



DIAGNOSTIC SERVICES
OF MANITOBA



2008 Antibiogram
Misericordia Health Centre
Winnipeg, Manitoba
(Data if for bacterial isolates obtained in 2007)

For further information contact:

Kanchana Manickam, Ph.D., D(ABMM), CIC
Clinical Microbiologist, Diagnostic Services of Manitoba

or

Michelle Alfa, Ph.D., FCCM
Medical Director, Clinical Microbiology, Diagnostic Services of Manitoba

For further input related to pharmacy information contact Dr. Rob Ariano, Clinical
Pharmacist, Pharmacy, St. Boniface General Hospital

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Antibiotic dosing information was obtained from the **2004 WRHA Clinical Handbook of
Pharmacotherapy**. Editors: B. Rosenthal, B.Sc.Pharm. & A. Gin, Pharm.D.

DISCLAIMERS

This guide is provided as an educational resource for physicians and other healthcare professionals caring for patients at the Misericordia Health Centre. The authors of the guide have made every effort to ensure that the information contained in it was accurate at the time of publication. Users of the guide are encouraged to consult other references to confirm the information presented in it. The authors are not responsible for errors, omissions, inaccuracies, or the continued completeness of the information contained in the guide. The information in the guide should not be used or relied upon to replace the skill and professional judgment required to determine appropriate patient care and treatment. Also, the guide is not intended to replace or to be used as a substitute for the complete prescribing information prepared by each pharmaceutical manufacturer for their anti-infective agents. Because of possible changes in anti-infective indications, changes in dosage information, differences in patients' responses to therapy, newly described toxicities, drug-drug interactions, and other items of importance, reference to complete prescribing information is recommended before any of the anti-infective agents described in the guide are used.

HOW TO USE THE ANTIBIOGRAM PORTION OF THE GUIDE (Tables 1-4)

- The antibiogram contains cumulative anti-infective agent susceptibilities for common pathogens isolated in the DSM Clinical Microbiology Laboratory at the St. Boniface General Hospital site for samples for Misericordia Health Centre from January to December 2007. Data were collected over longer periods of time for less frequently isolated pathogens; these exceptions are noted in each instance.
- The information presented in the antibiogram is intended only to guide initial empiric anti-infective agent therapy at the Misericordia Health Centre.
- Initial broad-spectrum empiric therapy should be focused to the most appropriate narrow-spectrum agent(s) based on the laboratory identification of pathogen(s) and known susceptibility patterns/results, if the situation permits.
- Consideration should be given to equally efficacious but less expensive anti-infective agents for empiric therapy or when streamlining of therapy is desired, if the situation permits.

Table 1. In vitro activity of selected anti-infective agents tested against Gram-negative bacilli^a

Organism (number tested): January through December 2007	Times Tested % Susceptible												
	Ampicillin	Piperacillin- Tazobactam	Cefazolin	Cefuroxime	Cefotaxime ¹	Ceftazidime	Gentamicin	Tobramycin	Ciprofloxacin	Levofloxacin	TMP/SMX	Meropenem	Nitrofurantoin ²
<i>Enterobacter cloacae</i>		14 100%			14* 100%	14* 100%	14 100%	14 100%	14 93%	14 100%	14 100%	14 100%	14 29%
<i>Escherichia coli</i>	666 62%	666 100%	666 97%		666 100%	666 100%	666 96%	666 97%	666 93%	666 93%	666 82%	666 100%	666 98%
<i>Klebsiella pneumoniae</i>		54 100%	54 100%		54 100%	54 100%	54 100%	54 98%	54 96%	54 96%	54 96%	54 100%	54 33%
<i>Proteus mirabilis</i>	40 90%	40 98%	40 92%		40 100%	40 100%	40 98%	40 98%	40 90%	40 100%	40 88%	40 100%	
<i>Citrobacter freundii</i>		6 100%			6* 100%	6* 100%	6 83%	6 100%	6 100%	6 100%	6 83%	6 100%	6 100%
<i>Serratia marcescens</i>		2 100%			2* 100%	2* 100%	2 100%	2 50%	2 100%	2 100%	2 100%	2 100%	
<i>Pseudomonas aeruginosa</i>		34 100%			34 3%	34* 100%	34 97%	34 100%	34 94%	34 94%		34 97%	
<i>Acinetobacter baumannii</i>		4 100%			4 0%	4 50%	4 100%	4 100%	4 100%	4 100%	4 100%	4 100%	
<i>Stenotrophomonas maltophilia</i>											4 100%		
<i>Haemophilus influenzae</i> ³	48 79%			11 91%							11 91%		

