Antibiotics

Why and Why Not

2025

DALHOUSIE UNIVERSITY
FACULTY OF MEDICINE
Academic Detailing Service

nova scotia health
Drug Evaluation Unit

PLANNING COMMITTEE, ACKNOWLEDGEMENTS, AND DISCLOSURES

CONTENT DEVELOPMENT

Clinical Content Expert Reviewers

- Paul Bonnar MD FRCPC, Assistant Professor Division of Infectious Disease, Dalhousie University, Medical Director, Antimicrobial Stewardship Program, Nova Scotia Health
- Jeannette Comeau MD MSc FRCPC FAAP, Pediatric Infectious Diseases Consultant, Assistant Professor, Dalhousie University, Medical Director, Infection Prevention and Control, Medical Lead, Antibiotic Stewardship IWK Health Centre
- Jennifer Curran BSc, PharmD, ACPR, ACPR2, Clinical Pharmacy Specialist, Infectious Diseases, Co-lead Antimicrobial Stewardship Program
- Andrea Kent, BSc Pharm, PharmD, Clinical Pharmacy Coordinator & Co-Lead Antimicrobial Stewardship Program, Nova Scotia Health
- Valerie Murphy BSc Pharm, ACPR, Antimicrobial Stewardship Pharmacist, Nova Scotia Health, Central Zone
- Emma Reid BSc Pharm, ACPR, PharmD, Antimicrobial Stewardship Pharmacist, Emerging & Re-emerging Infections, Nova Scotia Health
- Mariah Hughes MD FRCPC, Assistant Professor Division of Infectious Diseases, Dalhousie University, Medical Director NSHA Infection Prevention and Control Long-Term Care
- Reema Alabulqadar MD, Antimicrobial Stewardship Fellow, Dalhousie University, Nova Scotia Health
- Sarah Burgess, BSc Pharm, ACPR, PharmD, BCCCP, Clinical Pharmacy Coordinator – Infectious Diseases, Nova Scotia Health, Central Zone

Clinical Content Editors

- Jennifer Fleming, BSc Pharm, ACPR, Drug Evaluation Unit, NSH
- Edith Baxter MD, CCFP, Clinical Director Academic Detailing Service
- Kelly MacKinnon, BSc Pharm, Director Academic Detailing Service
- Deanna Field, MD, CCFP, FCFP, Clinical Director Academic Detailing Service

CONTENT PLANNING

Family Physician Advisory Panel

- Ken Cameron BSc, MD, CCFP, Dartmouth, NS.
- Deanna Field MD, CCFP, FCFP, Truro, NS.
- Madeline Arkle MD, CCFP, Yarmouth, NS.
- Stephanie Omoifo MD, Little Harbour, NS.

CONTENT DELIVERY

Academic Detailers

- Denise Brownell BSc Pharm
- Janelle Gray BSc Pharm
- Holly d'Entremont BSc Pharm
- Shelagh Campbell-Palmer BSc Pharm
- Jodi Matlock BSc Pharm
- Julia Green BSc Pharm
- Graham MacKenzie BSc Pharm
- Colleen Donder BSc Pharm, ACPR
- Kelly MacKinnon BSc Pharm

Cite this document as:
Antibiotics Why and Why Not 2025
Dalhousie Academic Detailing Service, 2025
https://medicine.dal.ca/departments/core-units/cpd/programs/academic-detailing-service.html
Please direct correspondence to: Kelly MacKinnon Kelly.mackinnin@dal.ca

"Seek simplicity and distrust it."
Alfred North Whitehead

ACKNOWLEDGEMENTS

The Dalhousie Academic Detailing Service wishes to acknowledge the following:

- Kim Kelly, BSc Pharm, Drug Evaluation Unit, Nova Scotia Health (retired) for her contributions to the research and writing of the 2018 content which has been the foundation for this content update.
- Lori Connors MD, MEd, FRCPC, Associate Dean, Continuing Professional Development and Medical Education, Faculty of Medicine, Dalhousie University, for her review and comments in the Beta-Lactam Allergy section.
- Alex Pupek MD FRCPC, Adult Infectious Diseases Fellow, Dalhousie University, Nova Scotia Health, for his review of, and contributions to, the Lyme Disease section.
- Hannah MacConnell and Katie Halliday, pharmacy students working with the Nova Scotia Health Drug Evaluation Unit, for their contributions to the Antimicrobial Stewardship Resources section and drug dose tables.

DISCLOSURES

The Academic Detailing Service operates through the office of Continuing Professional Development and Medical Education, Faculty of Medicine, Dalhousie University and is funded by the Nova Scotia Department of Health and Wellness. Dalhousie University Office of Continuing Professional Development has full control over content.

The Drug Evaluation Unit, Nova Scotia Health provides drug evaluation support to the Nova Scotia Department of Health and Wellness and affiliated organizations.

Jennifer Fleming has no conflicts of interest.

Edie Baxter has no conflicts of interest.

Kelly MacKinnon has no conflicts of interest.

Deanna Field has no conflicts of interest.

Academic Detailers (see planning committee) have no conflicts of interest; except Colleen Donder who is employed by Canada's Drug Agency. Current work is related to newborn screening for drugs for rare diseases.

Paul Bonnar has been part of a Pfizer Canada virtual Medical Advisory Board meeting on Antimicrobial Resistance in Gram Negative Bacteria in Canada (2023), ongoing Canadian Institutes of Health Research (CIHR) grants and research, and ongoing research project on antimicrobial stewardship awareness in Canada with AXDEV Group Inc.

Jeanette Comeau has been part of funded clinical trials (GlaxoSmithKline inc., ModernaTX, Merck Canada, CanSino Biologics inc. & Barinthus Biotherapeutics, Sanofi Pasteur inc., Entos pharmaceuticals inc., VBI Vaccines, VIDO-interVAC) and funded grants [Canadian Institutes of Health Research (CIHR), Canadian Immunization Network (CIRN), Dalhousie Pharmacy Endowment fund, IWK Development grant].

Jennifer Curran has received funded grants for ongoing antimicrobial stewardship related research (Dalhousie Pharmacy Endowment fund, Translating Research into Care and is a collaborator on 'Implementation and evaluation of pharmacist-led assessment and prescribing for upper respiratory tract infections in community pharmacies' with a Shoppers Drug Mart research grant.

Andrea Kent has no conflicts of interest.

Valerie Murphy has no conflicts of interest.

Emma Reid is a member of Emerging and Re-Emerging Infections Therapeutics and Prophylactics Recommendation Group and a collaborator on 'Implementation and evaluation of pharmacist-led assessment and prescribing for upper respiratory tract infections in community pharmacies' with a Shoppers Drug Mart research grant.

Reema Alabulqadar has no conflicts of interest.

Mariah Hughes has no conflicts of interest.

Lori Connors has been part of advisory boards on asthma, atopic dermatitis, chronic urticaria, hereditary angioedema and nasal polyps (Astra Zeneca, BioCryst, GSK, Sanofi) and has done talks for Astra Zeneca and Sanofi on asthma and chronic urticaria.

Sarah Burgess has no conflicts of interest.

Alex Pupek has no conflicts of interest.

TABLE OF CONTENTS

TABLES, FIGURES AND APPENDIX

Tables

Figures

Appendices

ABBREVIATIONS

ACE	Angiotensin-converting-enzyme
AOM	Acute otitis media
AECOPD	Acute exacerbation of chronic obstructive pulmonary disease
Amox/Clav	Amoxicillin/clavulanic acid
AMR	Antimicrobial resistance
AMS	Antimicrobial stewardship
ASB	Asymptomatic bacteriuria
CAP	Community acquired pneumonia
COPD	Chronic Obstructive Pulmonary Disease
CPS	Canadian Paediatric Society
CDI	*Clostridioides difficile* infection
CrCl	Creatinine clearance
DCDT	Definitive conservative dental treatment
DIS	Drug Information System
DRESS	Drug reaction with eosinophilia and systemic symptoms
EM	Erythema migrans
GAS	Group A streptococcus
GCS	Group C streptococcus
GGS	Group G streptococcus
HGA	Human granulocytic anaplasmosis
IDSA	Infectious Diseases Society of America
I & D	Incision and drainage
IE	Infective endocarditis
IWK	Isaac Walton Killam
MSSA	Methicillin-sensitive *Staphylococcus aureus*
MRSA	Methicillin-resistant *Staphylococcus aureus*
NAAT	Nucleic acid amplification test
NSH	Nova Scotia Health
PCR	Polymerase chain reaction
POCT	Point of care test
PVR	Post-void residual
RADT	Rapid antigen detection test
rUTI	Recurrent uncomplicated urinary tract infection
SIRS	Systemic inflammatory response syndrome
SSTI	Skin and soft tissue infection
SMX/TMP	Sulfamethoxazole/Trimethoprim
TBI	Tick borne infection
TEN	Toxic epidermal necrolysis
TM	Tympanic membrane
UTI	Urinary tract infection
WBC	White blood cell

INTRODUCTION

This document is an update of the "Antibiotics Why and Why Not" 2018 academic detailing topic.

Included throughout this document

- Best practices for the management of common community-acquired bacterial infections based on updated evidence, local antimicrobial susceptibilities, and antimicrobial stewardship (AMS) principles.

- Clinical information for adult and pediatric populations reviewed by local clinical experts, applicable to both community-dwelling outpatients and long-term care residents.

- *Updated* content for acute respiratory tract infections, acute genitourinary infections, skin and soft tissue infections (SSTIs), and Lyme disease.

- *Newly added* content for adult dental abscess infections and infective endocarditis prophylaxis before dental procedures, *Clostridioides difficile* infections (CDI) in adults, and human granulocytic anaplasmosis (HGA).

ANTIBIOTIC DOSE RECOMMENDATION TABLES

Colors in dose tables indicate treatment choices:

Green = 1st line
Yellow = 2nd line
Orange = 3rd line

Within each color, antibiotics are randomly listed.

Not all antibiotics in each class are listed and others may be appropriate. For example:

- For adults, cefuroxime is generally listed to represent the 2nd generation cephalosporins; cefoxitin and cefprozil are also options.
- Clarithromycin generally represents the macrolide class; azithromycin is also an option.
- For children, cefprozil is preferred over cefuroxime, when possible, due to better taste.

