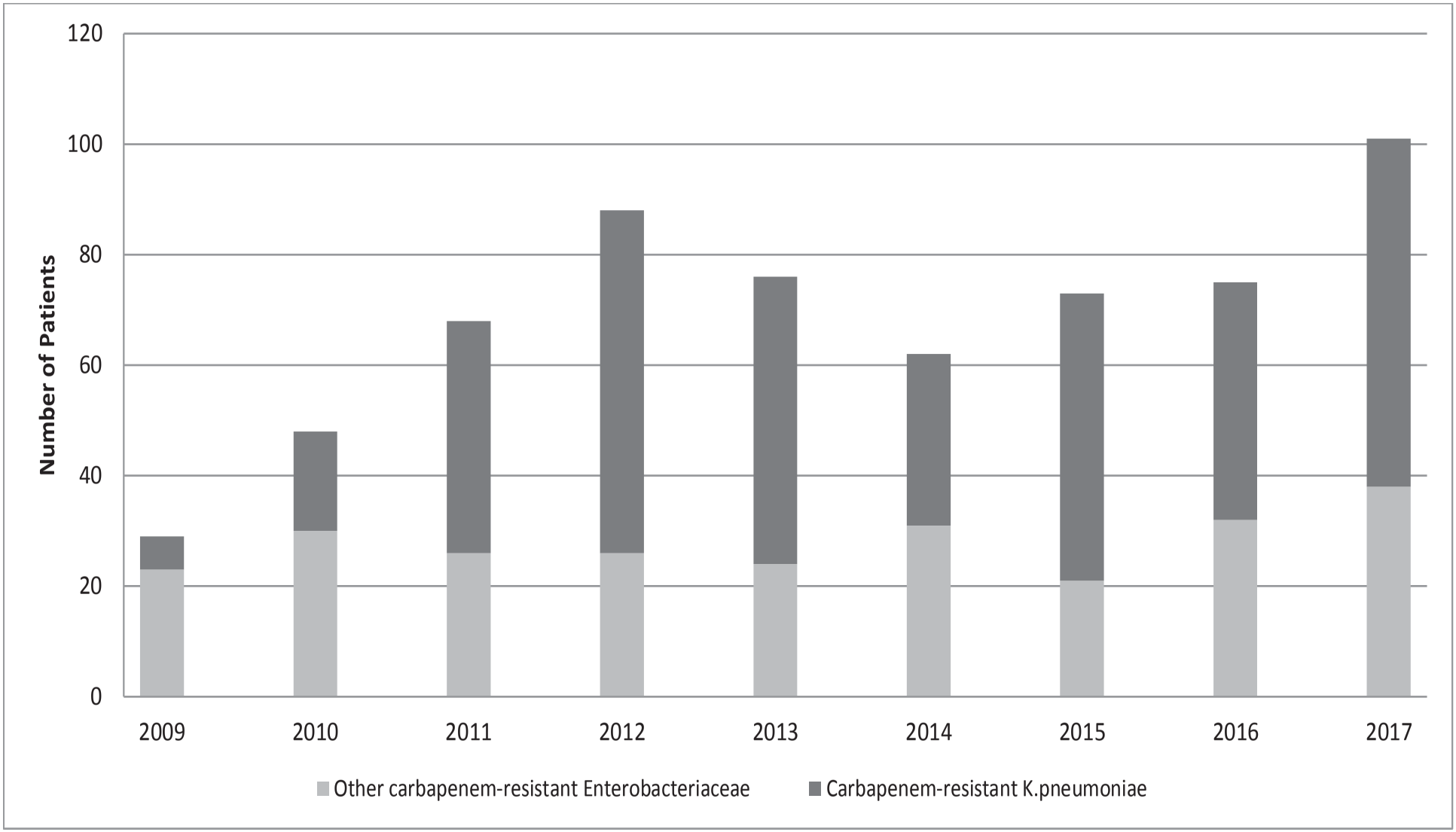
NOTE:
1990-2015: Derived from RRH data
2016-2017: Combined data from RRH and SMH

Table 14. Resistance Trends: 1990-2017 (cont.)



Note: No data prior to 1998
1998-2015: Derived from RRH data
2016-2017: Combined data from RRH and SMH

Table 15. Carbapenem-resistant *Enterobacteriaceae* (CRE): 2009-2017



* For Carbapenem-resistant Enterobacteriaceae antibiogram, refer to Table 8.

