

Table 8. Adult parenteral antimicrobial dosage guidelines

| Antibiotic | Usual Dosages* |
|-----------------------------|---|
| ANTIBACTERIAL AGENTS | |
| <i>Penicillins</i> | |
| ampicillin | 1-2 g q4-6h |
| cloxacillin | 2 g q4-6h |
| penicillin G | 2-4 million units q4-6h |
| piperacillin-tazobactam | 3.375 g q6h |
| meropenem | 500 mg q6h |
| <i>Cephalosporins</i> | |
| cefazolin | 1-2 g q8h |
| cefuroxime | 0.75-1.5 g q8h |
| ceftriaxone | 1-2 g q24h |
| ceftazidime | 1-2 g q8h |
| <i>Fluoroquinolones</i> | |
| ciprofloxacin | 400 mg q12h |
| levofloxacin | 500-750 mg q24h |
| moxifloxacin | 400 mg q24h |
| <i>Macrolides</i> | |
| azithromycin | 500 mg q24h |
| <i>Aminoglycosides</i> | |
| gentamicin or tobramycin | 80 mg q8h |
| <i>Others</i> | |
| clindamycin | 600 mg q8h |
| cotrimoxazole (TMP-SMX) | 10-20 mg/kg/day trimethoprim in divided doses q6-8h |
| metronidazole | 500 mg q8h |
| vancomycin | 1 g q12h or 15 mg/kg q12h |
| ANTIFUNGAL AGENTS | |
| amphotericin B | 0.5-1 mg/kg q24h |
| fluconazole | 100-400 mg q24h |
| caspofungin | 70 mg load then 50 mg q24h |
| ANTIVIRAL AGENTS | |
| acyclovir | 5-10 mg/kg/dose q8h |
| ganciclovir | 5 mg/kg/dose q12h |

* Based on normal renal function in a 70 kg patient.

Table 9. Parenteral to oral conversion suggestions

| Parenteral Drug | Oral Therapy Options* |
|-----------------------------|---|
| ANTIBACTERIAL AGENTS | |
| <i>Penicillins</i> | |
| ampicillin | amoxicillin |
| cloxacillin | cloxacillin or cephalixin |
| penicillin G | penicillin V |
| piperacillin-tazobactam | amoxicillin-clavulanate or cotrimoxazole (TMP-SMX) +/- metronidazole or ciprofloxacin +/- metronidazole |
| <i>Cephalosporins</i> | |
| cefazolin | cephalexin or cloxacillin |
| cefuroxime | cotrimoxazole or amoxicillin-clavulanate or azithromycin/clarithromycin |
| ceftriaxone | amoxicillin-clavulanate or cephalixin or ciprofloxacin/levofloxacin/moxifloxacin |
| ceftazidime | ciprofloxacin |
| <i>Fluoroquinolones</i> | |
| ciprofloxacin | ciprofloxacin |
| levofloxacin | levofloxacin |
| moxifloxacin | moxifloxacin |
| <i>Macrolides</i> | |
| azithromycin | azithromycin |
| <i>Others</i> | |
| clindamycin | cloxacillin +/- metronidazole or cephalixin +/- metronidazole or clindamycin |
| ANTIFUNGAL AGENTS | |
| fluconazole | fluconazole |
| ANTIVIRAL AGENTS | |
| acyclovir | acyclovir or valacyclovir |

* Patients should be clinically stable, demonstrate clinical improvement, and be able to tolerate oral feeding and medications. 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.