Doxycycline is often prescribed as 100 mg twice daily in adults, as reflected in the dose tables; however, in keeping with Canadian prescribing information (product monographs), a 200 mg loading dose upon initiation of therapy is also a reasonable option.

Kidney Icon  : Drugs tagged with this symbol may require dose adjustment in people with impaired kidney function. Consult renal dosing references as needed and always use clinical judgement in deciding the appropriate dose.

Prices listed are approximate wholesale costs (no fees or mark-up) accessed online from McKESSON Canada in May 2025 (available at www.mckesson.ca). They do not take into consideration wastage in cases where a part vial is required for a dose.

BACKGROUND

Common microorganisms implicated in community-acquired bacterial infections

- Respiratory tract infections:
  - *Streptococcus pneumoniae*, *Haemophilus influenzae,* group A streptococcus (pharyngeal), *Mycoplasma pneumoniae,* depending on the site of infection.
  - **Most respiratory infections are caused by viruses and DO NOT require antibiotics.**

- Urinary tract infections (UTIs):
  - *Escherichia coli*.

- Skin and soft tissue infections (SSTIs):
  - β-hemolytic streptococci (groups A, B, C/G streptococci), *Staphylococcus aureus*.

Antimicrobial Resistance (AMR)

The ability to identify and stop antimicrobial misuse is essential to slow the emergence and spread of antimicrobial-resistant microorganisms and minimize the associated collateral damage.

- **Antimicrobial misuse** spreads across human, animal, and agricultural use and is a major driver to the global AMR crisis. Misuse of antimicrobials includes:
  - Unnecessary use: Prescribing when not indicated and of no benefit (e.g. viral infections).
  - Underuse: Not prescribing an antibiotic when needed to treat infection.
  - Inappropriate use: Incorrect antibiotic selection, dose, route, or duration.

- **Unnecessary and inappropriate antibiotic use** provides minimal patient benefit while still portending all the following risks, known as collateral damage:
  - Infections resistant to antimicrobials become harder to treat and are often linked to more severe outcomes and medical complications, sometimes death.
    - If the predicted proportion of infections resistant to first-line antimicrobials increased from 26% in 2018 to 40% by 2050, the number of deaths in Canada attributable to AMR would rise to 13,700 per year in Canada.[1]
    - Adverse events associated with antimicrobial therapy may occur in up to 25% of patients, ranging from self-limiting/transient to serious.[2] Examples include:
      - Gastrointestinal complications, such as nausea, diarrhea, and CDI.
      - Hypersensitivity reactions.
      - Other: Altered microbiome, renal injury, hematologic effects, hepatobiliary effects, neurological symptoms, and QT prolongation (most often associated with macrolides and fluoroquinolones).

- **Community antimicrobial susceptibility data across Nova Scotia** is accessible from **antibiograms**.
  - Isaak Walton Killam (IWK) Health Centre and Nova Scotia Heath (NSH) Firstline resources report local antibiogram data.
  - Primary care providers are encouraged to know their local patterns to help guide optimal antimicrobial prescribing.

Antimicrobial Stewardship (AMS)

AMS aims to improve antibiotic use with a focus on appropriate drug selection, dose, route, and duration of use.[3]

AMS strategies

- Prescribe antibiotics only when there is a **clear indication**.
  - Viral infections and some bacterial infections will resolve *without* antibiotics.
  - Use point of care tests (POCT) when appropriate.
  - Avoid treating positive cultures in the absence of signs and symptoms of infection (e.g. most asymptomatic bacteriuria).

- Consider providing a **delayed prescription** and advise patients to fill it only if symptoms are not resolved or condition worsens. Choosing Wisely's viral prescription pads are among their prescribing tools: https://choosingwiselycanada.org/primary-care/antibiotics/#prescriber-tools

- Prescribe the **most appropriate antibiotic.**
  - Limit the spectrum of activity to what is usually required to treat common pathogens.
  - In general, do not replace older antibiotics (narrower spectrum and less expensive) with newer drugs unless they are more effective or less toxic.
  - Reserve fluoroquinolones for severe infections due to their adverse events, importance for other indications (e.g., *ciprofloxacin is the only oral antibiotic option to treat Pseudomonas infection*), and concern of resistance from overuse.

- Use the proper **dose** of antimicrobial.
  - This may require high doses of some antibiotics.
  - Calculate weight-based dose in children.
  - Adjust dose in renal dysfunction as required.

- Treat for the shortest effective **duration** to minimize exposure of both pathogens and normal microbiota to antimicrobials and minimize development of resistance and/or adverse events.

- Document details of adverse events to avoid mislabeling as an allergy.

- Consider **recent antimicrobial use** as it increases the chance of resistance.
  - The highest risk is within a month of therapy but can persist for up to one year.
  - Risk increases with the number and duration of antimicrobial courses.

- Ensure vaccinations are up to date at clinic visits and offer as an intervention to reduce AMR. For more information refer to the NS Health 5-minute update report (Jan 2025) available from: https://library.nshealth.ca/ld.php?content_id=37424605.

References

1. Canadian Antimicrobial Resistance Surveillance System (CARSS): 2024 Key Findings. Public Health Agency of Canada. November 2024. Accessed on January 22, 2025 at: https://www.canada.ca/en/public-health/services/publications/drugs-health-products/canadian-antimicrobial-resistance-surveillance-system-2024-executive-summary.html
2. Mohsen S, Dickinson JA, Somayaji R. Update on the adverse effects of antimicrobial therapies in community practice. Can Fam Physician. 2020 Sep;66(9):651-659. Accessed Jan 23, 2025, at: https://www.cfp.ca/content/66/9/651
3. Nova Scotia Health Clinical Practice Supports, Health Care Providers. Antimicrobial Stewardship (AMS). Available from: https://library.nshealth.ca/AMS/About . Accessed 01/29/2025.

CONSIDERATIONS BEFORE STARTING ANTIBIOTICS

Reflect on the need and urgency of antibiotics for the specific syndrome.

Take an antibiotic history. If the patient has used an antibiotic within the last 3 months, consider selecting an antibiotic from a different class.

Understand your patient's risk factors for having a resistant microorganism. The following factors are associated with increased risk of resistance:

- Antibiotic use in past 3 months
- Exposure to children in daycare
- Recent travel/immigration from areas with high rates of antibiotic resistance
- Exposure to healthcare facilities

Consider a second line alternative therapy if:

- The risk of resistance to first line agent is high
- There is a higher risk of complication associated with treatment failure
- A patient has not responded to first line therapy
- A patient is unable to take first line therapy due to a true allergy, intolerance, or severe drug interaction

Inform patients about the adverse effects of the antibiotic and when to seek care.

Antimicrobial Stewardship (AMS) Clinical Resources

Nova Scotia

- The Isaak Walton Killam (IWK) Health Centre and Nova Scotia Heath (NSH) Antimicrobial Stewardship programs promote appropriate antimicrobial use and provide information on guidelines, pathogens, antimicrobials (selection, dose, duration), and local antibiogram data.
  - **NSH** (adults):
    - https://library.nshealth.ca/ams (healthcare provider website)
    - https://library.nshealth.ca/AntibioticAwareness (patient-friendly website)
    - https://firstline.org/nsha (Firstline)
  - **IWK** *(*pediatrics & women's health*)*: https://firstline.org/iwk/ (Firstline)

- Nova Scotia Health Vaccine Consult Service (8:30am-4:30pm, 7 days/week) Phone: 1-833-768-1151, Fax:1-902-425-6707, Email: VaccineConsult@nshealth.ca

Canada

- Choosing Wisely Canada: https://choosingwiselycanada.org/primary-care/antibiotics/
- Bugs & Drugs: https://bugsanddrugs.org/
- Patient information: https://antibioticwise.ca/
- RxFiles Academic Detailing: www.RxFiles.ca/ABX
- Public Health Ontario: https://www.publichealthontario.ca/en/Health-Topics/Antimicrobial-Stewardship

BETA (β)-LACTAM ALLERGY

This section is based on the Practical guide for evaluation and management of beta-lactam allergy: position statement from the Canadian Society of Allergy and Clinical Immunology 2020, and NSH and IWK Firstline content unless otherwise noted.[1-3]

Background

- Beta (β)-lactams include penicillins, cephalosporins, and carbapenems.
  - Penicillin refers to all agents in the penicillin class (e.g., penicillin V, ampicillin, amoxicillin, cloxacillin, piperacillin, etc.).

- **Do not avoid all β-lactams** in all patients reporting penicillin allergies.
  - Penicillin allergy is **over reported** and cross-allergy between penicillins and cephalosporins is **overestimated**.
    - ~10% of the population is labelled as penicillin allergic, but ~98% of these individuals are β-lactam tolerant when assessed appropriately.[1]

- **Cross-reactivity** risk between **penicillins and cephalosporins** is **low**.
  - For IgE mediated allergies, the cross reaction between penicillin and cephalosporins is mediated by similarities in the chemical side chains of penicillins and cephalosporins, rather than the β-lactam ring.
    - Table 2 may be used to identify β-lactams with similar side chains.

- **Cross reaction among cephalosporins** is **rare** and dependent on side-chain similarities.

- Individuals with any IgE-mediated allergy are 3 times more likely to have allergies to another, unrelated medication.

- A family history of a β-lactam allergy has **NOT** been shown to increase an individual's risk of allergy.

- Patients with a history of a penicillin allergy who have since taken and tolerated the medication are no longer considered allergic to that drug.

Allergy Assessment

- Since many people mistakenly attribute an adverse drug reaction as an allergy, it is important to clarify the type of reaction.
  - *IgE-mediated hypersensitivity reaction*
    - Usually occurs within 1 to 2 hours of taking the drug
  - *Non-IgE-mediated hypersensitivity reaction* may be non-serious (e.g., non-urticarial rash) or serious/life threatening [e.g., Stevens-Johnson syndrome, toxic epidermal necrolysis (TEN), drug reaction with eosinophilia and systemic symptoms (DRESS), drug-induced hypersensitivity syndrome, erythema multiforme, hemolytic anemia, interstitial nephritis, or hepatitis].
  - *Non-hypersensitivity reaction (drug related adverse effect)*
    - GI complications, headache, yeast infections, isolated itch, etc.

- Appropriate management varies based on the type of reaction; see *Table 1* below.