Table 16. Treatment Suggestions for Organisms for which Susceptibility Testing is Not Routinely Performed

Organism	Recommended	Alternate treatment	Comments / Also Effective
Bordetella pertussis [1]	Azithromycin or Clarithromycin	Trimethoprim-sulfamethoxazole	
Campylobacter jejuni [1]	Azithromycin	Consult with ID	Trimethoprim-sulfamethoxazole, Penicillin & Cephalosporins **NOT Active**
Campylobacter fetus [1]	Gentamicin	Imipenem or Ceftriaxone	Ampicillin
Legionella spp. [1]	Levofloxacin or Moxifloxacin	Azithromycin	
Mycoplasma pneumoniae [1]	Doxycycline	Azithromycin, Minocycline	Clindamycin & B-lactams **NOT Effective**. Increasing macrolide resistance.
Mycoplasma hominis	Consult with ID	Clindamycin, Fluoroquinolone (if in vitro susceptibilty)	Resistant to Erythromycin and azithromycin. Fluoroquinolone and Tetracycline resistant strains have been reported. (*CMR 2005, 18:757-789)* [3] *(AAC 2004, 58:176)* [4]
Stenotrophomonas maltophilia [1, 2]	Trimethoprim-sulfamethoxazole	Minocycline (if in vitro susceptibility) (*Case reports JAC 2016; 71:1701)* [5]	Fluroquinolone See Table 7 Combination agent (if in vitro susceptibility) *(AAC 2004, 58:176)* [4]
Propionibacterium acnes [1]	Penicillin, Ceftriaxone	Vancomycin, Daptomycin, Linezolid	Resistant to Metronidozole
Ureaplasma	Azithromycin, Doxycycline		Resistant to Clindamycin. Tetracycline resistant strains have been reported. *(Case reports CMR 2005, 18:757-789)* [3]

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

[1] Based on The Sanford Guide to Antimicrobial Therapy 2017 47th edition.

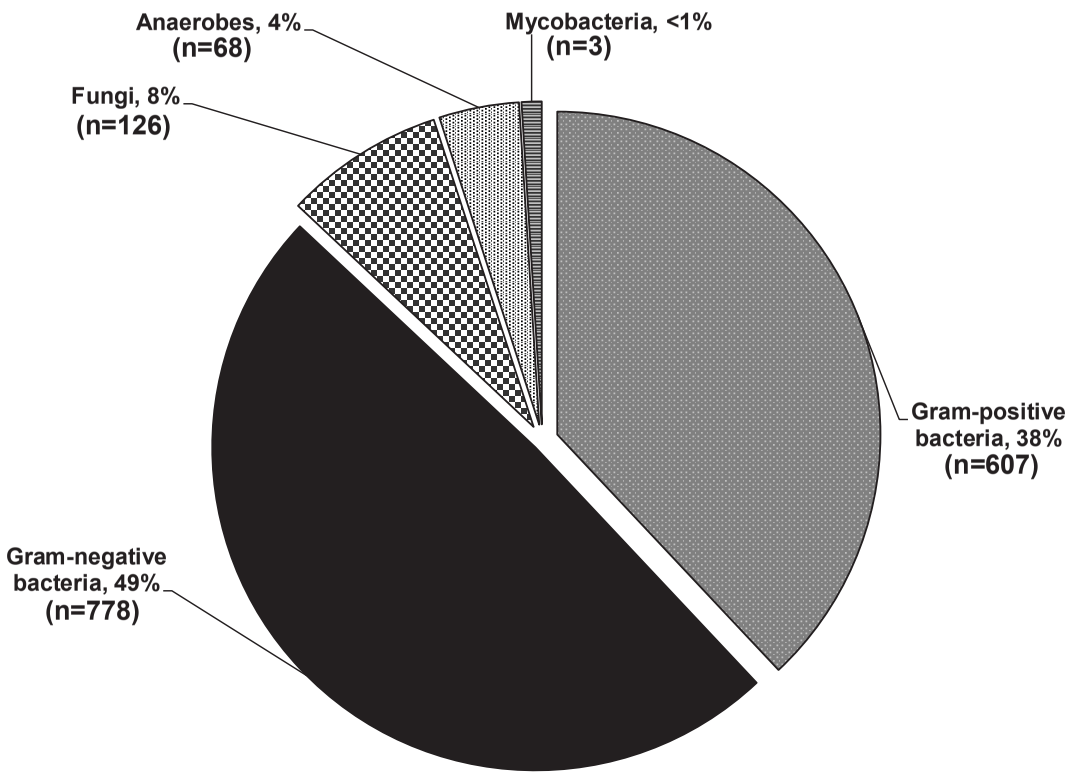
[2] Susceptibility performed on Stenotrophomonas maltophilia isolates from Sterile body sites and Cystic Fibrosis cases.