^a Clinical isolates were tested and reported from diagnostic samples only and the summary data was compiled according to the recommendations of the Clinical and Laboratory Standards Institute (CLSI) in their document M39-A2 (2005).

* Please note that these organisms can display inducible resistance to these antibiotics.

¹Cefotaxime results deduced from Ceftriaxone results

²For acute cystitis infection only

³Average for isolates from past 4 years

Table 2. In vitro activity of selected anti-infective agents tested against Gram-positive cocci^a

Organism (number tested): January through December 2007	Times Tested % Susceptible														
	Ampicillin	Cloxacillin	Penicillin	Cefazolin	Cefuroxime	Ceftazidime	Gentamicin	Ciprofloxacin	Levofloxacin	Clindamycin	TMP/SMX	Erythromycin	Tetracycline	Nitrofurantoin ¹	Vancomycin
<i>Staphylococcus aureus</i>		274 81%	274 6%	**			274 99%	274 82%	274 84%	273 73%	274 97%	274 73%	274 97%	274 99%	274 100%
<i>Coag Neg Staph species</i>		37 59%	37 8%	**			37 86%	37 70%	37 70%	37 81%	37 81%	37 46%	37 95%	37 97%	37 100%
<i>Enterococcus species</i>	105 99%							105 ¹ 71%	105 ¹ 71%					105 95%	105 99%
<i>Streptococcus pneumoniae</i> ²			42† 88%								18 67%	32 88%			

^a Clinical isolates were tested and reported from diagnostic samples only and the summary data was compiled according to the recommendations of the Clinical and Laboratory Standards Institute (CLSI) in their document M39-A2 (2005).

¹For acute cystitis infection only

²Average for isolates from past 4 years

**Cefazolin results same as Cloxacillin results

† 2% (1 of 42) of strains had high level resistance, 10% (4 of 42) of strains had intermediate resistance

Table 3. In vitro activity of selected anti-infective agents tested against anaerobic bacteria

Organism (number tested): January 2007 through December 2007	Times Tested % Susceptible				
	Meropenem	Clindamycin	Penicillin	Cefoxitin	Metronidazole
<i>Bacteroides fragilis</i> ¹	1 100%	1 100%	37 87%	1 0%	1 100%

¹Average for isolates from past 4 years

Table 4. Oral antimicrobial dosage guidelines^a

Antibiotic	Usual Dosages	Cost (\$) per day^b
ANTIBACTERIAL AGENTS		
<i>Penicillins</i>		
Amoxicillin	250 – 500 mg tid	0.50 – 0.75
Amoxicillin/Clavulanate	250 – 500 mg tid	2.00 – 3.00
Cloxacillin	250 – 500 mg qid	0.50 – 0.75
Penicillin V	300 mg qid	0.25
<i>Cephalosporins</i>		
Cephalexin	250 – 500 mg qid	0.75 – 1.50
<i>Macrolides</i>		
Azithromycin	250 – 500 mg daily	5.00 – 10.00
Clarithromycin	250 – 500 mg bid	3.00 – 6.00
Erythromycin	250 – 500 mg qid	2.00 – 3.75
<i>Fluoroquinolones</i>		
Ciprofloxacin	250 – 750 mg bid	4.50 – 9.50
Levofloxacin	500 mg daily	5.00
<i>Others</i>		
Clindamycin	300 – 450 mg tid	3.50 – 5.00
Co-trimoxazole	DS (double strength) bid	0.25
Doxycycline	100 mg bid	1.50
Nitrofurantoin	50 – 100 mg qid	1.00 – 1.25
Trimethoprim	100 mg bid	0.75
Metronidazole	500 mg tid	0.25
ANTIFUNGAL AGENTS		
Fluconazole	100 – 400 mg daily	8.75 – 34.50
Itraconazole	200 – 400 mg daily	7.00 – 14.00
Ketoconazole	200 – 400 mg daily	1.50 – 2.75
ANTIVIRAL AGENTS		
Acyclovir	200 – 800 mg 5x/day	6.00 – 22.75
Valacyclovir	500 mg – 1 g tid	9.25 – 18.25