Table 1: Onset, symptoms, and management of β-lactam associated reactions

Reaction	Onset	Symptoms	Management Strategy
Hypersensitivity IgE mediated	Usually within 2 hours	Anaphylaxis, urticaria, angioedema, laryngeal edema, wheeze, hypotension	• Avoid reaction-provoking drug • Choose a β-lactam with a different side chain (see Figure 1) • Consider further evaluation of allergy status when feasible
Hypersensitivity Non-IgE mediated[a]	More than 72 hours	Non-serious[b] (e.g., pruritic maculopapular eruption)	*If an oral challenge is not possible:* • Choose a β-lactam with a different side chain (see Figure 1) • Consider further evaluation of allergy status when feasible *If resources permit:* • Consider an oral challenge
		Serious or life threatening[c] (e.g., Stevens-Johnson syndrome	AVOID all β-lactams
Non-hypersensitivity	Anytime	Gastrointestinal symptoms, flushing during infusion, headache, yeast infection, isolated itch	Not a contraindication to using a β-lactam

[a] Skin testing has no role in the diagnosis of non-IgE mediated reactions.
[b] More than 90% of rashes occurring after people take penicillin are mild non-IgE-mediated reactions.
[c] Serious or life threatening non-IgE mediated hypersensitivity reactions are rare with β-lactams.

Figure 1: Probable β-lactam IgE mediated cross-reactivities based on side chain similarities

Probable beta-lactam IgE mediated cross-reactivities based on side chain similarities

	Penicillin	Amoxicillin	Ampicillin	Cloxacillin	Piperacillin	Cephalexin	Cefadroxil	Cefazolin	Cefoxitin	Cefaclor	Cefprozil	Cefuroxime	Cefotaxime	Ceftriaxone	Cefixime	Ceftazidime	Meropenem	Ertapenem
Penicillin		X	X	X	X	X	X		X									
Amoxicillin	X		X	X	X	X	X			X	X							
Ampicillin	X	X		X	X	X	X			X	X							
Cloxacillin	X	X	X		X													
Piperacillin	X	X	X	X		X	X			X	X							
Cephalexin	X	X	X		X		X			X	X							
Cefadroxil	X	X	X		X	X				X	X							
Cefazolin																		
Cefoxitin	X											X						
Cefaclor		X	X		X	X	X				X							
Cefprozil		X	X		X	X	X			X								
Cefuroxime									X				X	X	X	X		
Cefotaxime												X		X	X	X		
Ceftriaxone												X	X		X	X		
Cefixime												X	X	X		X		
Ceftazidime												X	X	X	X			
Meropenem																		X
Ertapenem																	X	

X: Risk of IgE mediated cross reaction, use alternative

Penicillin Allergy De-Labeling

- When time permits, a thorough allergy assessment offers value in exploring the possibility of penicillin allergy de-labeling.
  - Penicillin, amoxicillin and 1st generation cephalosporins are safe, effective, and inexpensive antibiotics. Unnecessarily avoiding their use can result in therapy that is[3]
    - Less effective
    - More toxic
    - More costly
    - Associated with greater risk of developing antibiotic resistant microorganisms

Questions to ask during allergy assessment

What medication was prescribed and what was the indication and route of administration?

Has the medication been taken since? If so, was there a reaction?

How long ago was the reaction?
- Reactions in childhood or more than 10 years in the past may be less concerning

How many doses were received prior to the onset of the reaction?

How soon after the dose was taken did the reaction occur?

Was the medication stopped? How was the reaction managed? How long did the symptoms last?

Were any other medications taken at the same time?

What was the nature of the reaction, and associated signs and symptoms?
- Raised, erythematous, pruritic rash with each lesion typically lasting <24h (hives/urticaria)?
- Swelling of the tongue, mouth, lips, or eyes (angioedema)?
- Respiratory or hemodynamic changes (anaphylaxis)?
- Lesions or ulcers involving the mouth, lips, or eyes; skin desquamation (Stevens Johnson Syndrome, TEN, and other severe type IV reactions)?
- Organ involvement such as hematologic, renal, or hepatic (cytopenia's, acute interstitial nephritis, transaminitis)?
- DRESS syndrome, and other severe type IV reactions?
- Joint pain (serum sickness-like reaction)?
- Rashes that were not hives, were mild, or delayed in onset (mild type IV reaction or morbilliform rash)?
- Nausea, vomiting, diarrhea, minor lab abnormalities or local injection reactions?

- **Tools** are available to guide practitioners through **penicillin allergy de-labeling assessments.**
  - IWK Firstline (children and women's health)
    - https://firstline.org/iwk/
    - The tools available in the above link were developed by the BC Women's Hospital + Health Centre and are validated for use in pediatrics and in pregnancy.[5,6]
  - Nova Scotia Health (NSH) Firstline (adults)
    - https://firstline.org/nsha
    - The tools available in the above link were adapted from the BC Women's Hospital + Health Centre and IWK .
  - PEN-FAST[7] (adults)
    - https://www.mdcalc.com/calc/10422/penicillin-allergy-decision-rule-pen-fast
    - Point-of-care **risk assessment tool** to identify *adults at low risk* of penicillin allergy.

Oral Drug Challenge

- A direct oral drug challenge is the gold standard test and may be useful to clarify allergy status when used in *appropriate candidates*, including:
  - **Low-risk people** (e.g., history of a non-severe reaction 10 years or more prior).
  - People identified as such through penicillin allergy de-labeling tools.

- A single step oral challenge consists of one full dose followed by 60 minutes observation.
  - Adults: Amoxicillin 500 mg PO once
  - Children: Amoxicillin 15 to 30 mg/kg/dose PO once (max 500 mg/dose).
    - May use amoxicillin chewable tablets for convenience and to reduce cost.

- Alternatively, a graded oral drug challenge may be considered.
  - Administer 10% of the therapeutic dose and observe for 30 minutes.
  - If there are no symptoms by the end of 30 minutes of observation, administer the remaining 90% of the therapeutic dose and observe for an additional 60 minutes.

- Appropriate anaphylaxis management protocol and supplies must be available when administering a direct oral drug challenge, including epinephrine, antihistamines, glucocorticoids, and a short-acting inhaled bronchodilator metered dose inhaler with spacer.

- Update the medical record and Drug Information System (DIS) to remove allergy label(s) as appropriate following a successful challenge. Include names of drugs that were tolerated.
  - A letter template is available in Firstline to facilitate communication about penicillin allergy de-labeling with the rest of the healthcare team (Test Dose Outcome | Nova Scotia Health | Firstline; Test Dose Outcome | IWK Health Centre | Firstline).

- Counsel patients and families about their updated allergy status and ability to take the specific medication in the future.

When to consider referral to an Allergist

- If unable to rule in/out an IgE mediated allergy. For moderate to high-risk patients, penicillin skin testing may be considered before the challenge.

<table>
<tr><th>ADULT referrals</th><th>ADULT and PEDIATRIC referrals</th><th>PEDIATRIC referrals</th></tr>
<tr><td rowspan="2">Drug Allergy Clinic
Bayer's Lake Community Outpatient Centre
f: 902-473-8430</td><td rowspan="2">Halifax Allergy and Asthma Associates
5657 Spring Garden Road, Suite 503
Halifax, NS, B3J 3R4
t: 902-425-3927
f: 902-425-3928</td><td>IWK Allergy Clinic
t: 902-470-6554
f: 902-470-7308</td></tr>
<tr><td>East Coast Allergy
Dr. Laura Murphy
4 Forest Hills Parkway, Cole Harbour
t: 902-435-5530 (ext. 10)
f: 1-833-333-2679</td></tr>
</table>

References

1. Jeimy S, Ben-Shoshan M, Abrams EM, Ellis AK, Connors L, Wong T. Practical guide for evaluation and management of beta-lactam allergy: position statement from the Canadian Society of Allergy and Clinical Immunology. Allergy Asthma Clin Immunol. 2020 Nov 10;16(1):95.
2. Nova Scotia Health. Nova Scotia Health FirstLine App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/78-nova-scotia-health-authority
3. Nova Scotia Health. BL Allergy De-labeling Tool. Nova Scotia Health FirstLine App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/78-nova-scotia-health-authority/steps/129299-bl-allergy-de-labeling-tool?navigator=eJxdzLEKgCAYBOBXiZsdipbyOWqKECkrwfxDjYjw3dOxpoOPuxse-MkpZYWVuwLHRiki-_Mhw3bJW6yOzgMMQQeTvfdqOU3RERmfWE9kwR_oGbxq2sjS0MndZ_tciNxAXZctYhxfXrkt5g%3D%3D&show_draft=true
4. MacFadden DR, LaDelfa A, Leen J, Gold WL, Daneman N, Weber E, Al-Busaidi I, Petrescu D, Saltzman I, Devlin M, Andany N, Leis JA. Impact of Reported Beta-Lactam Allergy on Inpatient Outcomes: A Multicenter Prospective Cohort Study. Clin Infect Dis. 2016 Oct 1;63(7):904-910.
5. Roberts H, Soller L, Ng K, Chan ES, Roberts A, Kang K, Hildebrand KJ, Wong T. First pediatric electronic algorithm to stratify risk of penicillin allergy. Allergy Asthma Clin Immunol. 2020 Dec 4;16(1):103.
6. Wang J, Elwood C, Paquette V, Kwan N, Erdle S, Watt M, Van Schalkwyk J, Bone JN, Roberts A, Mak R, Wong T. Reliability and validation of an electronic penicillin allergy risk-assessment tool in a pregnant population. Allergy Asthma Clin Immunol. 2024 Oct 19;20(1):55.
7. Copaescu AM, Vogrin S, James F, et al. Efficacy of a Clinical Decision Rule to Enable Direct Oral Challenge in Patients With Low-Risk Penicillin Allergy: The PALACE Randomized Clinical Trial. *JAMA Intern Med.* 2023;183(9):944–952.