[3] CMR - Clinical Microbiology Review

[4] AAC - Antimicrobial Agents & Chemotherapy Journal

[5] JAC - Journal of Antimicrobial Chemotherapy

Table 17. Blood: One Isolate per Patient, 2017



	Organism	n	% of Total Blood Isolates
1	*Escherichia coli*, 28% ceftriaxone R	316	20
2	*Staphylococcus aureus*, 39% MRSA	222	14
3	*Enterococcus* spp., 44% VRE	164	10
4	*Klebsiella* spp., 20% ceftriaxone R	153	10
5	Other *Enterobacteriaceae* spp.	86	5
6	Viridans group *Streptococcus*	80	5
7	*Pseudomonas aeruginosa*	70	4
8	*Candida glabrata*	42	3
9	*Enterobacter cloacae*	42	3
10	B-hemolytic *Streptococci* (Groups A, B, C & G)	32	2
11	*Candida albicans*	30	2
12	*Proteus mirabilis*	29	2
13	*Bacteroides* spp.	26	2
14	*Serratia marcescens*	22	1
15	*Acinetobacter* spp.	21	1
	Total blood isolates	**1582***	

*Excludes Coagulase-negative *Staphylococcus* (n=185)
Corynebacterium spp. (n=10)
Bacillus spp. (n=5)
Micrococcus spp. (n=4)
Propionibacterium acnes (n=1)

Table 17. Blood: One Isolate per Patient, 2017 (cont.)

By Organism Group

Gram-positive Bacterial Isolates	n	% of Gram-positive Isolates
Staphylococcus aureus, 39% MRSA	222	37
Enterococcus spp., 44% VRE	164	27
Viridans group *Streptococcus*	80	13
Other gram-positives (includes 5 *S. lugdunensis*)	32	5
Beta-hemolytic *Streptococcus*	32	5
Granulicatella spp.	19	3
Lactobacillus spp.	17	3
Streptococcus pneumoniae	15	3
Abiotrophia spp.	13	2
Gemella spp.	13	2
Total	**607**	

(excludes other coagulase –negative staphylococcus, *Corynebacterium* spp., *Bacillus* spp., *Micrococcus* spp.)

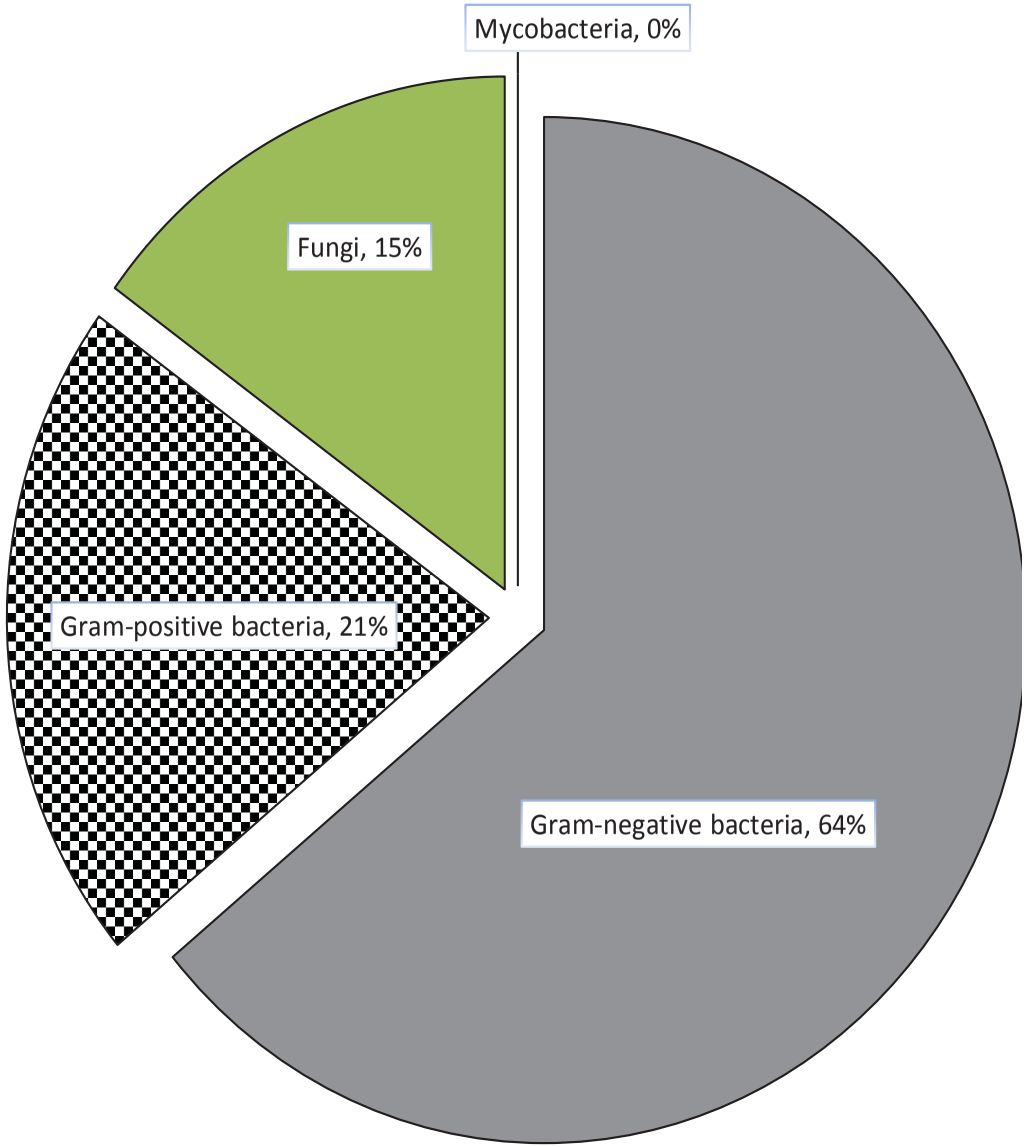
Gram-negative Bacterial Isolates	n	% of Gram-negative Isolates
Escherichia coli, 28% ceftriaxone R	316	41
Klebsiella spp., 20% ceftriaxone R	153	20
Pseudomonas aeruginosa	70	9
Other *Enterobacteriaceae* spp.	57	7
Other gram-negatives	55	7
Enterobacter cloacae	42	5
Proteus mirabilis	29	4
Acinetobacter spp.	21	3
Citrobacter spp.	15	2
Stenotrophomonas maltophilia	13	2
Total	**778**	

