

Streptococci and Enterococci																			
Percent Susceptible	No. Tested (a)	Penicillin or Ampicillin			Cefuroxime	Ceftriaxone	Vancomycin	Erythromycin	Clindamycin	Meropenem	Trimethoprim/sulfa	Tetracycline (Doxycycline)	Gentamicin Synergy with Pen/Amp	Streptomycin Synergy with Pen/Amp	Moxifloxacin	Nitrofurantoin (UTI only)	Levofloxacin (UTI only)	Ciprofloxacin (UTI only)	Linezolid
		%S	%I	%R															
<b>Streptococci</b>																			
Grp. B (Strep. agalactiae) (b)	218	100	0	0	-	-	-	58	61	-	-	-	-	-	-	96	-	-	-
Viridans (various species)	191	90	9	1	-	100	100	55	78	-	-	-	-	-	-	-	-	-	-
Strep. pneumoniae (b,c)	73	75d	-	25	94	99d	100	75	93	97	81	-	-	100	-	-	-	-	-
<b>Enterococcus (no species I.D.) (e)</b>																			
Enterococcus faecalis (e)	701	84	0	16	-	-	87	-	-	-	-	23	-	-	-	90	75	67	99
Enterococcus faecium (e)	133	100	0	0	-	-	99	-	-	-	-	67	79	-	-	-	-	-	98
Enterococcus faecium (e)	118	27	0	73	-	-	45	-	-	-	-	25	95	49	-	-	-	-	93
Cost (\$)		\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$

- (a) First isolate from each patient was included.  
 (b) Penicillin is the drug of choice for all beta hemolytic streptococci; penicillin resistance has not been documented. Clindamycin induction test performed on all beta hemolytic streptococci and S. pneumoniae.  
 (c) Penicillin-susceptible isolates are also susceptible to all other  $\beta$ -lactam agents.  $\beta$ -lactamase inhibitor combination drugs do not add additional efficacy to penicillin alone.  
 (d) Based on meningitis interpretive criteria (more conservative). Nonmeningitis interpretation is 100% for penicillin. Infectious diseases consultation is recommended for meningitis in penicillin-allergic patients or those with resistant ceftriaxone or cefotaxime results.  
 (e) If susceptible, ampicillin is the drug of choice when enterococci must be treated. Ampicillin susceptibility predicts piperacillin susceptibility. Nitrofurantoin or ampicillin is recommended for uncomplicated UTI. Serious infections (septicemia, endocarditis) require both a  $\beta$ -lactam agent and an aminoglycoside. Use vancomycin+aminoglycoside only if strain is ampicillin-resistant or patient is penicillin allergic. High level resistance to gentamicin also indicates lack of synergy for tobramycin, amikacin and kanamycin.

Candida					
Percent Susceptible or Susceptible-Dose Dependent by Broth Microdilution Method	No. Tested	Amphotericin B (a)	Caspofungin	Fluconazole (b)	Voriconazole (b)
Candida albicans	76	100	99	93	96
Candida glabrata	61	100	92	89	-
Candida parapsilosis	23(c)	100	100	100	100
C. tropicalis	16(c)	100	100	94	93
Other Candida spp.	40	100	95	(d)	100
Costs (\$)		\$\$\$\$	\$\$\$\$	\$	\$\$\$\$

- (a) Based on suggested resistant breakpoint MIC  $\geq 2$   $\mu$ g/ml.  
 (b) Susceptible dose-dependent breakpoint MIC was used.  
 (c) Data from <30 isolates may be statistically unreliable.  
 (d) Species other than C. krusei are 100% susceptible; C. krusei is intrinsically resistant to fluconazole.

### SITUATIONS FOR WHICH THE USE OF VANCOMYCIN IS APPROPRIATE AND ACCEPTABLE:

- For treatment of serious infections due to  $\beta$ -lactam-resistant gram-positive bacteria. Clinicians should be aware that vancomycin is usually less active and less rapidly bactericidal than  $\beta$ -lactam agents for organisms that are susceptible to the  $\beta$ -lactams. Clinicians should also be aware that vancomycin sensitive MIC 2mcg/ml is associated with increased treatment failures.
- For treatment of infections due to gram-positive organisms in patients with serious allergy to  $\beta$ -lactam-antibiotics.
- Prophylaxis, (infused 60-120 min before the first incision), in penicillin-allergic patients, as recommended by the Amer. Heart Assoc., for endocarditis following certain procedures in patients at high risk for endocarditis. Cephalosporins are still recommended for non-allergic patients.
- Prophylaxis for major surgical procedures involving implantation of prosthetic materials or devices, e.g., cardiac and vascular procedures and total hip replacements, at institutions with a high rate of infections due to MRSA or MRCoNS. Currently MRSA and MRCoNS rates are 24% and 60% at SHC, respectively. A single dose administered 60-120 min before surgery is sufficient unless the procedure lasts more than 6 hours, in which case the dose should be repeated. Prophylaxis should be repeated after 2 doses maximum.