^a Refer to WRHA Clinical Handbook of Pharmacotherapy 2004 for more information.

^b Approximate cost per inpatient day excluding dispensing costs as of January 2002 based on Manitoba Formulary and Manufacturers' List Prices. Prices are rounded to the nearest 0.25.

Table 5. Parenteral antimicrobial dosage guidelines^a

Antibiotic	Usual Dosages ^b	Cost (\$) per day ^c
ANTIBACTERIAL AGENTS		
<i>Penicillins</i>		
Ampicillin	1-2 g q6h	3.75 – 7.00
Cloxacillin	1-2 g q4-6h	4.50 – 8.50
Penicillin G Sodium	1-2 million units q4-6h	4.00 – 8.00
Piperacillin	3 g q6h	42.00
Piperacillin/Tazobactam	3.375 g q6h	64.25
Meropenem	500 mg q6h	96.50
<i>Cephalosporins</i>		
Cefazolin	1-2 g q8h	4.50 – 8.50
Cefoxitin	1-2 g q6-8h	17.00 – 33.50
Cefuroxime	0.75-1.5 g q8h	7.00 – 13.25
Cefotaxime	1-2 g q8h	19.25 – 37.75
Ceftazidime	1-2 g q8h	21.50 – 42.50
<i>Fluoroquinolones</i>		
Ciprofloxacin	200-400 mg q12h	33.50 – 66.50
Levofloxacin	500 mg q24h	34.00
<i>Macrolides</i>		
Azithromycin	500 mg q24h	20.50
<i>Aminoglycosides</i>		
Gentamicin	80 mg q8h	12.00
Tobramycin	80 mg q8h	15.00
<i>Others</i>		
Clindamycin	600 mg q8h	8.50
Co-trimoxazole	10-20 mg/kg/day trimethoprim in divided doses q6-8h	
Metronidazole	500 mg q8h	4.00
Vancomycin	1 g q12h	100
ANTIFUNGAL AGENTS		
Amphotericin B	0.5-1 mg/kg q24h	27.00 – 53.00
Fluconazole	100-400 mg q24h	22.25 – 87.25
ANTIVIRAL AGENTS		
Acyclovir	5-10 mg/kg q8h	179.00 – 357.75
Ganciclovir	5 mg/kg q12h	58.25

^a Refer to WRHA Clinical Handbook of Pharmacotherapy 2004 for more information.

^b Based on normal renal function in a 70 kg patient.

^c Cost as of January 2005, also includes approximate cost of material and preparation used for preparing doses based on Manitoba Formulary and Manufacturers' List Prices. Prices are rounded to the nearest 0.25.