Fungal Isolates	n	% of Fungal Isolates
Candida glabrata	42	33
Candida albicans	30	24
Candida parapsilosis	15	12
Candida tropicalis	10	8
Candida dubliniensis	6	5
Candida lusitaniae	5	4
Candida krusei	4	3
Cryptococcus neoformans	4	3
Candida guilliermondii	3	2
Rhodotorula spp.	2	2
Other yeast	3	2
Fusarium sp.	1	1
Scedosporium prolificans	1	1
Total	**127**	

Anaerobic Bacterial Isolates	n	% of Anaerobic Bacterial Isolates
Bacteroides spp.	26	38
Clostridium spp.	10	15
Fusobacterium spp.	8	12
Eubacterium spp.	5	7
Prevotella spp.	2	3
Veillonella Spp.	2	3
Parvimonas micra	1	1
Finegoldia magna	1	1
Actinomyces spp.	1	1
Porphyromonas asaccharolytica	1	1
Other anaerobes	11	16
Total	**68**	

Mycobacterial Isolates	n	% of Mycobacterial Isolates
Mycobacterium mucogenicum	1	34
Mycobacterium chelonae	1	33
Mycobacterium phocaicum	1	33
Total	**3**	

Table 18. CSF: One Isolate per Patient, 2017



n = 33	Number of CSF Isolates
• **Gram-positive bacteria (21)**	
Staphylococcus aureus	4
Staphylococcus epidermidis	3
Staphylococcus capitis	2
Staphylococcus warneri	2
Streptococcus pneumoniae	2
Bacillus sp.	1
Enterococcus faecalis	1
Enterococcus faecium	1
Listeria monocytogenes	1
Staphylococcus cohnii	1
Staphylococcus hominis	1
Staphylococcus lugdunensis	1
Propionibacterium acnes	1
• **Gram-negative bacteria (7)**	
Enterobacter aerogenes	2
Brevundimonas diminuta	1
Enterobacter cloacae	1
Escherichia coli	1
Serratia liquefaciens	1
Sphingomonas paucimobilis	1
• **Yeast (1)**	
Cryptococcus neoformans	3
Coccidioides immitis	2
• **Mycobacteria (0)**	