ACUTE PHARYNGITIS

This section is based on the Canadian Paediatric Society (CPS) "GAS pharyngitis: A practical guide to diagnosis and treatment" document, the IDSA Clinical Practice Guideline for the Diagnosis and Management of Group A Streptococcal Pharyngitis, and NSH and IWK Firstline unless otherwise noted.[1-4]

- Acute pharyngitis is typically a self-limited infection that resolves within 4 to 5 days.[1,5]

- Most adult (80-90%) and pediatric (>70%) cases are viral and do NOT require antibiotics.[5]

- Symptomatic management includes rest, fluids, regular hand washing, lozenges for adults, and analgesics (e.g. acetaminophen, ibuprofen).[5]

- A minority of cases are bacterial, with Group A Streptococcus (GAS) being the most common bacterial pathogen.[5]
  - Although GAS pharyngitis is typically self-limiting, confirmed GAS infection should receive an antibiotic to decrease the risk of complications, in particular acute rheumatic fever and pharyngeal abscess.[5]
  - Antimicrobials can decrease severity of symptoms and duration by ~ 1 day.[6]

- A clinical decision tool like the Modified Centor Score (Table 1)[7-8] can help predict the likelihood of GAS pharyngitis and direct the need for confirmatory testing and antibiotic therapy.
  - Confirm GAS pharyngitis diagnosis by throat swab culture, or a point of care test (POCT) such as a rapid antigen detection test (RADT) or nucleic acid amplification test (NAAT).
  - Do not routinely do a throat swab when people present with a sore throat if they have a cough, rhinitis, or hoarseness as they almost certainly have viral pharyngitis.[9]
  - Up to 20% of the pediatric population may carry GAS asymptomatically.[10]

- **"Do not routinely prescribe antibiotics unless the patient's modified Centor score is ≥ 2 AND throat swab culture or point of care test (POCT) confirms presence of GAS."** [11]

- Empiric antibiotic therapy prior to confirmatory testing is not recommended for most patients.
  - A delayed antibiotic prescription pending GAS confirmation is a reasonable strategy.
    - **Treatment started *within 9 days of symptom onset* effectively reduces the risk of rheumatic fever.**[1]
  - Exceptions to delayed antibiotics include: [1, 12]
    - Severely ill or systemic toxicity, suspected suppurative complications.
    - Those at increased risk of complications of acute rheumatic fever (e.g., immunocompromised, older adults with frailty, remote Indigenous communities, valvular heart disease, history of acute rheumatic fever).

Table 2: Modified Centor Score[7-8]

Criteria	Points
Temperature > 38^0 C	1
Absence of cough	1
Swollen tender anterior cervical lymph nodes	1
Tonsillar swelling or exudate	1
Age 3-14 years[a] Age 15-44 years Age ≥ 45 years	1 0 -1
Total Score[b]:	
IWK & NSH Suggested Management	
Total score ≤ 1: No throat swab or antibiotics. **Total score = 2:** Use clinical judgement (e.g., may test a patient with mild symptoms if they have a close contact who tested positive for GAS pharyngitis). **Total score ≥ 3:** Perform throat swab culture or POCT • A back-up culture is recommended in *children* ≤ 18 years old with a negative RADT. A negative NAAT does not require a back-up culture. • A back-up culture is NOT required in *adults* with a negative RADT due to low incidence of GAS pharyngitis and very low risk of rheumatic fever.[13] • If culture or POCT is **positive for GAS, TREAT with antibiotic** to ↓ the risk of complications. • In uncomplicated cases, if culture is **negative for GAS, STOP antibiotics** (if started).	

a. GAS pharyngitis is rare in children less than 3 years of age; testing is indicated only in outbreak settings, if a close contact tests positive for GAS, or when scarlet fever is suspected.
b. This scoring tool should not be used during epidemics or in high-risk populations, such as those with a history of rheumatic fever, valvular heart disease, or immunosuppression.
RADT=rapid antigen detection test; POCT=point of care test; NAAT = nucleic acid amplification test

- Group C streptococci (GCS) and group G streptococci (GGS) can cause pharyngitis, but rheumatic fever has **NOT** been associated with these infections.[14]
  - GCS and GGS are not detected by most POCT as they test for GAS specifically.
  - Antibiotics are **not routinely indicated** for GCS and GGS pharyngitis, but in severe presentations of culture-proven infections, antibiotics may reduce the clinical impact of the illness.
    - Antibiotic alternatives are the same as used for treatment of GAS, but local antimicrobial stewardship experts suggest a 5-day course to be adequate.

Antibiotic	PEDIATRIC Acute Pharyngitis	Cost/day
Penicillin V[a] No commercially available suspension	≤ 27 kg: 300 mg PO BID > 27 kg: 600 mg PO BID	$0.48 $0.97
Amoxicillin[b]	50 mg/kg/day once daily or divided PO BID (max 1000 mg/day)	$0.05/kg
Cefprozil	20 mg/kg/day divided PO BID (max 1000 mg/day)	$0.08/kg
Cefuroxime[c]	30 mg/kg/day divided PO BID (max 1000 mg/day)	$0.22/kg
Clarithromycin[d]	15 mg/kg/day divided PO BID (max 1000 mg/day)	$0.14/kg
Duration: 10 days		

[a] Penicillin V preferred 1st line (narrow spectrum, safe and low cost). No documented GAS resistance.
[b] Amoxicillin broader spectrum than required, but option in children where palatable liquid preferred.
[c] 1st line option if patient has experienced an IgE mediated amoxicillin reaction.
[d] If patient is unable to take any β-lactam (e.g., history of a delayed, severe, non-IgE mediated hypersensitivity reaction).
Increased GAS resistance to macrolides.

Antibiotic	ADULT Acute Pharyngitis	Cost/day
Penicillin V[a]	600 mg PO BID	$0.97
Amoxicillin[b]	500 mg PO BID	$0.26
Cephalexin	500 mg PO BID	$0.35
Cefuroxime[c]	500 mg PO BID	$1.66
Clarithromycin[d]	250 mg PO BID	$0.82
Duration: 10 days		

[a] Penicillin V preferred 1st line (narrow spectrum, safe and low cost). No documented GAS resistance.

[b] Amoxicillin broader spectrum than required.

[c] 1st line option if patient has experienced an IgE mediated amoxicillin reaction.

[d] If patient is unable to take any β-lactam (e.g. history of delayed, severe, non-IgE mediated hypersensitivity reaction).

Increased GAS resistance to macrolides.

RED FLAGS

- Symptoms should improve within 48-72 hours of starting treatment. If there is no treatment response, consider an alternative diagnosis or complication.

- Consider epiglottitis, peritonsillar abscess, or retropharyngeal abscess (suppurative complications of GAS infection) in people experiencing significant difficulties swallowing until proven otherwise, especially if associated with drooling, altered voice, or airway obstruction (stridor).

References

1. Sauve L, Forrester M, Top KA. Canadian Paediatric Society (CPS), Infectious Diseases and Immunization Committee. Group A streptococcal (GAS pharyngitis: A practical guide to diagnosis and treatment). Paediatr Child Health 2021;26(5):319. https://cps.ca/documents/position/group-a-streptococcal
2. Nova Scotia Health. Nova Scotia Health FirstLine App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/78-nova-scotia-health-authority .
3. Isaak Walton Killam Health Centre. Isaak Walton Killam Health Centre Firstline App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/7-iwk-health-centre .
4. Clinical Practice Guideline for the Diagnosis and Management of Group A Streptococcal Pharyngitis: 2012 Update by the Infectious Diseases Society of America Clinical Infectious Diseases, Volume 55, Issue 10, 15 November 2012, Pages e86–e102.
5. RxFiles "Acute Pharyngitis: Management Considerations" November 2024. https://www.rxfiles.ca/RxFiles/uploads/documents/ABX-Pharyngitis.pdf
6. Bugs & Drugs. bugsanddrugs.org/9C234740-DFE0-46A8-AF4D-2F001B0A4E79. Cited April 10, 2025, Content version 0.0.313 Apr 03, 2025. Alberta Health Services, Alberta Health, BC Ministry of Health, Pharmaceutical Services Division
7. McIsaac WJ; Kellner JD; Aufricht P et al. "Empirical Validation of Guidelines for the Management of Pharyngitis in Children and Adults". Journal of the American Medical Association. 2004;291 (13): 1587–1595.
8. Centor Score (Modified/McIsaac) for Strep Pharyngitis calculator https://www.mdcalc.com/centor-score-modified-mcisaac-strep-pharyngitis
9. Pavia A. Pharyngitis, Tonsillitis. Sanford Guide Online. Antimicrobial Therapy, Inc. Updated April 22, 2025. Available from: https://web.sanfordguide.com/en/sanford-guide-online/disease-clinical-condition/pharyngitis-exudative-diffuse. Accessed May 8, 2025.
10. Tanz RR, et al. Performance of a rapid antigen-detection test and throat culture in community pediatric offices: implications for management of pharyngitis. Pediatrics. 2009 Feb;123(2):437-44.
11. Choosing Wisely Canada, Primary Care, Using Antibiotics Wisely. https://choosingwiselycanada.org/primary-care/antibiotics/
12. Sykes EA, Wu V, Beyea MM, Simpson MT, Beyea JA. Pharyngitis: Approach to diagnosis and treatment. Canadian Family Physician. 2020 Apr 1;66(4):251-7.
13. https://www.cdc.gov/group-a-strep/hcp/clinical-guidance/strep-throat.html Cited April 3, 2025, U.S. Centers for Disease Control and Prevention. March 1, 2025
14. Rwebembera J, Cannon JW, Sanyahumbi A, Sotoodehnia N, Taubert K, Yilgwan CS, Bukhman G, Masterson M, Bruno FP, Bowen A, Dale JB, Engel ME, Beaton A, Van Beneden C. Research opportunities for the primary prevention and management of acute rheumatic fever and rheumatic heart disease: a National Heart, Lung, and Blood Institute workshop report. BMJ Glob Health. 2023 Oct;8(Suppl 9):e012356.

ACUTE OTITIS MEDIA

This section is based on IWK Firstline content and the CPS Position Statement on Management of acute otitis media in children 6 months of age and older, unless otherwise noted.[1,2]

These recommendations are NOT intended for treating children < 6 months of age, or for treating those with craniofacial abnormalities, immunocompromising conditions, tympanostomy tubes, or recurrent acute otitis media.

- Acute otitis media (AOM) is a common, **symptomatic** infection of the middle ear in pediatrics. AOM is *uncommon in adults.*

- Most cases of symptomatic infection **do not** require antibiotics as they spontaneously resolve. These cases are mild in presentation and are usually due to viruses or less virulent bacteria.

- The most common pathogens associated with AOM are *S. pneumoniae, H. influenzae, M. catarrhalis* and, less often, group A streptococci (GAS).
  - *M. catarrhalis* and some strains of *H. influenzae* are less virulent, causing a mild presentation that resolves rapidly whether treated with antibiotics or not.