Table 10. Adult dosing recommendations in renal impairment*

| Drug | Creatinine Clearance (CrCl) in mL/min ^b (suggested dosage adjustment based on normal dose) | | | |
|--|--|------------------------------------|--|-------------------------|
| Penicillins | | | | |
| ampicillin | > 30 (q6h) | 10-30 (q6-12h) | < 10 (q12h) | |
| cloxacillin | NO CHANGE NECESSARY | | | |
| penicillin | > 50 (q4-6h) | 10-50 (q6-8h) | < 10 (20-50% of usual dose) ^a | |
| piperacillin-tazobactam | > 40 (q6h) | 20-40 (q8h) | < 20 (q12h) | |
| Carbapenems | | | | |
| meropenem | > 50 (q6h) | 30-49 (q8h) | 10-29 (q12h) | < 10 (q24h) |
| Cephalosporins | | | | |
| cefazolin | > 50 (q8h) | 10-50 (q12h) | < 10 (q24h) | |
| cefuroxime | > 20 (q8h) | 10-20 (q12h) | < 10 (q24h) | |
| ceftriaxone | NO CHANGE NECESSARY | | | |
| ceftazidime | > 50 (q8h) | 30-50 (q12h) | 10-30 (q24h) | < 10 (50% q24-48h) |
| Aminoglycosides^c | | | | |
| gentamicin/ tobramycin/ amikacin | Contact the Pharmacist at your facility for dosing assistance | | | |
| Fluoroquinolones | | | | |
| ciprofloxacin | > 30 (q12h) | < 30 (q24h) | | |
| levofloxacin (e.g. CAP) | > 50 (q24h) | 20-49 (500 mg load, then 50% q24h) | 10-19 (500 mg load, then 50% q48h) | |
| moxifloxacin | NO CHANGE NECESSARY | | | |
| Macrolides | | | | |
| azithromycin | NO CHANGE NECESSARY | | | |
| Antifungal Agents | | | | |
| fluconazole | > 50 (q24h) | 20-50 (50% q24h) | < 20 (25% of usual dose q24h) | |
| caspofungin | NO CHANGE NECESSARY | | | |
| Antiviral Agents | | | | |
| acyclovir | > 50 (q8h) | 25-50 (q12h) | 10-25 (q24h) | < 10 (50% q24h) |
| ganciclovir (induction doses) | 50-69 (2.5 mg/kg q12h) | 25-49 (2.5 mg/kg q24h) | 10-25 (1.25 mg/kg q24h) | < 10 (1.25 mg/kg 3x/wk) |
| Miscellaneous | | | | |
| clindamycin | NO CHANGE NECESSARY | | | |
| metronidazole | NO CHANGE NECESSARY | | | |
| cotrimoxazole (TMP-SMX) | > 25 (q6-8h) | 15-25 (50% q6-8h) | < 15 (2.5-5 mg/kg, generally not recommended) ^a | |
| vancomycin ^d | Contact the Pharmacist at your facility for dosing assistance | | | |

^a Suggested dosages – for individualized dosage modifications or more information contact the Pharmacy Department at your facility.
^b To estimate creatinine clearance (CL_{CR}) (mL/min) use the following calculation normalized for a 72 kilogram person.
 CL_{CR} male = $\frac{140 - \text{age}}{72} \times 88.4$ CL_{CR} female = 0.85 x CL_{CR} male
 S_{Cr} (µmoles/L)
^c Monitor serum concentrations..



Concordia Hospital Antibiogram for 2023

(Based on data from 2022)

Provided by:
Shared Health, Clinical Microbiology Discipline

For further information contact:

Andrew Walkty, MD, FRCPC
Medical Microbiologist, Health Sciences Centre/Shared Health

or

Heather J. Adam, PhD, D(ABMM), FCCM
Clinical Microbiologist, Health Sciences Centre/Shared Health

or

Philippe Lagacé-Wiens, MD, FRCPC
Medical Microbiologist, St. Boniface Hospital/Shared Health

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HOW TO USE THE ANTILOGRAM PORTION OF THE GUIDE (Tables 1-6)

- The information presented in the antibiogram is intended only to guide initial empiric anti-infective agent therapy at the Concordia General Hospital.
- 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.

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, co-trimoxazole (TMP-SMX), fluoroquinolones).
- If anti-infective agent susceptibilities are known, anti-infective therapy should be tailored based on available data.

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

| Organism (number tested): January through December 2022 | Percent Susceptible | | | | | | | | | | | | | | |
|--|---------------------|-------------------------|-------------------------|-----------|-------------------------|------------|-------------|------------|-----------|-----------|------------|------------|---------------|-------------------------------|-----------------------------|
| | Ampicillin | Amoxicillin-Clavulanate | Piperacillin-Tazobactam | Cefazolin | Cephalexin ^b | Cefuroxime | Ceftriaxone | Cefazidime | Ertapenem | Meropenem | Gentamicin | Tobramycin | Ciprofloxacin | Trimethoprim-Sulfamethoxazole | Nitrofurantoin ^c |
| <i>Citrobacter</i> spp. (31) | | | 90 | | | 81 | 87 | 97 | 100 | 94 | 94 | 84 | 94 | 87 | 86 |
| <i>Enterobacter cloacae</i> complex (39) | | | 74 | | | 77 | 72 | 100 | 100 | 90 | 90 | 95 | 79 | 46 | |
| <i>Escherichia coli</i> (59) systemic | 68 | 90 | 100 | 75 | | 86 | 93 | 100 | 100 | 90 | 90 | 73 | 78 | | |
| <i>Escherichia coli</i> (565) urine | 54 | 84 | 98 | 75 | n.d. | 88 | 93 | 100 | 100 | 91 | 91 | 63 | 77 | 96 | |
| <i>Haemophilus influenzae</i> (142) ^d | | | 82 | n.d. | | 97 | | | | | | | 65 | | |
| <i>Klebsiella pneumoniae</i> (95) | | 84 | 95 | 86 | n.d. | 90 | 94 | 100 | 100 | 98 | 94 | 81 | 88 | 33 | |
| <i>Klebsiella/Raoultella</i> spp. (35) ^e | | 94 | 100 | 26 | | 94 | 94 | 100 | 100 | 97 | 97 | 89 | 91 | 80 | |
| <i>Proteus mirabilis</i> (64) | 81 | 100 | 100 | n.d. | | 100 | 100 | 100 | 100 | 97 | 97 | 95 | 88 | | |
| <i>Pseudomonas aeruginosa</i> (116) | | | 90 | | | | | | | 91 | 97 | 98 | 99 | 87 | |