Table 19. Mycobacteria, One Isolate per Patient per Source, 2017

Organisms	No of Isolates	# Patients By Source[1]		
		Respiratory	Abscess/ wound/ tissue/other	Blood
Mycobacterium avium complex	362	322	31	9
Mycobacterium abscessus	46	39	7	
Mycobacterium tuberculosis / MTBC	42	36	6	
Mycobacterium mucogenicum	38	38		
Mycobacterium gordonae	29	26	3	
Mycobacterium chelonae	24	23	1	
Mycobacterium kansasii	12	12		
Mycobacterium fortuitum	10	8	1	1
Mycobacterium lentiflavum	7	7		
Mycobacterium simiae	7	4	3	
Mycobacterium arupense	6	4	2	
Mycobacterium phocaicum	5	4		1
Mycobacterium haemophilum	3		3	
Mycobacterium immunogenum	3	3		
Mycobacterium peregrinum	3	3		
Mycobacterium porcinum	3	1	2	
Mycobacterium szulgai	2	2		
Mycobacterium triviale	2	2		
Mycobacterium colombiense	1		1	
Mycobacterium mageritense	1	1		
Mycobacterium nonchromogenicum	1	1		
Mycobacterium paraffinicum	1	1		
Mycobacterium senegalense	1	1		
Mycobacterium szulgai	1	1		
Mycobacterium setense	1	1		
Mycobacterium xenopi	1	1		
Total Mycobacteria	**612**	541	60	11

[1] Some patients have isolates in more than one source

Table 20. 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
	p-aminosalicylic acid
	streptomycin

2. ***Mycobacterium avium* complex*:***
Performed on first isolate per patient; performed on additional isolates recovered after 3 months, 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. abscessus*, *M. chelonae*, *M. fortuitum group* and *M. mucogenicum*):**
Performed on one isolate per patient, testing performed in-house. Additional agents on request.

Agents routinely reported	**Agents conditionally reported**
amikacin	imipenem
cefoxitin	linezolid
ciprofloxacin	meropenem
clarithromycin (inducible)	moxifloxacin
doxycycline	tigecycline
trimethoprim-sulfamethoxazole	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 21. California *Mycobacterium tuberculosis* % Resistant, 2012-2016

Antimicrobial Agent	2011	2012	2013	2014	2015	2016
Isoniazid	10.9%	10.0%	10.6%	9.8%	10.9%	10.9%
Rifampin	2.2%	0.9%	1.8%	1.3%	1.4%	1.8%
Ethambutol	1.6%	0.9%	1.1%	0.8%	0.7%	ND
Pyrazinamide	7.0%	6.7%	6.7%	5.5%	5.1%	5.4%
MTB Case rates per 100,000 population	6.2%	5.7%	5.6%	5.5%	5.5%	5.2%
Multi-drug Resistant Tuberculosis rates[1]	2.0%	0.8%	1.6%	1.1%	1.3%	1.8%
Number of Cases	2321	2186	2163	2130	2131	2062

* Based on California Department of Public Health Annual report "*Report on Tuberculosis in California*"

[1] MDR = Resistant to Isoniazid and Rifampin

[2] ND = No Available Data

Table 22. Rapid Grower - Mycobacteria % Susceptible, 2011-2017

Organism	No. Isolates	Amikacin	Cefoxitin	Ciprofloxacin	Clarithromycin	Doxyclycline	Imipenem	Trimethoprim-sulfamethoxazole	Tobramycin
Mycobacterium abscessus Complex [1, 4]	40	95	30	R[2]	48	R	31	R	— [3]
Mycobacterium fortuitum	44	100	9	100	5	47	95	95	—
Mycobacterium chelonae	58	86	2	14	95	16	36	9	93
Mycobacterium mucogenicum	81	100	100	96	100	92	100	100	—

[1] *M. abscessus* complex is differentiated into 3 subspecies: *M. abscessus* subsp. a*bscessus, M. abscessus* subsp. *massiliense* and *M. abscessus* subsp. *bolletii.*

[2] R = Intristic resistance.

[3] — = Not routinely tested and/or not applicable.

[4] Some isolates of *M. abscessus* subsp. *abscessus* and *M. abscessus* subsp. *bolletii* may contain an *erm* (41) gene that confers inducible macrolide resistance. Resistance is detected in MIC at day 15, which is routinely tested for.

Table 23. Anaerobic Bacteria, % Susceptible

Anaerobic Organisms	Number of Strains	Ampicillin– Sulbactam	Number of Strains	Piperacillin–Tazobactam	Number of Strains	Cefoxitin	Number of Strains	Ertapenem	Number of Strains	Imipenem	Number of Strains	Meropenem	Number of Strains	Clindamycin	Number of Strains	Moxifloxacin	Number of Strains	Metronidazole
Breakpoints %S		≤8/4		≤16/4		≤16		≤4		≤4		≤4		≤2		≤2		≤8
B.fragilis	129	84	1030	96	830	100	133	82	189	97	1505	93	1013	26	256	61	1140	100
B.thetaiotaomicron	76	82	252	87	258	13	—	—	70	100	328	99	328	28	70	54	322	100
B.ovatus	30	80	206	94	177	20	19[2]	84[2]	49	100	236	95	207	46	59	41	236	100
B.vulgatus	20[2]	45[2]	168	92	153	73	—	—	35	97	171	96	171	53	29[2]	31[2]	186	100
B.uniformis	19[2]	8[2]	78	96	72	85	—	—	19[2]	100[2]	93	100	87	45	25[2]	48[2]	89	100
Parabacteroides distasonis	27[2]	59[2]	92	95	82	29	—	—	26[2]	100[2]	119	97	108	43	37	62	118	100
B.fragilis group w/o *B.fragilis*	172	74	796	91	742	36	19[2]	84[2]	199	100	947	98	901	40	220	48	951	100
B.fragilis group (all species[3])	301	78	1826	94	1572	70	152	82	388	98	2052	95	1914	33	476	55	2091	100