Diagnosis

- Symptoms are often non-specific (e.g., fever, crying, irritability). Therefore, diagnosis depends on a **detailed examination of the middle ear to identify presence or absence of bacterial infection**.

- **Bacterial AOM is characterized by:**
  - Signs of middle ear **effusion** with any of the following:
    - A full or bulging tympanic membrane (TM)
    - Loss of bony landmarks or presence of an air-fluid level on the TM
    - Absence or significantly decreased motility of the TM with a pneumatic otoscope
  - Signs of middle ear **inflammation**
    - Distinct intense erythema or hemorrhagic patches over a bulging TM
    - Yellow TM
  - Images: https://medtube.net/otorhinolaryngology/medical-images/28128-acute-otitis-media

- An acutely ruptured TM in the setting of AOM should always be presumed to be caused by bacteria (usually GAS) and treated with oral antibiotics.
  - A bacterial culture should be done if pus is present in the ear canal.
  - **Current CPS guidelines do NOT include use of topical antibiotics as part of treatment of AOM with or without TM perforation.**
    - If there is chronic drainage, the diagnosis of chronic suppurative OM must be considered. Management of chronic suppurative OM is beyond the scope of this Academic Detailing topic.

- **Signs and symptoms** indicating a diagnosis **other than** AOM:
  - Chronic ear drainage
  - Isolated erythema or opacity of the TM
  - TM with limited mobility but no evidence of inflammation
  - Retracted or neutral position of TM

RED FLAGS indicating complicated AOM requiring emergent referral or hospital admission.

- Suspect acute **mastoiditis** in the presence of pain and/or swelling over the mastoid bone. There can be associated petrous bone inflammation that causes unilateral facial palsy (seventh cranial nerve) and/or diplopia on lateral gaze (sixth cranial nerve palsy).

- Venous sinus thrombosis or meningitis can manifest as a persistent or severe headache and/or cranial nerve palsies.

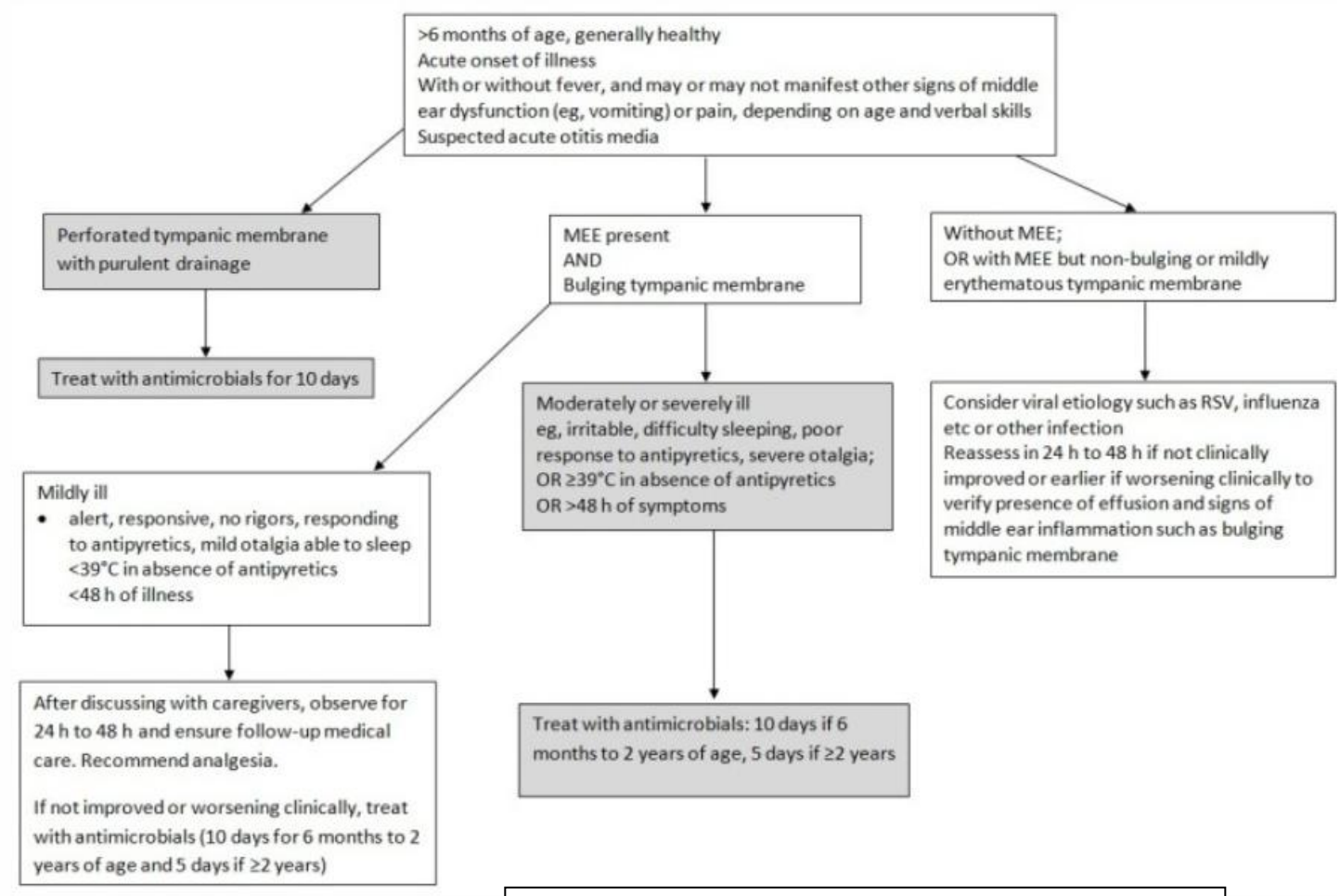
Management

- Figure 2 below describes the management of children greater than 6 months of age with suspected and confirmed AOM.[2]

- The CPS says, "All children with a perforated tympanic membrane who present with symptoms of AOM should be treated promptly with systemic antimicrobials and examined for associated complications."[2]

- When indicated, symptoms should improve within 24 hours and resolve within 2-3 days of starting an antibiotic.

Figure 2: **Flow diagram for the management of children with suspected and confirmed acute otitis media[2]**



Local Expert Opinion: Culture purulent discharge from a perforated tympanic membrane (TM)

MEE = Middle ear effusion; RSV = Respiratory syncytial virus

Copied with permission. Source: Le Saux N, Robinson J; Canadian Paediatric Society, Infectious Diseases and Immunization Committee. Management of acute otitis media in children six months of age and older. Paediatr Child Health 2016;21(1):39-44. https://cps.ca/en/documents/position/acute-otitis-media

Antibiotic	PEDIATRIC Acute Otitis Media (≥ 6 months of age)	Cost/kg/day
Amoxicillin	45-60 mg/kg/day divided PO TID (max 3000 mg/day) 75-90 mg/kg/day divided PO BID (max 3000 mg/day) 80-90 mg/kg/day[a] divided PO BID-TID (max 4000mg/day)	$0.05 – 0.06 $0.08 – 0.10 $0.09 – 0.10
Amox/Clav[b] 80mg/mL, 7:1 formulation	45-60 mg/kg/day divided PO TID (max 1500 mg/day) Dose based on amoxicillin component	$0.09 – 0.12
Cefprozil	30 mg/kg/day divided PO BID (max 1000 mg/day)	$0.12
Cefuroxime[c]	30 mg/kg/day divided PO BID (max 1000 mg/day)	$0.22
Clarithromycin[d]	15 mg/kg/day divided PO BID (max 1000 mg/day)	$0.14
Ceftriaxone[c]	50 mg/kg/day IM or IV once daily x 3 days Reserve for emergency department	Variable
Duration: **5 days for age ≥ 2 years** if no known complications **10 days for age 6 months to < 2 years, frequent, recurrent AOM, perforation or failed initial antibiotic**		

[a] Consider **high dose amoxicillin** for known or suspected drug-resistant *S. pneumoniae* (antibiotic use within past 3 months, daycare attendance and/or unimmunized or incompletely immunized).[2-3]

[b] Broader spectrum for amoxicillin treatment failure (symptomatic after 2-3 days of treatment).

[c] 1st line option if patient has experienced an IgE mediated amoxicillin reaction.

[d] If patient is unable to take any β-lactam (e.g., history of a delayed, severe, non-IgE mediated hypersensitivity reaction). **Increased *S. pneumoniae* resistance to macrolides.**

References

1. Isaak Walton Killam Health Centre. Isaak Walton Killam Health Centre Firstline App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/7-iwk-health-centre .
2. Le Saux N, Robinson JL. Canadian Paediatric Society (CPS), Infectious Diseases and Immunization Committee. Management of acute otitis media in children six months of age and older. Paediatr Child Health 2016;21(1):39-44. (Reaffirmed June 1, 2022; Last updated February 1, 2024). Available at https://www.cps.ca/en/documents/position/acute-otitis-media.
3. Toews S, LeBras M. Acute Otitis Media: Pediatric Management Considerations. RxFiles. January 2025.

ACUTE RHINOSINUSITIS

This section is based on NSH Firstline content, the NSH Antimicrobial Handbook, and IDSA guidelines unless otherwise noted.[1-3]

- **Most cases** of acute rhinosinusitis **are viral and DO NOT require antibiotics.**[4,5]

- Cardinal symptoms of acute rhinosinusitis include purulent nasal discharge and/or nasal obstruction, along with facial pain, pressure or fullness, or a reduced sense of smell.[5,6]
  - Individual symptoms such as purulent nasal discharge or facial pain cannot be used to accurately distinguish viral from bacterial causes.
    - Color of nasal discharge is **not indicative** of bacterial infection.
    - Sinus X-rays are **not routinely** recommended as they too cannot differentiate between viral and bacterial etiology.
    - Nasopharyngeal cultures are not recommended.

- Bacterial infection:
  - Occurs in ~ 0.5-2% of adults[7] and ~ 10% of children[8] (potential overestimate as diagnosis is difficult to confirm).
  - Often self-limiting and improves without antibiotics. Over 70% of adults will achieve cure after 14 days whether they receive antibiotics or not.[9]
  - Usually caused by *S. pneumoniae, H. influenzae* and *M. catarrhalis* (*M. catarrhalis* more common in children).