**STANFORD**  
HOSPITAL & CLINICS

Stanford University Medical Center

### CLINICAL MICROBIOLOGY LABORATORY

### SUH ANTIBIOGRAM DATA FOR BACTERIAL AND YEAST ISOLATES

Jan 1, 2015 - Dec 31, 2015

Niaz Banaei, M.D., Director

Nancy Watz, CLS

Reference Technologist, Antibiotic Testing

Diane Getsinger, CLS

Reference Technologist, AFB/Mycology

Laleh Ghafghaichi, CLS

Senior Technologist, Anaerobes

Gram negative rods																			
Percent Susceptible	PENICILLINS				CEPHEMS			LACTAMS			AMINOGLYC's			OTHERS		Urine			
	No. Tested (a)	Ampicillin	Piperacillin	Amp/Subbactam	Pip/Tazobactam	Cefazolin [Urine Only]	Ceftriaxone	Cefepime	Aztreonam (b)	Imipenem	Meropenem	Ertapenem	Gentamicin	Tobramycin	Amikacin		Ciprofloxacin	Levofloxacin	Trimeth/Sulfamethox
Achromobacter xylosoxidans	25(c)	-	-	-	79	-	-	24	0	84	64	-	3	4	8	21	56	86	-
Acinetobacter baumannii	23(c)	-	-	78	-	-	-	47	-	-	71	-	68	83	87	53	61	53	-
Burkholderia cepacia (d)	13(c,e)	Ceftazidime 62%				Minocycline 85				-	62	-	-	-	-	-	-	69	-
Citrobacter freundii complex	68	0	-	0	92	0	90	100	74	100	100	98	95	97	100	92	92	82	97
Citrobacter koseri	71	0	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	76
Enterobacter aerogenes	85	0	-	0	88	0	86	100	88	88	97	96	100	100	100	98	99	98	16
Enterobacter cloacae complex	173	0	-	0	76	0	74	97	80	94	98	90	94	94	100	95	97	86	42
Escherichia coli	2601	53	-	53	95	84	90	97	84	100	100	100	89	91	100	78	78	71	95
Klebsiella oxytoca	96	0	-	67	92	31	93	99	92	100	100	100	99	98	100	95	96	89	77
Klebsiella pneumoniae	478	0	-	71	92	88	92	95	90	99	99	99	94	92	100	91	93	86	21
Morganella morganii	44	0	-	0	98	0	89	100	93	-	100	100	85	98	100	83	85	69	0
Proteus mirabilis	250	77	-	86	100	87	95	99	97	-	100	100	87	90	100	82	87	81	0
Proteus vulgaris	11(c)	0	-	100	100	0	-	100	-	-	100	100	100	100	100	100	-	100	0
Pseudomonas aeruginosa	509	-	-	-	93	-	-	90	83	83	88	-	87	94	93	85	82	-	-
Ps. aeruginosa CF mucoid (d)	155	-	87	-	-	-	-	85	81	77	83	-	-	91	69	65	-	-	-
Ps. aeruginosa CF non-mucoid (d)	124	-	70	-	-	-	-	66	65	65	71	-	-	66	46	54	-	-	-
Salmonella spp.	12(c)	73	-	-	-	-	-	-	-	-	-	-	-	-	-	92	-	100	-
Serratia marcescens	96	0	-	0	97	0	95	100	98	98	98	98	99	98	98	91	97	98	0
Stenotrophomonas maltophilia	129	-	-	-	-	-	-	-	-	-	-	-	-	-	-	90	98	-	-
Cost		\$\$	\$\$	\$	\$\$	\$	\$	\$\$\$	\$\$\$	\$\$\$	\$\$\$	\$	\$	\$	\$	\$	\$	\$	\$

- (a) First isolate from each patient was included.
- (b) Unlike aztreonam, aminoglycosides have synergistic activity with  $\beta$ -lactams (ex: piperacillin, ampicillin) against aerobic gram negative rods and enterococci. Aztreonam should only be used for treating documented infections due to susceptible organisms in patients with anaphylactic reactions to  $\beta$ -lactams. In patients with renal insufficiency, aminoglycosides can be administered safely when doses are adjusted for patient's renal function. For information on dosing, including single daily dosing, please contact a Clinical Pharmacist (beeper # available from unit secretary).
- (c) Data from isolate totals <30 may be statistically unreliable.
- (d) Cystic fibrosis patient isolates tested by disk diffusion.
- (e) Includes isolates from 2014.