[1] Adapted from CLSI M100S 28th ed.
[2] Calculated from fewer than the CLSI document M39 recommendation of 30 isolates.
[3] *B. fragilis* group includes *fragilis*, *distasonis*, *uniformis*, *vulgatus*, *ovatus*, and *thetaiotaomicron*.
[4] — Not routinely tested and/or not applicable.

Table 24. Antimicrobials (IV, PO), Formulary Status and Cost Reference

Drug	Usual Dose	Usual Interval	($)*Per Day
Penicillins			
Ampicillin	1 gm	q6h	26.50
Ampicillin	2 gm	q6h	30.10
Ampicillin-sulbactam	3 gm	q6h	39.70
Oxacillin(24-hr infusion)	12 gm	q24h	71.60
Penicillin G (24-hr infusion)	24 million units	q24h	44.70
Piperacillin-tazobactam (Extended 4-hr infusion)	3.375 gm	q8h	29.55
Amoxicillin (PO)	500 mg	q8h	0.25
Amoxicillin-clavulanic acid (PO)	500 mg	q8h	1.70
Amoxicillin-clavulanic acid (PO)	875 mg	q12h	1.00
Dicloxacillin (PO)	500 mg	q6h	3.30
Cephalosporins			
Cefazolin	1 gm	q8h	8.55
Cefepime[1,2]	1 gm	q8h	22.60
Cefoxitin[1,3]	1 gm	q6h	30.75
Ceftriaxone	1 gm	q24h	7.50
Ceftriaxone	2 gm	q24h	14.35
Cephalexin (PO)	500 mg	q6h	1.35
Cefpodoxime (PO-UTI)	100 mg	q12h	8.45
Cefpodoxime (PO)	200 mg	q12h	10.35
Carbapenems/monobactam			
Aztreonam[1,4]	2 gm	q8h	197.90
Ertapenem[1,5]	1 gm	q24h	106.35
Meropenem[1,6]	1 gm	q8h	45.00
Aminoglycosides			
Amikacin[1,7]	1000 mg (15 mg/kg/dose)	q24h	26.75
Gentamicin	500 mg (7 mg/kg/dose)	q24h	15.50
Tobramycin[1,8]	500 mg (7 mg/kg/dose)	q24h	13.95

Table 24. (cont.) Antimicrobials (IV, PO), Formulary Status and Cost Reference

	Usual Dose	Usual Interval	($)*Per Day
Others			
Azithromycin	500 mg	q24h	7.50
Ciprofloxacin	400 mg	q12h	4.40
Clindamycin	600 mg	q8h	48.90
Colistimethate[1,9]	150 mg (CBA)**	q12h	29.60
Daptomycin[1,10]	500 mg	q24h	294.00
Doxycycline	100 mg	q12h	44.55
Levofloxacin[1,11]	750 mg	q24h	3.10
Linezolid[1,12]	600 mg	q12h	74.90
Metronidazole	500 mg	q8h	3.10
Rifampin[1,13]	600 mg	q24h	148.00
Tigecycline[1,9]	50 mg	q12h	209.75
TMP/SMX***	320 mg TMP	q12h	55.45
Vancomycin	1 gm	q12h	14.75
Azithromycin (PO)	500 mg	q24h	1.15
Ciprofloxacin (PO)	500 mg	q12h	0.30
Clarithromycin (PO)	500 mg	q12h	9.05
Doxycycline (PO)	100 mg	q12h	4.25
Levofloxacin (PO)[1,12]	750 mg	q24h	0.45
Linezolid (PO)[1,13]	600 mg	q12h	7.85
Metronidazole (PO)	500 mg	q8h	2.00
Nitrofurantoin (PO) (macrocrystal formulation)	100 mg	q6h	9.95
Rifampin (PO)	600 mg	q24h	2.05
TMP/SMX (PO)	160 mg/800 mg	q12h	0.40
Vancomycin (PO-cap)	125 mg	q6h	21.20
Vancomycin (PO-susp)	125 mg	q6h	3.25