- ^a Isolates tested and reported are from all sources combined, with the exception of *Escherichia coli* (subdivided into systemic isolates and urine isolates); isolates were collected from Jan 1 to Dec 31, 2022 with the exception of systemic *Escherichia coli* (collected from Jan 2021 to Dec 2022); data compiled according to the recommendations of the Clinical and Laboratory Standards Institute (CLSI) in their document M39, 5th ed. (2022).
- ^b Cephalixin is only indicated for the treatment of uncomplicated lower urinary tract infections.
- ^c Nitrofurantoin is only indicated for acute cystitis.
- ^d *H. influenzae* data obtained from isolates tested at Health Sciences Centre, Jan 1 to Dec 31, 2022. Only 112 isolates were tested for Trimethoprim-Sulfamethoxazole. Data from adult and pediatric patients.
- ^e The current laboratory identification system is unable to differentiate *Klebsiella oxytoca* from *Raoultella* spp.
- n.d. = no data – absence of data for certain drug-organism combinations reflects limitations of the testing method currently used by Shared Health Clinical Microbiology laboratories.

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

| Organism (number tested): January through December 2022 | Percent Susceptible | | | | | | | | | | | | | |
|---|---------------------|------------|------------------------|------------|------------|------------------------------------|--------------------------------------|---------------------------|-------------|-------------------------------|-----------------------|-----------|--------------|-----------------------------|
| | Penicillin | Ampicillin | Oxacillin ^b | Vancomycin | Daptomycin | High-Level Gentamicin ^c | High-Level Streptomycin ^c | Erythromycin ^d | Clindamycin | Trimethoprim-Sulfamethoxazole | Rifampin ^e | Linezolid | Tetracycline | Nitrofurantoin ^f |
| <i>Enterococcus</i> spp. (232) | | | | 97 | n.d. | 86 | 85 | | | | | | | 87 |
| <i>Staphylococcus aureus</i> (310) | | | 69 | 100 | 100 | | | 52 | 73 | 98 | 100 | 100 | 94 | 100 |
| <i>Staphylococcus epidermidis</i> (48) | | | 50 | 100 | 100 | | | 54 | 71 | 79 | 98 | 100 | 90 | 100 |
| <i>Staphylococcus lugdunensis</i> (44) | | | 100 | 100 | 100 | | | 82 | 84 | 93 | 100 | 100 | 98 | 100 |
| <i>Streptococcus pyogenes</i> (n.a.) ^g (Group A <i>Streptococcus</i>) | 100 | | | | | | | | | | | | | |
| <i>Streptococcus agalactiae</i> (148) ^h (Group B <i>Streptococcus</i>) | 100 | | 100 | | | | | | 64 | | | | | |