Table 6. Parenteral to oral conversion suggestions

Parenteral Drug	Oral Therapy Options ^a	Cost (\$) Differential Per Day ^b
ANTIBACTERIAL AGENTS		
<i>Penicillins</i>		
Ampicillin	Amoxicillin	6.25
Cloxacillin	Cloxacillin, Co-trimoxazole	7.75
Penicillin	Penicillin V	7.75
Piperacillin +/- Tazobactam	Amoxicillin/Clavulanate Amoxicillin + Metronidazole Co-trimoxazole +/- Metronidazole Ciprofloxacin +/- Metronidazole	39.00 41.00 Depends on infection 32.25
	Amoxicillin/Clavulanate Amoxicillin + Metronidazole Co-trimoxazole +/- Metronidazole Ciprofloxacin +/- Metronidazole	
<i>Cephalosporins</i>		
Cefazolin	Cephalexin, Co-trimoxazole	7.00
Cefotaxime	Amoxicillin/Clavulanate Cephalexin Ciprofloxacin, Levofloxacin	16.25 – 34.75 17.75 – 36.25 14.25 – 33.00
Cefoxitin	Cephalexin + Metronidazole Co-trimoxazole + Metronidazole Amoxicillin/Clavulanate	31.75 Depends on infection 30.50
Ceftazidime	Ciprofloxacin	33.00
Cefuroxime	Co-trimoxazole, Amoxicillin/Clavulanate Azithromycin, Clarithromycin	Depends on infection 10.00 3.25 – 10.25
<i>Fluoroquinolones</i>		
Ciprofloxacin IV	Ciprofloxacin	57.00 – 62.50
Levofloxacin IV	Levofloxacin	30.00
<i>Macrolides</i>		
Azithromycin	Azithromycin	14.00
<i>Others</i>		
Clindamycin	Cloxacillin +/- Metronidazole Co-trimoxazole +/- Metronidazole Cephalexin +/- Metronidazole Clindamycin	7.50 Depends on infection 6.75 3.50
ANTIFUNGAL AGENTS		
Fluconazole	Fluconazole	52.75
ANTIVIRAL AGENTS		
Acyclovir	Acyclovir	163.00

^a Selection of oral therapy should be based on cultures and sensitivities. In absence of useful cultures, oral therapy may be selected based on potential pathogens, community- versus hospital-acquired infection, pharmacokinetics, spectrum of activity, and cost of each oral agent. Oral agents listed above represent those currently on the WRHA Formulary and does not represent all commercially available oral agents.

^b Cost based on Manitoba Formulary and Manufacturers' List Prices. Prices are rounded to the nearest 0.25.

SUGGESTED CRITERIA FOR IV TO ORAL ANTIBIOTIC CONVERSION IN ADULTS

- Clinical improvement of infectious signs and symptoms (e.g., temperature defervescence, decreased white blood cell count).
- Patient is clinically stable (excludes patients in the intensive care unit, patients with febrile neutropenia, or patients with life threatening infections).
- Patient can tolerate oral feeding and medications (bowel sounds, no diarrhea/nausea/vomiting).
- For rapid step-down, choose agents with high bioavailability (e.g., clindamycin, trimethoprim-sulfamethoxazole, fluoroquinolones).
- If anti-infective agent susceptibilities are known, anti-infective therapy should be tailored based on available data.