Table 24. (cont.) Antimicrobials (IV, PO), Formulary Status and Cost Reference

Drug	Usual Dose	Usual Interval	($)*Per Day
Antifungal Agents			
Amphotericin B	50 mg	q24h	37.25
Amphotericin B Liposomal (AmBisome)[1,10]	350 mg	q24h	459.85
Caspofungin[1,10]	50 mg	q24h	58.65
Fluconazole	400 mg	q24h	5.10
Isavuconazonium[1,9]	372 mg	q24h	209.00
Posaconazole[1,5,13,14]	300 mg		327.05
Voriconazole[1,15]	300 mg	q12h	169.05
Fluconazole (PO)	400 mg	q24h	4.80
Isavuconazonium (PO)[1,9]	372 mg	q24h	119.75
Posaconazole (PO-susp)[1,5,14]	200 mg	TID	175.85
Posaconazole (PO-DR)[1,5,14]	300 mg	q24h	175.85
Voriconazole (PO)[1,15]	200 mg	q12h	39.05

* 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

1 Use of Controlled Formulary (CF) 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 Restricted: surgical prophylaxis; refer to Pre-incisional Antimicrobial Recommendations.

4 Restricted: aerobic gram-negative infections in beta-lactam allergic patients.

5 For Pediatric patients: restricted to use by Pediatric Infectious Diseases Service approval.

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

7 Restricted: organisms with suspected/documented resistance to gentamicin and tobramycin.

8 Restricted: infections caused by organisms with suspected/documented resistance to gentamicin.

9 Restricted: requires formal consultation by an Infectious Diseases physician

10 Restricted to use by Adult or Pediatric Infectious Diseases Service approval.

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).

13 Injection: For use in patients unable to tolerate the oral formulations.

14 For prophylaxis of invasive *Aspergillus* and *Candida* infections in severely immunocompromised patients

15 Restricted: treatment of suspected/documented 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 25. Indications for Performing Routine Antimicrobial Susceptibility Tests - Aerobic Bacteria

Susceptibility tests will be performed as follows:

1. **Blood—all isolates except*:**
   Aerococcus spp.[1]
   Bacillus spp.[1]
   Corynebacterium spp. [1]
   Coagulase-negative *Staphylococcus* [1, 2]
   Cutibacterium (Propionibacterium) acnes[1]
   Micrococcus spp.[1]
   Viridans group *Streptococcus*[1]

2. **Urine**
   >10^5 CFU/ml (1 or 2 species)
   >50,000 CFU/ml (pure culture):
   Gram-negative bacilli; *Staphylococcus aureus*
   Urine from Urology
   Susceptibilities on 1 or 2 species of pure or predominant potential pathogens; any quantity of Gram-negative bacilli and/or *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. [3] (≤ 3 mo. only)
   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*
* neonates, susceptibilities performed on all isolates

Table 25. (cont.) Indications for Performing Routine 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. 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:

- **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 26. Antimicrobial Agents Routinely Reported - Aerobic Bacteria

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

[1] 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.

[2] *Enterobacteriaceae* other than *E. coli, Klebsiella* spp., *P. mirabilis*, *Salmonella* spp., *Shigella* spp.

[3] Cefazolin results should only be used to predict potential effectiveness of oral cephalosporins for uncomplicated UTIs.

[4] Colistin is not reported on *Serratia marcescens, Proteus spp., Providencia spp. and Morganella morganii* because these organisms are intermediate/resistant to colistin.

[5] If result is intermediate (I) or resistant (R): ertapenem, imipenem (≤ 18 y.o.) and meropenem (≤ 18 y.o.) are reported.

Table 26. Antimicrobial Agents Routinely Reported - Aerobic Bacteria (cont.)

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s)[1]
***Salmonella* spp.[1], *Shigella* spp.[2]**		
ciprofloxacin (>11 y.o) trimethoprim-sulfamethoxazole	 Non-fecal sources/resistant to all primary antimicrobials	 azithromycin (*S. flexneri* and *S. sonnei*) ceftriaxone
Pseudomonas aeruginosa		
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, ceftolozane - tazobactam amikacin, tobramycin imipenem, meropenem
***Acinetobacter* spp.**		
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
Stenotrophomonas maltophilia*- Sterile body site isolates** ***Burkholderia cepacia		
ceftazidime levofloxacin (>11 y.o.) meropenem (*B. cepacia* only) minocycline trimethoprim-sulfamethoxazole		

[1] If stool isolates, perform on patients ≤3 mo., or if isolate is *Salmonella typhi* or *Salmonella paratyphi A*.