- **The likelihood of viral vs bacterial infection depends on symptom duration and pattern over time**.
  - Bacterial infection is more likely when symptoms:
    - Persist for more than 10 days.
    - Worsen after 5-7 days of initial improvement.
    - Have severe onset or include high fever (39°C or greater) and purulent nasal discharge or facial pain lasting 3-4 days.

- **RED FLAGS** for urgent referral include:
  - Systemic toxicity
  - Altered mental status
  - Severe headache
  - Swelling of the orbit or change in visual acuity
  - Suspected orbital or intracranial complications.

- **Watchful waiting** and supportive care/symptom management are appropriate for otherwise healthy patients presenting with uncomplicated (no red flags) rhinosinusitis.
  - Consider providing a delayed prescription for antibiotics instructing them to fill it only if certain criteria are met (e.g., symptoms worsen in 2-3 days or fail to improve in 5-7 days).

- Symptomatic treatments include analgesics, saline nasal drops or rinses, warm facial packs, and intranasal corticosteroids.[4]

Antibiotic	PEDIATRIC Acute Bacterial Rhinosinusitis	Cost/kg/day
Amoxicillin	45-90 mg/kg/day divided PO TID (max 3000 mg/day)	$0.05 – 0.10
Amox/Clav[a] 80mg/mL, 7:1 formulation only	45-60 mg/kg/day divided PO TID (max 1500 mg/day) Dosing is based on the amoxicillin component	$0.09 – 0.12
Cefprozil	30 mg/kg/day divided PO BID (max 1000 mg/day)	$0.12
Cefuroxime[b]	30 mg/kg/day divided PO BID (max 1000 mg/day)	$0.22
Clarithromycin[c]	15 mg/kg/day divided PO BID (max 1000 mg/day)	$0.14
Duration: 5-7 days[10] 7-10 days may be considered if fever > 39°C or failure to respond to amoxicillin after 3-5 days.		

[a] For fever > 39°C or failure to respond to amoxicillin after 3-5 days.
[b] 1st line option if patient has experienced an IgE mediated amoxicillin reaction.
[c] If patient is unable to take any β-lactam (e.g., history of a delayed, severe, non-IgE mediated hypersensitivity reaction).
Increased *S. pneumoniae* resistance to macrolides.

Antibiotic	ADULT Acute Bacterial Rhinosinusitis	Cost/day
Amoxicillin	500 mg – 1000 mg PO TID[a]	$0.39 – 0.78
Amox/Clav[b]	875 mg PO BID	$1.11
Cefuroxime[c]	500 mg PO BID	$1.66
Clarithromycin[d]	500 mg PO BID	$1.66
Doxycycline[d]	100 mg PO BID	$0.93
Duration: 5 days in otherwise healthy individuals.[11]		

[a] Use higher dose if antibiotic use in past 3 months.[12]
[b] Broader spectrum for amoxicillin treatment failure.
[c] 1st line option if patient has experienced an IgE mediated amoxicillin reaction.
[d] If patient is unable to take any β-lactam (e.g., history of a delayed, severe, non-IgE mediated hypersensitivity reaction).
Increased *S. pneumoniae* resistance to macrolides and tetracyclines.

- Expect symptoms to improve but not completely disappear at the end of therapy. Some persistence of symptoms is **not** an indication for immediate prescription of a second antibiotic.

References

1. Nova Scotia Health. Nova Scotia Health FirstLine App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/78-nova-scotia-health-authority .
2. Nova Scotia Health. Nova Scotia Health Antimicrobial Handbook, Acute Sinusitis [Internet]. Nova Scotia, Canada; January 2025. Available from: https://library.nshealth.ca/ld.php?content_id=37416483 .
3. Chow AW, Benninger MS, Brook I, Brozek JL, Goldstein EJ, Hicks LA, Pankey GA, Seleznick M, Volturo G, Wald ER, File TM Jr; Infectious Diseases Society of America. IDSA clinical practice guideline for acute bacterial rhinosinusitis in children and adults. Clin Infect Dis. 2012 Apr;54(8):e72-e112.
4. Theriault G, Ostrow O, Leis J, Grill A, Day D; Choosing Wisely Canada and The College of Family Physicians of Canada. The Cold Standard, A Toolkit for Using Antibiotics Wisely for the Management of Respiratory Tract Infections in Primary Care. 5th edition. Available at: https://choosingwiselycanada.org/toolkit/the-cold-standard/ Last updated May 2024.
5. Fokkens WJ, Lund VJ, Hopkins C, Hellings PW, Kern R, Reitsma S, et al. European Position Paper on Rhinosinusitis and Nasal Polyps 2020. Rhinology. 2020 Feb 20;58(Suppl S29):1-464.
6. Rosenfeld RM, Piccirillo JF, Chandrasekhar SS et al. Clinical practice guideline (update): adult sinusitis. *Otolaryngol Head Neck Surg.* 2015;152(2 suppl):S1-S39.
7. Gwaltney JM Jr, Phillips CD, Miller RD, et al. Computed tomographic study of the common cold. *NEJM* 1994;330:25–30.
8. M. LeBras, L. Kosar. Acute Rhinosinusitis: Management Considerations. RxFiles. May 2024.
9. Lemiengre MB, van Driel ML, Merenstein D, Liira H, Mäkelä M, De Sutter AIM. Antibiotics for acute rhinosinusitis in adults. Cochrane Database of Systematic Reviews 2018, Issue 9. Art. No.: CD006089. DOI: 10.1002/14651858.CD006089.pub5.
10. Isaak Walton Killam Health Centre. Isaak Walton Killam Health Centre Firstline App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/7-iwk-health-centre .
11. Falagas ME, Karageorgopoulos DE, Grammatikos AP, Matthaiou DK. Effectiveness and safety of short vs. long duration of antibiotic therapy for acute bacterial sinusitis: a meta-analysis of randomized trials. Br J Clin Pharmacol 2009. 67(2):161-171.
12. Bugs and Drugs. https://www.bugsanddrugs.org/787AF3B6-A09B-46A4-920F-B28C01B49950 . Cited June 4, 2025.

ACUTE BRONCHITIS

This section is based on NSH Firstline content unless otherwise noted.[1]

- Acute bronchitis is viral and **DOES NOT require antibiotics**.[1,2] However, many patients receive antibiotics despite **no benefit** and increased **adverse effects**.

Diagnosis

- Acute bronchitis is inflammation of the large and mid-airways that presents with **acute cough** (with or without sputum, lasts 10 days to 3 weeks, sometimes longer) in absence of chronic obstructive pulmonary disease (COPD).

- **Fever, tachycardia, tachypnea, hypoxia are uncommon** and suggest an alternative diagnosis (e.g. influenza or pneumonia).

- No signs of pneumonia on physical exam. Acute bronchitis can cause wheeze.

RED FLAGS: New-onset fever, difficulty breathing, symptoms lasting greater than 3 to 4 weeks, or bloody sputum.

- It is important to rule out alternative diagnoses, such as pertussis (paroxysms of coughing, inspiratory whoop, or post-tussive emesis).

- Imaging is NOT routinely indicated but may be warranted in select patients, including those with:
  - Concern of pneumonia (See page 29)
  - Certain comorbidities (e.g. impaired lung function, smoking history, immunocompromise, or chronic heart disease)

Management

- **No evidence of pneumonia, no role for antibiotics**

Endpoint	RR (95% CI)[3]
Clinical improvement at follow-up	1.07 (0.99 to 1.15); no significant difference between antibiotics & placebo
Adverse effects in the antibiotic group	(1.05 to 1.36); NNH=24, primarily GI related
RR = relative risk; CI = confidence interval; NNH = numbers needed to harm; GI = gastrointestinal	

- Consider
  - Supportive care measures such as reassurance, humidifier, honey, and cough suppressants.
    - Evidence is limited, but risk of harm is low.[4]
  - Optimizing preventative strategies such as education and support for smoking cessation, and vaccination (when indicated).
  - Other causes of cough lasting more than 3 weeks with normal X-ray such as gastroesophageal reflux disease, postnasal drip, asthma, and ACE inhibitor use.

References
1. Nova Scotia Health. Nova Scotia Health FirstLine App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/78-nova-scotia-health-authority .
2. Choosing Wisely Canada, Primary Care, Using Antibiotics Wisely. https://choosingwiselycanada.org/primary-care/antibiotics/
3. Smith SM, Fahey T, Smucny J, Becker LA. Antibiotics for acute bronchitis. Cochrane Database of Systematic Reviews 2017, Issue 6. Art. No.: CD000245. DOI: 10.1002/14651858.CD000245.pub4.
4. LeBras M, Kosar L. Acute Bronchitis: Management Considerations. RxFiles. November 2024.

ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (AECOPD)

This section is based on NSH Firstline, NSH Antimicrobial Handbook, and 2024 GOLD Guidelines unless otherwise noted.[1-3]

- The chronic and progressive course of chronic obstructive pulmonary disease (COPD) is interspersed with **acute exacerbations**.
  - Acute exacerbation of chronic obstructive pulmonary disease (AECOPD) is defined as an acute, sustained worsening of dyspnea, cough, and/or sputum production.
  - Sustained implies a change from baseline lasting 48 hours or more.

- Causes of acute exacerbations
  - Viral in 30-50% of exacerbations[4]
    - Rhinovirus is most common
    - Influenza during periods of increased influenza activity
    - COVID-19
  - Bacteria
    - *H. influenzae*
    - *S. pneumoniae*
    - *M. catarrhalis*
  - Non-infectious
    - Irritants, allergens, pollution
    - Pulmonary embolism
    - Heart failure
    - Pleural effusion

Management

- Outpatient management is recommended for mild to moderate exacerbations (no red flags).

- **RED FLAGS for hospitalization:**
  - Severe symptoms (e.g. sudden worsening of resting dyspnea, high respiratory rate, hypoxia, confusion, drowsiness)
  - Acute respiratory failure
  - Onset of new physical signs (e.g. cyanosis, peripheral edema)
  - Failure to respond to outpatient/initial medical management
  - Presence of serious comorbidities (e.g. heart failure, newly occurring arrhythmias).

