

GRAM POSITIVE ISOLATES – % SUSCEPTIBLE

	Number of strains		
<i>Staphylococcus aureus</i> (MSSA)	1350	NT	100
MRSA**	285	IR	15
Coag negative staphylococci	401	NT	41
<i>Enterococcus faecalis</i>	73	99	IR
<i>Enterococcus faecium</i>	42	5	IR
<i>Streptococcus pyogenes</i> (Group A Strep)*	67	100*	100*
All Group A Strep are sensitive to all penicillins, carbapenems, vancomycin and cephalosporins except Ceftazidime	NT	91	100*
Vancomycin	100*	NT	NT
TMP-SMZ	98	99	100
Tetracycline	97	96	99
Nitrofurantoin*	91	95	99
Erythromycin	91	95	99
Clindamycin	91	95	99
Ciprofloxacin	91	95	99
Cephalexin	91	95	99
Ampicillin	91	95	99
Cefazolin	91	95	99
Not Use	91	95	99

* For use in urinary tract infection only. NOTE: MRSA /MSSA in the urine often reflects systemic infection

** Methicillin resistant *S. aureus* is resistant to all penicillins, cephalosporins, and carbapenems

¥ All Group A Strep are sensitive to all penicillins, carbapenems, vancomycin and cephalosporins except Ceftazidime

GRAM NEGATIVE ISOLATES – % SUSCEPTIBLE

	Number of strains		
<i>Escherichia coli</i>	7977	85	63
<i>Klebsiella pneumoniae</i>	546	95	IR
<i>Klebsiella oxytoca</i>	129	82	IR
<i>Enterobacter aerogenes</i>	114	IR	IR
<i>Enterobacter cloacae</i>	300	IR	IR
<i>Citrobacter freundii</i>	109	IR	IR
<i>Serratia marcescens</i>	240	IR	IR
<i>Morganella morganii</i>	117	IR	IR
<i>Proteus mirabilis</i>	470	100	81
All Group A Strep are sensitive to all penicillins, carbapenems, vancomycin and cephalosporins except Ceftazidime	97	100	97
Amoxicillin/Clavulanate	96	97	95
Ceftriaxone	94	97	95
Ceftazidime	94	97	95
Cefazolin	94	97	95
Ampicillin	94	97	95
Cephalexin	94	97	95
Ciprofloxacin*	94	97	95
Gentamicin	94	97	95
Tobramycin	94	97	95
Meropenem**	94	97	95
Ertapenem	94	97	95
Piperacillin/Tazobactam	94	97	95
TMPS-MZ	94	97	95
Tetracycline	94	97	95

IR = Intrinsically Resistant (EUCAST susceptibility rules Clin Microbiol Infect 2013); 19:141-160; NT = Not Tested

* Ciprofloxacin susceptibility in *E. coli* isolated from the ICU is 69%

** Meropenem generally is predictive of sensitivity to imipenem

*** For use in urinary tract infection only

¥ Enterobacter isolated from the ICU has been resistant to piperacillin/tazobactam

AERMENTERS – % SUSCEPTIBLE

	Number of strains		
<i>Pseudomonas aeruginosa</i>	824	86	NT
<i>Stenotrophomonas maltophilia</i>	96	32	26
<i>Acinetobacter baumannii</i>	64	88	NT
<i>Burkholderia cepacia</i> *	69	34	3
All Group A Strep are sensitive to all penicillins, carbapenems, vancomycin and cephalosporins except Ceftazidime	97	84	IR
Ceftriaxone	97	84	IR
TMPS-MX	97	84	IR
Tetracycline	97	84	IR
Levofloxacin	97	84	IR
Penicillin	97	84	IR
Erythromycin	97	84	IR
Clindamycin	97	84	IR
Ciprofloxacin	97	84	IR
Amikacin	97	84	IR
Tobramycin	97	84	IR
Genitamycin	97	84	IR
Ertapenem	97	84	IR
Meropenem*	97	84	IR
Tazobactam/Piperacillin/Tazobactam	97	84	IR
Clavulanate/Ticarcillin/Cloxacillin	97	84	IR
Ertapenem	97	84	IR
Meropenem*	97	84	IR
TMPS-MZ	97	84	IR

S. PNEUMONIAE (NON - CSF)

	Number of strains		
<i>S. pneumoniae</i>	77	68	100
Penicillin	77	68	100
Tetracycline	77	68	100
Levofloxacin	77	68	100
Erythromycin	77	68	100
Clindamycin	77	68	100
Ciprofloxacin	77	68	100
Amikacin	77	68	100
Tobramycin	77	68	100
Genitamycin	77	68	100
Ertapenem	77	68	100
Meropenem*	77	68	100
Tazobactam/Piperacillin/Tazobactam	77	68	100
Clavulanate/Ticarcillin/Cloxacillin	77	68	100
Ertapenem	77	68	100
Meropenem*	77	68	100
TMPS-MZ	77	68	100

IR = Intrinsically Resistant (EUCAST susceptibility rules Clin Microbiol Infect 2013)

NB: Specific susceptibilities should be consulted when they are available, as individual results can be especially difficult to predict when the number of isolates tested is small.