- ^a Isolates tested and reported are from all sources (surveillance isolates excluded); isolates were collected from Jan 1 to Dec 31, 2022 with the exception of *Staphylococcus lugdunensis* (collected from Jan 2021 to Dec 2022); data compiled according to the recommendations of the Clinical and Laboratory Standards Institute (CLSI) in their document M39, 5th ed. (2022).
- ^b Oxacillin accurately predicts the activity of all semi-synthetic penicillins, including cloxacillin, beta-lactam/beta-lactamase inhibitor combinations, cephalosporins, and carbapenems for *Staphylococcus aureus* and coagulase-negative staphylococci.
- ^c Susceptibility to high-level gentamicin or high-level streptomycin indicates that these agents can be used in combination with a cell wall active agent (e.g., ampicillin or vancomycin) for synergy. Gentamicin and streptomycin should never be used alone as treatment for *Enterococcus* spp.
- ^d Erythromycin activity predicts the activity of azithromycin and clarithromycin for staphylococci and streptococci.
- ^e Rifampin should NOT be used alone as treatment for infection.
- ^f Nitrofurantoin is indicated for acute cystitis only.
- ^g n.a. = not applicable – Susceptibility testing of *Streptococcus pyogenes* is not routinely performed as 100% are susceptible to penicillin. If treating infection in a penicillin allergic patient, contact the lab for testing of second line agents.
- ^h *Streptococcus agalactiae* isolates were obtained from vaginal/rectal swabs submitted for Group B *Streptococcus* detection to the Health Sciences Centre, St. Boniface Hospital, and Westman Laboratory in 2022.
- n.d. = no data – absence of data for certain drug-organism combinations reflects limitations of the testing method currently used by Shared Health Clinical Microbiology laboratories.

Table 3. In vitro activity of selected anti-infective agents tested against *Streptococcus pneumoniae*^a

| Infection Type (number tested) | Percent Susceptible | | | | | | | |
|--|---------------------|--------------------------|-------------|------------|--------------|----------------|-------------|-------------------------------|
| | Penicillin (oral) | Penicillin (intravenous) | Ceftriaxone | Vancomycin | Levofloxacin | Clarithromycin | Doxycycline | Trimethoprim-Sulfamethoxazole |
| Systemic Isolates (Blood + CSF) ^b | | | | | | | | |
| Meningitis (160) | | 81 | 88 | 100 | | | | 79 |
| Non-Meningitis infection (160) | 81 | 96 | 97 | 100 | 100 | n.d. | n.d. | 79 |
| Respiratory Isolates ^c | | | | | | | | |
| Non-Meningitis infection (40) | 78 | 95 | 98 | 100 | 100 | 68 | 83 | 80 |

- ^a For *Streptococcus pneumoniae*, different susceptibility breakpoints for penicillin and ceftriaxone exist depending on whether meningitis or a non-meningitis infection is being treated (CLSI, M100, 32nd edition). For penicillin, when treating a non-meningitis infection different breakpoints exist for oral and intravenous dosing. For non-meningitis infections, susceptibility to oral penicillin predicts susceptibility to amoxicillin. Oral agents are not appropriate for the treatment of bacterial meningitis.
- ^b Systemic isolates were obtained from the Health Sciences Centre (HSC) and St. Boniface Hospital (SBH) clinical microbiology laboratories between January and December, 2022. CSF = cerebrospinal fluid.
- ^c Respiratory isolates were obtained from patients at the Health Sciences Centre (HSC) and St. Boniface Hospital (SBH) between January and December, 2018.
- n.d. = no data.

Table 4. In vitro activity of selected anti-infective agents tested against Methicillin-Susceptible and Methicillin-Resistant *Staphylococcus aureus* isolates^a

| Organism (number tested) | Percent Susceptible | | | | | | | |
|--|------------------------|------------|-------------------------------|--------------|-------------|--------------|-----------|------------|
| | Oxacillin ^b | Vancomycin | Trimethoprim-Sulfamethoxazole | Erythromycin | Clindamycin | Tetracycline | Linezolid | Daptomycin |
| Methicillin-Susceptible <i>Staphylococcus aureus</i> (215) | 100 | | 99 | 62 | 66 | 94 | | |
| Methicillin-Resistant <i>Staphylococcus aureus</i> (103) | 0 | 100 | 97 | 28 | 85 | 93 | 100 | 100 |

- ^a Isolates tested and reported are from all sources (surveillance isolates excluded). Jan to Dec, 2022; data compiled according to the recommendations of the Clinical and Laboratory Standards Institute (CLSI) in their document M39, 5th ed. (2022).
- ^b Oxacillin accurately predicts the activity of all semi-synthetic penicillins, including cloxacillin, beta-lactam/beta-lactamase inhibitor combinations, cephalosporins, and carbapenems for *Staphylococcus aureus*.