- Pharmacologic therapies include:
  - An increase in dose &/or frequency of inhaled **short-acting bronchodilators** (β_2 agonist +/- anticholinergics ideally delivered by metered dose inhaler + valve holding chamber).
    - Adequate to improve symptoms in mild exacerbations.
  - Corticosteroid (prednisone 50mg or equivalent orally daily for 5 days[5-6]).
  - Antiviral therapy in some cases (in addition to routine COPD management).
    - Influenza positive: consider oseltamivir, avoid inhaled zanamivir.
    - COVID-19 positive: Complete “Report and Support form” to initiate assessment process for antiviral therapy: https://c19hc.nshealth.ca/self-report/s2.php

- Antibiotics recommended **if increased sputum purulence** *with* increased dyspnea *or* increased sputum volume.
  - Antibiotic recommendations differ if AECOPD is precipitated by pneumonia. (confirmed by new changes on chest x-ray); see page 30 for pneumonia options.
  - **Macrolides are not recommended** as first line empiric therapy due to poor *Haemophilus* coverage and high rates of *S. pneumoniae* resistance.
  - **Fluoroquinolones should be reserved** for severe cases or failure with first line options due to concerns regarding resistance and CDI.
  - C reactive protein and white blood cell (WBC) count are not helpful in determining antibiotic need as they can be elevated in both bacterial and viral cases.

Antibiotic	ADULT AECOPD	Cost/day
< 4 exacerbations in the past year		
Amoxicillin	500 mg PO TID	$0.39
Cefuroxime[a]	500 mg PO BID	$1.66
SMX/TMP[b,c]	800 mg/160 mg (1 DS tablet) PO BID	$0.45
Doxycycline[b]	100 mg PO BID	$0.93
Clarithromycin[b,d]	500 mg PO BID	$1.66
≥ 4 exacerbations in the past year, or one of the following: Treatment failure[e], recent antibiotics, home oxygen, or chronic systemic steroid use		
Amox/Clav	875 mg PO BID	$1.11
Ceftriaxone[a]	1 g IV daily	$12.50
Levofloxacin[b,f]	750 mg PO once daily	$6.55
Moxifloxacin[b,f]	400 mg PO once daily	$1.52
Duration: 5 days[5-6] Expect symptoms to improve but not completely resolve at the end of therapy. Complete resolution may take several weeks.		

[a] 1st line option if patient has experienced an IgE mediated amoxicillin reaction.
[b] If patient is unable to take any β-lactam (e.g., history of a delayed, severe, non-IgE mediated hypersensitivity reaction).
[c] Regular monitoring of kidney function and electrolytes recommended for patients at risk of hyperkalemia, such as those with: baseline renal dysfunction, age > 65 years, prolonged duration of SMX/TMP therapy, concomitant therapy with ACE inhibitors, angiotensin receptor blockers, or potassium sparing diuretics.
[d] **Macrolides are less effective** against *H. influenzae* and *S. pneumoniae*; Reserve for when unable to use other options.
[e] Treatment failure defined as: Clinical deterioration over 72 hours or no improvement after completion of first line treatment.
[f] **Reserve fluroquinolones** for treatment failure or if patient is unable to take other treatment options and no fluroquinolone use in previous 3 months.

- Review strategies to decrease the risk of recurrence such as
  - Optimal use of maintenance medications and inhaler technique
  - Smoking cessation
  - Vaccinations (e.g. influenza, COVID-19, pneumococcal), pulmonary rehabilitation
  - The INSPIRED program: https://www.nshealth.ca/clinics-programs-and-services/copd-inspired-copd-outreach-program-and-copd-care-and-education-nova

References

1. Nova Scotia Health. Nova Scotia Health FirstLine App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/78-nova-scotia-health-authority
2. Nova Scotia Health. Nova Scotia Health Antimicrobial Handbook. Acute Exacerbation of Chronic Obstructive Pulmonary Disease [Internet]. Nova Scotia, Canada; August 2023. Available from: https://library.nshealth.ca/ld.php?content_id=36906350 .
3. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2024. [Internet]. Available from: https://goldcopd.org/2024-gold-report/
4. Sanford Guide. (2025). Sanford Guide to Antimicrobial Therapy (Version 7.0.5) [Mobile application software]. Retrieved from [Sanfordguide.com/products/antimicrobial/digital/mobile], Accessed April 2025.
5. Theriault G, Ostrow O, Leis J, Grill A, Day D; Choosing Wisely Canada and The College of Family Physicians of Canada. The Cold Standard, A Toolkit for Using Antibiotics Wisely for the Management of Respiratory Tract Infections in Primary Care. 5th edition. Available at: https://choosingwiselycanada.org/toolkit/the-cold-standard/ Last updated May 2024.
6. Leuppi JD, Schuetz P, Bingisser R et al. Short-term vs conventional glucocorticoid therapy in acute exacerbations of chronic obstructive pulmonary disease: the REDUCE randomized clinical trial. *JAMA* 2013 Jun 5;309(21):2223-31.

ADULT COMMUNITY ACQUIRED PNEUMONIA (CAP)

This section is based on NSH Firstline content and the NSH Antimicrobial Handbook unless otherwise noted.[1-2]

- Many microorganisms cause CAP, including viruses and bacteria.

- The usual causative bacterial microorganism is *S. pneumoniae.*
  - *H. influenzae* is relatively uncommon; β-lactamase production occurs in < 22% of cases.[3]
  - Overall, atypical microorganisms (e.g., *Mycoplasma pneumoniae, Chlamydia pneumoniae, Legionella pneumoniae*) are *NOT* a common etiology, but there may be *intermittent periods* of increased atypical infections requiring antibiotic coverage.

Diagnosis

- Diagnosis is based on clinical presentation AND infiltrate on chest x-ray.
  - Clinical symptoms suggestive of CAP include fever, cough, sputum production, pleuritic chest pain, dyspnea, tachypnea, and tachycardia.
  - Physical findings consistent with consolidation (e.g., dullness to percussion, increased tactile fremitus, reduced normal vesicular breath sounds, and increased bronchial breath sounds)[4]

- Consider alternative diagnoses such as influenza, acute bronchitis, congestive heart failure, pulmonary embolism, and AECOPD.

- Patients who show an initial lack of infiltrate on x-ray should be advised to seek reevaluation if symptoms worsen within 48 to 72 hours, at which time the chest x-ray should be repeated.

Management

- Need for hospitalization can be guided by clinical judgement or the **CRB-65** score (see Table 3).[5]

Table 3: CRB-65 score[5]

CRB-65	
Criteria	**Points**
Confusion: based on a specific mental test or new disorientation to person, place, time	1
Respiratory rate ≥ 30 breaths/minute	1
Low **B**lood pressure (systolic < 90 mm Hg; or diastolic ≤ 60 mmHg)	1
Age ≥ **65** years	1

Score[a]	**Management setting**
0 (plus O_2 sat > 92% on room air)	Can be treated as outpatients
1 - 2	Consider admission to hospital ward
3 - 4	Often require ICU care

[a] Ratings may change over a short period of time and repeat assessments over several hours may be necessary.

- Management of outpatients and those admitted to non-ICU hospital wards
  - **Routine coverage of *atypical bacteria* with a macrolide has not been proven to be of benefit in outpatients or those admitted to non-ICU hospital wards.**[6]
  - Modifications to and/or expert advice on the recommendations below should be considered in patients at risk for antimicrobial resistant microorganisms (e.g. recent antimicrobial therapy or structural lung disease).
  - Referral/expert advice is recommended for patients with significant immunocompromise. Alteration of choice of empiric therapy may be required. This includes patients with:
    - Recent/current use of immunomodulating drugs
    - Human Immunodeficiency Virus with low (known/suspected) CD4 count
    - Solid organ transplantation
    - Stem cell transplantation
    - Chemotherapy-associated neutropenia

Antibiotic	ADULT CAP	Cost/day
CRB-65 score 0 plus O_2 sat > 92% on room air → can be managed in **OUTPATIENT setting**		
Amoxicillin	500 mg to 1000 mg PO TID	$0.39 – 0.78
Cefuroxime[a]	500 mg PO BID	$1.66
Doxycycline[b,c]	100 mg PO BID	$0.93
Levofloxacin[b,d]	750 mg PO once daily	$6.55
Moxifloxacin[b,d]	400 mg PO once daily	$1.52
CRB-65 score 1-2 → *consider* admission to **HOSPITAL (NON-ICU)**		
Amoxicillin	500 mg to 1000 mg PO TID	$0.39 – 0.78
Ampicillin	2 g IV q6h	$44.92
Cefuroxime[a]	500 mg PO BID or 750 mg IV q8h	$1.66/$78.35
Ceftriaxone[a]	1 g IV once daily	$12.50
Levofloxacin[b,d]	750 mg PO/IV once daily	$6.55/$60.05
Moxifloxacin[b,d]	400 mg PO/IV once daily	$1.52/$43.54
Atypical coverage is NOT routinely required. Consider atypical coverage with the *addition of one of the following* if not receiving a fluoroquinolone and: Strong suspicion of atypical pathogens, not responding to β-lactams, age ≥ 65 years, or comorbidities (e.g., chronic heart, lung, liver, or renal disease, diabetes mellitus, alcohol dependence, or immunosuppression).		
Doxycycline	100 mg PO BID	$0.93
Clarithromycin[e]	500 mg PO BID	$1.66
Duration: 5 days[7]		

[a] 1st line option if patient has experienced an IgE-mediated amoxicillin reaction.
[b] If patient is unable to take any β-lactam (e.g., history of a delayed, severe, non-IgE mediated hypersensitivity reaction)
[c] **Increased *S. pneumoniae* resistance.**
[d] Reserve for treatment failure (worsening after 72 hours or no response after therapy completion) or unable to take other treatment options and no fluoroquinolone use in the previous 3 months.
[e] Macrolides *alone are not* a 1st line option due to **poor *S. pneumoniae* coverage.**

References

1. Nova Scotia Health's Firstline app https://app.firstline.org/en/clients/78-nova-scotia-health-authority
2. Nova Scotia Health. Nova Scotia Health Antimicrobial Handbook, Community Acquired Pneumonia in Adults [Internet]. Nova Scotia, Canada; July 2020. Available from https://library.nshealth.ca/ld.php?content_id=35148941.
3. Nova Scotia Health Microbiology Lab communication from Dr Ian Davis to Dr. Paul Bonnar, May 8, 2025.
4. Le Saux N, Robinson JL. Canadian Paediatric Society (CPS), Infectious Diseases and Immunization Committee. Uncomplicated pneumonia in healthy Canadian children and youth: Practice points for management. Updated by Barton-Forbes M, Viel-Theriault I, Penner J in March 2024. Available at https://cps.ca/documents/position/pneumonia-management-children-youth
5. Bauer TT, Ewig S, Marre R, Suttorp N, WElte T, CAPNETZ Study Group. CRB-65 predicts death from community-acquired pneumonia. J Intern Med. 2006;260(1):93-101.
6. Postma, D. F. et al. Antibiotic treatment strategies for community-acquired pneumonia in adults. N Engl J Med 2015; 372: 1312-1323.
7. Metlay JP, Waterer GW, Long AC, Anzueto A, Brozek J, Crothers K, Cooley LA, Dean NC, Fine MJ, Flanders SA, Griffin MR, Metersky ML, Musher DM, Restrepo MI, Whitney CG. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019 Oct 1;200(7):e45-e67.