[2] Susceptibility performed on stool isolates.

Table 26. Antimicrobial Agents Routinely Reported - Aerobic Bacteria (cont.)

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

Table 26. Antimicrobial Agents Routinely Reported - Aerobic Bacteria (cont.)

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

[3] excluding urine and sterile body site isolates
[4] patients >11 y.o.
[5] excluding CSF isolates

Table 27. Susceptible MIC (µg/ml) Breakpoints for Aerobic Gram-positive 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[1]	Levofloxacin[2]	Colistin	Trimethoprim – sulfamethoxazole	Nitrofurantoin	Minocycline	Tigecycline	Ceftolozane-tazobactam	Ceftazidime-avibactam
ENTEROBACTERIACEAE[3]	≤8	≤8	≤16	≤2	≤2	≤1	≤4	≤1	≤.5	≤1	≤1	≤16	≤4	≤4	≤1	≤2	≤2[6]	≤2/38	≤32	≤4	≤2	≤2/4	≤8/4
NONFERMENTERS																							
Acinetobacter baumannii	R[4]	≤8	≤16	R	≤8	≤8	≤8	≤8	R	≤2	≤2	≤16	≤4	≤4	≤1	≤2	≤2	≤2/38	–[5]	≤4	–	–	–
Burkholderia cepacia	R	R	R	R	R	–	≤8	R	R	R	≤4	R	R	R	–	≤2	R	≤2/38	–	≤4	–	–	–
Pseudomonas aeruginosa	R	R	≤16	R	≤8	R	≤8	R	R	≤2	≤2	≤16	≤4	≤4	≤1	≤2	≤2	R	–	–	R	≤4/4	≤8/4
Stenotrophomonas maltophilia	R	R	R	R	–	R	≤8	R	R	R	R	R	R	R	–	≤2	–	≤2/38	–	≤4	–	–	–
Other nonfermenters	–	–	≤16	–	≤8	≤8	≤8	≤8	–	≤4	≤4	≤16	≤4	≤4	≤1	≤2	–	≤2/38	–	≤4	-	–	–

[1] *Salmonella* spp. breakpoint for ciprofloxacin ≤ 0.06 µg/ml

[2] *Salmonella* spp. breakpoint for levofloxacin ≤ 0.12 µg/ml

[3] *Enterobacteriaceae*: *Citrobacter, Enterobacter* spp., *Escherichia coli, Klebsiella* spp., *Morganella, Proteus spp., Providencia spp., Salmonella* spp., *Serratia* spp., *Shigella* spp.

[4] R = Intrinsic resistance

[5] – = Not routinely tested and/or not applicable.

[6] There are currently no interpretive criteria (breakpoints) for colistin and this organism. The MIC is based on Epidemiological Cutoff Value (ECV); isolate whose MIC is below the wild type MIC, which suggests this isolate does not have any acquired or mutational mechanisms of resistance to colistin. The clinical implication of this finding is currently unknown. Infectious diseases consultation strongly recommended.

Table 28. Susceptible MIC (µg/ml) Breakpoints for Aerobic Gram-positive Cocci

Organism	Penicillins			Cephalo-sporin	Aminoglycosides		Fluoroquin-olone	Other									
	Ampicillin	Oxacillin	Penicillin	Ceftaroline[1]	Gentamicin	Gentamicin synergy	Ciprofloxacin	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Linezolid	Nitrofurantoin	Quinupristin-dalfopristin	Rifampin	Trimethoprim – sulfamethoxazole	Vancomycin
Staphylococcus aureus *Staphylocccus lugdunensis*	—[1,4]	≤2	≤.12[2]	≤1	≤4	—	≤1	≤.5	≤1	≤4	≤.5	≤4	≤32	≤1	≤1	≤2/38	≤2
Coagulase-negative *Staphylococcus*	—	≤.25	≤.12[2]	—	≤4	—	≤1	≤.5	≤1	≤4	≤.5	≤4	≤32	≤1	≤1	≤2/38	≤4
Enterococcus spp.	≤8	—	≤8	R[3]	R	≤500	≤1	R[2]	≤4	≤4	R	≤2	≤32	≤1	≤1	R	≤4

[1] *S. aureus* only, including MRSA
[2] beta-lactamase negative
[3] R - Inrinstic resistance
[4] — = Not routinely tested and/or not applicable.

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

[1] — = Not routinely tested and/or not applicable.

Table 29. 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

Rapid Reference

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 (ID), Dr. Elise Martin (ID), Dr. Christine Pham (Pharm – SM), Dr. Jennifer Curello (Pharm – RR), and Dr. Meganne Kanatani (Pharm – RR).

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