Table 5. In vitro activity of selected anti-infective agents tested against anaerobic isolates collected from hospitals in Winnipeg^a

| Organism (number tested) | Percent Susceptible | | | | | |
|--|---------------------|-------------------------|-------------------------|-------------|-----------|---------------|
| | Penicillin | Amoxicillin-Clavulanate | Piperacillin-Tazobactam | Clindamycin | Meropenem | Metronidazole |
| <i>Bacteroides fragilis</i> (108) | | 93 | n.d. | 44 | 93 | 100 |
| <i>Bacteroides thetaiotaomicron</i> (37) | | 94 | n.d. | 14 | 97 | 100 |
| <i>Prevotella bivia</i> (54) | 7 | 100 | n.d. | 32 | 100 | 96 |
| <i>Prevotella disiens</i> (34) | 32 | 97 | n.d. | 18 | 100 | 100 |

- ^a Isolates were obtained from WRHA hospitals between Jan 2019 and Dec 2020; data compiled according to the recommendations of the Clinical and Laboratory Standards Institute (CLSI) in their document M39, 5th ed. (2022).
- n.d. = no data – absence of data for certain drug-organism combinations reflects limitations of the testing method currently used by Shared Health Clinical Microbiology laboratories.

Table 6. In vitro activity of selected anti-fungal agents tested against *Candida* species collected from hospitals in Winnipeg^{a,b}

| Organism (number tested) | Percent Susceptible | | |
|------------------------------|--------------------------|--------------|------------|
| | Fluconazole ^c | Voriconazole | Micafungin |
| <i>Candida albicans</i> (33) | 100 | 100 | 100 |
| <i>Candida glabrata</i> (46) | 93 | n.d. | 98 |

- ^a Data obtained by testing a random sample of *C. albicans* isolates from Health Sciences Centre and St. Boniface Hospital, collected between Jan 2017 and Dec 2018. Susceptibility interpretations are based on updated CLSI breakpoints (M27M44S, 3rd Edition). Isolates tested and reported are from blood only.
- ^b Data obtained by testing *C. glabrata* isolates from the Health Sciences Centre and St. Boniface Hospital, collected between Jan 2021 and Dec 2022. Susceptibility interpretations are based on updated CLSI breakpoints (M27M44S, 3rd Edition). Isolates tested and reported are from blood only.
- ^c For fluconazole, there is only a susceptible-dose dependent (SDD) breakpoint for *C. glabrata*. The percentage of *C. glabrata* isolates that tested SDD to fluconazole was 93%. Susceptibility of SDD isolates to fluconazole is dependent on achieving the maximum blood level possible (i.e., should use the maximum dosage regimen). Consultation with infectious diseases is recommended for further guidance.
- n.d. = breakpoints have not been defined for voriconazole versus *C. glabrata*.

Table 7. Adult oral antimicrobial dosage guidelines

| Antibiotic | Usual Dosages | Cost (\$) per day ^a |
|---|--------------------------------|--------------------------------|
| ANTIBACTERIAL AGENTS | | |
| <i>Penicillins</i> | | |
| amoxicillin | 500 mg tid | 1.10 |
| amoxicillin-clavulanate | 500 mg tid or 875 mg bid | 2.75–3.00 |
| cloxacillin | 500 mg qid | 1.50 |
| penicillin V | 300 mg qid | 0.30 |
| <i>Cephalosporins</i> | | |
| cephalexin | 500 mg qid | 1.80 |
| <i>Macrolides</i> | | |
| azithromycin | 250–500 mg daily | 1.25–2.50 |
| clarithromycin | 250–500 mg bid | 2.25–3.25 |
| <i>Fluoroquinolones</i> | | |
| ciprofloxacin | 250–750 mg bid | 1.40–2.50 |
| levofloxacin | 500–750 mg daily | 3.50–6.50 |
| moxifloxacin | 400 mg daily | 1.50 |
| <i>Others</i> | | |
| clindamycin | 450–600 mg tid | 1.50–3.00 |
| cotrimoxazole (TMP-SMX) | 1 DS (double strength) tab bid | 0.25 |
| doxycycline | 100 mg bid | 1.30 |
| nitrofurantoin (Macrobid [®]) | 100 mg bid | 1.50 |
| metronidazole | 500 mg tid | 0.35 |
| ANTIFUNGAL AGENTS | | |
| fluconazole | 100–400 mg daily | 5.55–22.20 |
| itraconazole | 200–400 mg daily | 8.00–16.00 |
| ANTIVIRAL AGENTS | | |
| acyclovir | 200–800 mg 5x/day | 5.00–16.00 |
| valacyclovir | 1 g tid | 5.25 |

- ^a Approximate cost per inpatient day excluding dispensing costs as of February 2017 based on the Manitoba Drug Interchangeability Formulary and Manufacturer's List Prices. Prices have been rounded