* Although susceptibility to meropenem generally is predictive of sensitivity to imipenem, literature suggests that meropenem should be used for *B. cepacia* infections

* Colistin can be used in multidrug resistant *Pseudomonas* (62% susceptible at CbHA) but it has no activity against *B. cepacia*

NOTES

GUIDELINES FOR INTERPRETATION OF GRAM STAIN RESULTS

Gram-Positive Cocci (GPC)

Pairs, chains, clusters:

- *Staphylococcus* sp

Pairs, chains:

- *Streptococcus* sp
- *Enterococcus* sp

Gram-Negative Cocci (GNC)

Diplococci

Pairs:

- *Neisseria meningitidis*
- *Neisseria gonorrhoeae*
- *Moraxella catarrhalis*

Other:

- *Acinetobacter* sp

Gram-Positive Bacilli (GPB)

Diphtheroids:

- Small, pleomorphic:
- > *Corynebacterium* sp
- > *Propionibacterium* (anaerobe)

Large, with spores:

- *Clostridium* sp
- *Bacillus* sp

Branching, beaded, rods:

- *Nocardia* sp
- *Actinomyces* sp (anaerobe)

Other:

- *Listeria* sp
(blood/cerebrospinal fluid)
- *Lactobacillus* sp
(vaginal/blood)

Gram-Negative Bacilli (GNB)

Enterobacteriaceae:

- *Escherichia coli*
- *Serratia* sp
- *Klebsiella* sp
- *Enterobacter* sp
- *Citrobacter* sp

Aermenters:

- *Pseudomonas* spp
- *Stenotrophomonas maltophilia*

Other:

- *Haemophilus influenzae*
- *Bacteroides fragilis* group (anaerobe)

Fusiform (long, pointed):

- *Fusobacterium* sp (anaerobe)
- *Capnocytophaga* sp

These guidelines are not definitive but presumptive for the identification of organisms on gram stain. Treatment will depend on the quality of the specimen and appropriate clinical evaluation.

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ANTIBIOTIC ASSAYS

a. "Traditional" aminoglycoside dosing (usually every 8 hours):

Therapeutic range:	PRE	POST (0.5 hr. after IV)
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Gentamicin	1-2 mg/l	5-8 mg/l (d)
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Tobramycin	1-2 mg/l	5-8 mg/l
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b. Single daily dosing of aminoglycosides: Post dose levels are not required. A level taken 6 hrs before the next dose is suggested in circumstances including: changing or impaired renal function; age over 65; exposure to concurrent nephrotoxins; infection with resistant organisms; or aminoglycoside therapy for more than 5 days.

The result should be < 1mg/l.

c. Vancomycin: Post (2 hr) vancomycin levels are only required in special circumstances (e.g. changing renal function; poor response to therapy; resistant organism; pharmacokinetic analysis).

Therapeutic range:	PRE	POST
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Vancomycin	5-10 mg/l	Not routinely performed
	10-20mg/l*	

* For treatment of deep seated infections, osteomyelitis, meningitis and endocarditis and more resistant organisms (i.e. MRSA).

d. Notes:

- Assays are routinely performed 7 days per week. Amikacin levels are referred out.
- Assays of other antibiotics are not available.
- See the QEII HSC Pharmacy Antimicrobial Handbook for further information on monitoring guidelines.
- Post gentamicin levels for synergy for gram positive infections (3-5 mg/L).

ANAEROBIC SUSCEPTIBILITIES

Most anaerobes will be susceptible to metronidazole, except *Peptostreptococcus* sp which are often resistant, but usually susceptible, to penicillin.

Anaerobic susceptibilities are performed only on isolates from selected sites (e.g. endocarditis and brain abscesses) or on special request.



Capital Health

Antibiotic Susceptibility Patterns for Commonly Isolated Organisms

Division of Microbiology

Department of Pathology and Laboratory Medicine
Developed by the Antimicrobial Agents Subcommittee

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