### Interpretation of susceptibility results

Results are reported as minimum inhibitory concentrations (MICs), the minimum amount of drug needed to inhibit growth *in vitro*. Interpretive criteria are based on achievable serum levels. For certain antibiotics, the amount excreted into the urine via the kidneys is above the MIC, and the agent is effective clinically in this site even though reported as "resistant". Intermediate results (I), especially for beta-lactam agents, indicate that doses higher than standard recommendations may be effective. In other cases, "I" results indicate that the organism may be susceptible or resistant but the *in vitro* tests are not sensitive enough to determine specifically. For this antibiogram, Intermediate results are NOT included within the "%S" category.

### Staphylococci

Percent Susceptible	No. Tested	Penicillin	Nafcillin, Oxacillin (b,c)	1st Generation Cepheims (c)	Vancomycin	Erythromycin	Clindamycin (d)	Gentamicin	Trimeth/Sulfa	Moxifloxacin	Tetracycline (bony)	Linezolid	Haemophilus Influenzae	
													For infections with $\beta$ -lactamase-producing H. influenzae: cefuroxime, cefotaxime, trimethoprim/sulfamethoxazole, amoxicillin/clavulanate or azithromycin is recommended.	Cefotaxime or ceftriaxone is drug of choice for CNS infections. At Stanford, 74% of H. influenzae (n=149) are ampicillin susceptible.
Staphylococcus aureus, ALL(b)	1719	(a)	76	76	100	58	74	97	99	72	95	100		
MRSA (ONLY) (c)	411	0	0	0	100	13	50	94	98	24	95	100		
MSSA (ONLY)	1308	(a)	100	100	100	72	81	98	99	88	95	100		
Staph. lugdunensis	85	(a)	91	91	100	80	81	95	95	98	87	100		
Staph. coagulase negative (other)	280	(a)	40	40	100	36	56	76	60	48	82	99		
Cost (\$)		\$	\$\$	\$	\$	\$	\$	\$	\$	\$	\$	\$\$\$		

- (a) Penicillin sensitivity confirmed by PCR per request. Penicillin-resistant staphylococci should be considered resistant to all penicillinase-sensitive penicillins, including ampicillin, amoxicillin, mezlocillin, piperacillin and ticarcillin.
- (b) For empiric therapy where S. aureus is a potential pathogen, nafcillin and first generation cephalosporins are recommended drugs of choice for infections other than serious or systemic, for which vancomycin should be used until the susceptibility results are available. Vancomycin MIC 2 mg/ml, currently interpreted sensitive, is associated with increased treatment failure.
- (c) Oxacillin resistant staphylococci (MRSA & MRSE) should be considered resistant to all penicillins, cephalosporins (except anti-MRSA cephalosporins), imipenem and beta-lactams including combinations with clavulanic acid, sulbactam and tazobactam. Oxacillin susceptibility predicts susceptibility to all other beta-lactams and cephalosporins.
- (d) Clindamycin induction test performed on all staphylococcal isolates.

### Anaerobes (selected species)

Percent Susceptible by Etest (a)	No. Tested	Penicillin	Amp/subbactam	Pip/tazobactam	Meropenem	Clindamycin	Metronidazole
Bacteroides fragilis	45	0	94	90	96	69	100
Bacteroides sp. NOT fragilis	29	0	87	80	93	28	100
Gram negative rods (other) (b)	35	50	100	100	100	77	100
Clostridium perfringens	8	88	100	100	-	50	100
Clostridium sp. NOT perfringens	21	55	100	100	-	50	100
Gram positive rods (other) (c)	29	xx	100	100	96	92	0
Gram positive cocci	26	100	100	100	-	76 (d)	92
Cost (\$)		\$	\$	\$\$	\$\$	\$\$	\$

- (a) Not all isolates tested with every drug
- (b) Include Fusobacterium, Prevotella, Porphyromonas, & other.
- (c) Non-sporeforming rods include Actinomyces, Bifidobacterium, Lactobacillus, Propionibacterium, and others.
- (d) Notify Micro Lab to perform antibiotic susceptibility testing if clindamycin is being considered for a Peptostreptococcus.
- (e) <30 isolates may be statistically unreliable

### Campylobacter sp. (n = 21)

Drug (mcg/mL)	% Resistant
Ciprofloxacin	43% R
Doxycycline	55% R
Erythromycin	5% R

### M. tuberculosis (n = 21)

Drug (mcg/mL)	% Resistant
Isoniazid (0.1)	15% R
Rifampin (2)	5% R
Ethambutol (25)	5% R
Pyrazinamide	0% R