Table 7. Adult dosing recommendations in renal impairment^a

Drug	Creatinine Clearance (CrCl) in mL/min ^b (suggested dosage adjustment based on normal dose)				Supplement for Dialysis
	>30 (q6h)	10-30 (q6-12h)	<10 (q12h)		
Penicillins					
Ampicillin	>30 (q6h)	10-30 (q6-12h)	<10 (q12h)		HD
Cloxacillin	NO CHANGE NECESSARY				NO
Penicillin	>50 (q4-6h)	10-50 (q6-8h)	<10 (20-50%)		HD
Piperacillin (± tazobactam)	>40 (q6h)	20-40 (q8h)	<20 (q12h)		HD
Cephalosporins					
Cefazolin	>50 (q8h)	10-50 (q12h)	<10 (q24h)		HD
Cefotaxime	>20 (q8h)	<20 (q12h ^c -q24h)			HD
Cefotetan	>30 (q12h)	10-30 (q24h)	<10 (50% q24h)		
Cefoxitin	>30 (q6-8h)	10-30 (q12-24h)	<10 (q24h)		HD
Ceftazidime	>50 (q8h)	30-50 (q12h)	10-30 (q24h)	<10 (50% q24-48h)	HD, PD
Cefuroxime	>20 (q8h)	10-20 (q12h)	<10 (q24h)		HD
Miscellaneous					
Acyclovir	>50 (q8h)	25-50 (q12h)	10-25 (q24h)	<10 (50% q24h)	HD
Aminoglycosides ^d	Refer to WRHA Clinical Handbook of Pharmacotherapy 2004 for more information				HD, PD
Azithromycin	NO CHANGE NECESSARY				
Ciprofloxacin	>30 (q12h)	<30 (q24h)			HD
Clindamycin	NO CHANGE NECESSARY				NO
Fluconazole	>50 (q24h)	20-50 (50%)	<20 (25%)		HD
Ganciclovir (induction doses)	50-70 2.5 mg/kg q12h	25-50 2.5 mg/kg q24h	10-25 1.25 mg/kg q24h	<10 1.25 mg/kg 3x/wk	HD
Levofloxacin (e.g. CAP)	>50 (q24h)	20-49 (500 mg load, then 50% q24h)	10-19 (500 mg load, then 50% q48h)		HD
Meropenem	>50 (q6h)	30-49 (q8h)	10-29 (q12h)	<10 (q24h)	HD, PD
Metronidazole	NO CHANGE NECESSARY				HD
TMP/SMX ^a	>25 (q6-8h)	15-25 (50% q6-8h)	<15 (2.5-5 mg/kg, generally not recommended) ^a		HD
Vancomycin ^d	>70 (q12h)	50-70 (q24h)	10-49 (q24-72h)	<10 (q5-7days)	NO

^a Suggested dosages – for individualized dosage modifications or more information contact the Department of Pharmaceutical Services.

^b To estimate creatinine clearance (CL_{CR}) (mL/min) use the following calculation normalized for a 72 kilogram person.

$$CL_{CR} \text{ male} = \frac{(140 - \text{age}) \times 88.4}{S_{CR} (\mu\text{moles/L})} \quad CL_{CR} \text{ female} = 0.85 \times CL_{CR} \text{ male}$$

^c Use q12h for severe infection (e.g., meningitis).

^d Monitor serum concentrations, for individualized dosage modifications contact Department of Pharmaceutical Services.

Table 8. Antimicrobial Restrictions at Health Sciences Centre and St. Boniface General Hospital (revised December 2007)

Antimicrobial (alphabetical order)	Status	Exception Criteria	Criteria For Use*
Acyclovir IV	Consultation		
Amphotericin B Lipid Complex	Consultation		Yes
Caspofungin	Consultation		Yes
Cefotaxime	Verbal Approval	CAP**	
Ceftriaxone	Verbal Approval	CAP**; ambulatory care (e.g. Emergency Dept. or Community IV Therapy Program); Single dose for uncomplicated gonorrhea	
Ceftazidime	Consultation	Hemodialysis (HSC or SBGH) or Peritoneal (SBGH)	
Ciprofloxacin IV	Consultation		
Ertapenem	Consultation (CPTP ^s only)		
Fluconazole IV	Consultation		
Ganciclovir IV	Consultation	under protocol	
Levofloxacin IV	Consultation	CAP**	
Linezolid	Consultation		Yes
Meropenem	Consultation		
Moxifloxacin	Consultation		Yes
Piperacillin/Tazobactam	Consultation		
Quinupristin/Dalfopristin	Consultation		Yes
Vancomycin Oral [‡]	Verbal Approval		
Voriconazole	Consultation		Yes

^a Criteria for use may be obtained from a WRHA Department of Pharmaceutical Services.

^b CAP = community-acquired pneumonia

^c Due to the concern with the potential emergence of vancomycin-resistant enterococci, all new and repeat orders for oral vancomycin must receive verbal approval or formal consultation.