

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)	Quinopristin/daifopristin	Ciprofloxacin (UTI only)	Linezolid
		%S	%I	%R															
<b>Streptococci</b>																			
Grp. B (Strep. agalactiae) (b)	147	100	0	0	-	-	-	52	56	-	-	-	-	-	-	-	-	-	-
Viridans (various species)	171	85	15	0	-	99	100	60	75	-	-	-	-	-	-	-	-	-	-
Strep. pneumoniae (c)	41	78d	-	22	90	100d	100	76	86	97	88	-	-	100	-	-	-	-	-
<b>Enterococcus (no species I.D.) (e)</b>																			
Enterococcus faecalis (e)	558	83	0	17	-	-	85	-	-	-	-	22	-	-	-	88	-	59	99
Enterococcus faecium (e)	100	100	0	0	-	-	96	-	-	-	-	68	86	-	-	-	-	-	99
Enterococcus faecium (e)	126	13	0	87	-	-	31	-	-	-	-	98	35	-	-	100	-	-	94
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.  
 (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	Itraconazole	Voriconazole
Candida albicans	104	100	100	96	96	96
Candida glabrata	60	100	92	95	87	-
Candida parapsilosis	22(b)	100	100	100	100	100
C. tropicalis	8(b)	100	88	88	100	100
Other Candida spp.	24(b)	100	79	(c)	100	96
Costs (\$)		\$\$\$\$	\$\$\$\$	\$	\$	\$\$\$\$

- (a) Based on suggested resistant breakpoint MIC  $\geq 2$   $\mu$ g/ml.  
 (b) Data from <30 isolates may be statistically unreliable.  
 (c) 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 61% 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 dc'd after 2 doses maximum.



**STANFORD**  
HOSPITAL & CLINICS

Stanford University Medical Center

### CLINICAL MICROBIOLOGY LABORATORY

### SUH ANTIBIOGRAM DATA FOR BACTERIAL AND YEAST ISOLATES

Jan 1, 2014 - Dec 31, 2014

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 Only		
	No. Tested (a)	Ampicillin	Piperacillin	Amp/Subbactam	Pip/Tazobactam	Cefazolin [Urine Only]	Ceftriaxone	Cefepime	Aztreonam (b)	Imipenem	Meropenem	Gentamicin	Tobramycin	Amikacin	Ciprofloxacin	Levofloxacin	Trimeth/Sulfamethox	Nitrofurantoin
Achromobacter xylosoxidans	34	-	-	-	85	-	-	21	0	91	79	12	6	9	9	47	85	-
Acinetobacter baumannii	16(c)	-	-	56	-	-	-	50	-	-	63	75	75	75	50	56	56	-
Burkholderia cepacia (d)	10(c)	Ceftazidime 60%				Minocycline 70				-	60	-	-	-	-	-	50	-
Citrobacter freundii complex	61	0	-	0	90	0	78	97	84	96	100	93	92	100	88	90	77	81
Citrobacter koseri	54	0	-	0	98	95	98	100	100	100	100	100	100	100	100	100	100	37
Enterobacter aerogenes	70	0	-	0	88	0	84	100	82	100	100	100	100	100	96	97	100	9
Enterobacter cloacae complex	164	0	-	0	85	0	73	100	78	100	100	99	97	100	97	98	93	24
Escherichia coli	1780	51	-	41	95	83	90	96	82	100	100	90	89	100	78	78	71	93
Klebsiella oxytoca	92	0	-	50	88	35	87	98	84	100	100	96	96	100	98	98	92	70
Klebsiella pneumoniae	427	0	-	72	93	87	92	95	89	99	99	94	92	99	91	91	83	18
Morganella morganii	32	0	-	13	100	0	97	100	100	-	100	83	93	100	86	90	58	0
Proteus mirabilis	151	80	-	96	98	79	96	98	96	-	100	90	92	99	90	90	79	0
Proteus vulgaris	13(c,e)	0	-	-	100	0	-	100	-	-	100	100	100	100	100	100	93	0
Pseudomonas aeruginosa	422	-	-	-	88	-	-	86	77	81	87	87	95	90	81	81	-	-
Ps. aeruginosa CF mucoid (d)	153	-	84	Ticarcillin 67%			-	84	78	76	79	-	91	-	68	-	-	-
Ps. aeruginosa CF non-mucoid (d)	101	-	70	Ticarcillin 48%			-	74	67	73	75	-	71	-	54	-	-	-
Salmonella spp.	15(c)	93	-	-	-	Ceftriaxone 100%	-	-	-	-	-	-	-	-	80	-	100	-
Serratia marcescens	88	0	-	0	100	0	98	100	99	100	100	100	92	100	93	97	99	0
Stenotrophomonas maltophilia	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	83	97	-
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 2013.

### 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, 76% of H. influenzae (n=78) are ampicillin susceptible.
Staphylococcus aureus, ALL(b)	1185	(a)	76	76	100	58	72	97	99	73	93	100	
MRSA (ONLY) (c)	289	0	0	0	100	13	44	95	98	21	93	100	
MSSA (ONLY)	901	(a)	100	100	100	72	81	97	99	89	93	100	
Staph. lugdunensis	91	(a)	97	97	100	88	89	99	99	99	-	100	
Staph. coagulase negative (other)	262	(a)	39	39	100	36	61	79	60	54	-	100	
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	39	0	95	97	97	72	97
Bacteroides sp. NOT fragilis	32	0	74	83	100	19	97
Gram negative rods (other) (b)	31	87	100	100	100	90	100
Clostridium perfringens	14	100	100	100	-	58	93
Clostridium sp. NOT perfringens	32	63	100	100	-	57	93
Gram positive rods (other) (c)	24	96	100	100	100	74	18
Gram positive cocci	18	100	100	100	-	83 (d)	100
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.

### Campylobacter sp. (n = 33)

Drug (mcg/mL)	% Resistant
Ciprofloxacin	30% R
Doxycycline	58% R
Erythromycin	0% R

### M. tuberculosis (n = 16)

Drug (mcg/mL)	% Resistant
Isoniazid (0.1)	6% R
Rifampin (2)	0% R
Ethambutol (25)	0% R
Pyrazinamide	12% R