PEDIATRIC COMMUNITY ACQUIRED PNEUMONIA (CAP)

This section is based on the CPS Uncomplicated pneumonia in healthy Canadian children and youth: Practice points for management guidelines and IWK Firstline content unless otherwise noted.[1-2]

- Viruses are the most frequent cause of pneumonia in the first 5 years of a child's life. Viruses as a sole cause of pneumonia are less common in older children, apart from influenza.

- When bacterial
  - *S. pneumoniae* is the most common pathogen.
  - GAS is less common.
  - *H. influenzae* type b is very rare due to vaccination.
  - *Mycoplasma pneumoniae* and *Chlamydophila pneumoniae* are more common causes in children > 5 years of age but occasionally cause pneumonia in younger children.

Diagnosis (bacterial pneumonia)

- Symptoms may be nonspecific, especially in infants and younger children.

- Common symptoms include acute onset of fever, cough, difficulty breathing, lethargy, and poor feeding or vomiting.
  - Chest or abdominal pain may also be prominent features.
  - Abrupt onset of rigors favours a bacterial cause.
  - *M. pneumoniae* is typically characterized by malaise and headache for 7 to 10 days before the onset of fever and cough, which then predominate.

- Children typically experience fever and tachypnea (determined by counting the respiratory rate for 60 seconds in a calm state).

Table 4: Age-specific criteria for tachypnea[1]

Age	Approximate normal respiratory rate	Upper limit for defining tachypnea
< 2 months	34 – 50	60
2 – 12 months	25 – 40	50
1 – 5 years	20 – 30	40
> 5 years	15 – 25	30

- Physical signs of consolidation include dullness to percussion, increased tactile fremitus, reduced normal vesicular breath sounds, and increased bronchial breath sounds – all of which may be difficult to detect in young children.

- Optimally, the diagnosis of bacterial pneumonia should be supported by a chest X-ray before starting antimicrobials.
  - It is difficult to differentiate bacterial pneumonia from other conditions such as viral infections or reactive airway disease based on clinical presentation alone.
  - In bacterial pneumonia, there is likely to be a much more visible presence of infiltrate in the lungs than viral pneumonia.

Management

- Most children with pneumonia can be managed as outpatients.

- Hospitalization is generally indicated if a child:
  - Has inadequate oral intake.
  - Is intolerant of oral therapy.
  - Has severe illness or respiratory compromise requiring oxygen.

- *Mycoplasma pneumoniae* infection in children may resolve spontaneously. Suspected or confirmed cases do not always require antibiotic treatment.
  - Features suggestive of *Mycoplasma pneumoniae* include:
    - Age > 5 years and
    - Features consistent with atypical pneumonia and
    - Not responding to β-lactam monotherapy

Antibiotic	PEDIATRIC Outpatient CAP (age > 3 months)	Cost/kg/day
Amoxicillin[a]	45-90 mg/kg/day divided PO TID (max 4000 mg/day)	$0.05 – 0.10
Cefprozil[b]	30 mg/kg/day divided PO BID (max 1000 mg/day)	$0.12
Cefuroxime[c]	30 mg/kg/day divided PO BID (max 1000 mg/day)	$0.22
Azithromycin[d,e]	10 mg/kg/day on **day 1** (max 500 mg/day), then 5 mg/kg/day PO daily x **4 days** (max 250 mg/day)	$0.15 – 0.30
Duration: 5 days[3-4]		
ADD one of the following for suspected *Mycoplasma pneumoniae*:		
Azithromycin[e]	10 mg/kg/day on **day 1** (max 500 mg/day), then 5 mg/kg/day PO daily x **4 days** (max 250 mg/day)	$0.15 – 0.30
Doxycycline[f]	4 mg/kg/day divided PO BID (max 200 mg/day) x **7 days**	$0.93 or less

[a] Use **higher dose** (75-90 mg/kg/day) if patient has any of the following risk factors for resistant *S. pneumoniae*[5]: Unimmunized or incompletely immunized, daycare attendance, use of antibiotics in the preceding 3 months.
[b] Cefprozil does not cover *S. pneumoniae* as well as amoxicillin and is not effective against *C. pneumoniae* and *M. pneumonia*.
[c] 1st line option if patient has experienced an IgE-mediated amoxicillin reaction.
[d] If patient is unable to take any β-lactam (e.g., history of a delayed, severe, non-IgE-mediated hypersensitivity reaction).
[e] **Increased *S. pneumoniae* resistance to macrolides but covers *C. pneumoniae* and *M. pneumoniae*.**
[f] For children with macrolide allergy.

References

1. Le Saux N, Robinson JL. Canadian Paediatric Society (CPS), Infectious Diseases and Immunization Committee. Uncomplicated pneumonia in healthy Canadian children and youth: Practice points for management. Updated by Barton-Forbes M, Viel-Theriault I, Penner J in March 2024. Available at https://cps.ca/documents/position/pneumonia-management-children-youth
2. Isaak Walton Killam's Health Centre's Firstline app https://app.firstline.org/en/clients/7-iwk-health-centre
3. Kuitunen I, Jääskeläinen J, Korppi M, Renko M. Antibiotic Treatment Duration for Community-Acquired Pneumonia in Outpatient Children in High-Income Countries-A Systematic Review and Meta-Analysis. Clin Infect Dis. 2023 Feb 8;76(3):e1123-e1128.
4. Pernica JM, Harman S, Kam AJ, Carciumaru R, Vanniyasingam T, Crawford T, Dalgleish D, Khan S, Slinger RS, Fulford M, Main C, Smieja M, Thabane L, Loeb M. Short-Course Antimicrobial Therapy for Pediatric Community-Acquired Pneumonia: The SAFER Randomized Clinical Trial. JAMA Pediatr. 2021 May 1;175(5):475-482.
5. RxFiles. "Community Acquired Pneumonia (CAP): Outpatient Management Considerations." July 2023. Available at https://www.rxfiles.ca/RxFiles/uploads/documents/members/ABX-CAP.pdf

URINARY TRACT INFECTIONS

This section is based on NSH Firstline and IWK Firstline content unless otherwise noted.[1-2]

Acute Uncomplicated Cystitis

- Cystitis is an infection of the bladder, usually caused by bacteria from the gastrointestinal tract entering the urethra and travelling up to the bladder.
  - The most common **infecting bacteria is *E. coli;*** others include *Proteus* and *Klebsiella* species.

- Acute uncomplicated cystitis is a clinical diagnosis in individuals who do not have complicated host factors and who present with typical signs and symptoms. These individuals include those who:
  - Have a vagina
  - Are not pregnant
  - Are not immunocompromised
  - Do not have poorly controlled diabetes
  - Do not have any structural or functional abnormalities of the genitourinary tract (e.g., obstruction, instrumentation, impaired voiding, surgery, gender affirming genital surgery)

- A **diagnosis** of acute uncomplicated cystitis is **dependent on** the presence of **symptoms** such as dysuria, urgency, frequency, suprapubic pain or tenderness.[3]
  - If dysuria, urgency, and frequency are present, there is an approximate 90% chance of an accurate clinical diagnosis.[3]
  - **Asymptomatic bacteriuria** (ASB) refers to colonizing bacteria present in the bladder, *not* causing symptoms or infection. **Antibiotics** are **not recommended** for most cases of ASB.

- Reliability of urine dipstick as a diagnostic tool is low due to inability to differentiate between infection and ASB, and as such, is not recommended as a diagnostic test for UTI.[3]

- **Urine culture** is **not** generally recommended unless:
  - Antibiotic use or UTI in the last 3-6 months
  - Suspected UTI in a host with complicating factors
  - Travel outside North America in the last 6 months
  - Recent hospitalization
  - History of a UTI caused by a multidrug resistant microorganism
  - Complicated UTI, including indwelling foley catheter
  - Failure to respond to empiric therapy after 48 hours
    - **Post treatment** urine cultures are **not routinely recommended if adequate response** to therapy.

- **RED FLAGS** - Symptoms suggesting a diagnosis other than acute uncomplicated cystitis include:
  - Fever, chills, nausea, or vomiting
  - Back pain, flank pain and tenderness
  - Perineal, penile or rectal pain, penile discharge, tender prostate on rectal examination
  - Vaginal discharge

- It is important to rule out infections that have extended beyond the bladder (e.g. pyelonephritis, prostatitis), otherwise known as complicated UTI, as they require different management.

- Classification of ***complicated UTI*** is not consistent; however, the 2 main groupings are UTIs:
  1. That may have **extended beyond the bladder** *(this is the preferred definition)*
  2. That occur in an individual with **host factors,** which may **increase the risk of** treatment failure, recurrence, or progression to severe infection. These factors include:
     - Pregnancy
     - Immunosuppression
     - Poorly controlled diabetes mellitus
     - Catheter use
     - Delayed or impaired voiding (neurogenic bladder, ileal conduit, etc.)
     - Structural or functional abnormality of urinary tract (strictures, congenital abnormalities, stones, surgery, including gender affirming surgery)
     - Recent urogenital procedure (stents, nephrostomy tubes, etc.)
     - Individuals with a penis
       **Individuals with a penis are at risk for infections that extend beyond the bladder. However, if infection does not extend beyond the bladder, assessment for anatomic abnormalities should be considered (strictures, stones, delayed/impaired voiding).*

- In infants and children,
  - For complete details, refer to the CPS position statement available at: https://www.cps.ca/en/documents/position/urinary-tract-infections-in-children
  - If symptoms suggest UTI (dysuria, urinary frequency, hematuria, abdominal pain, back pain or new daytime incontinence), or if unexplained fever in a preverbal child, it should be ruled out.[4]
    - In toilet-trained children, a midstream urine sample should be collected for urinalysis and culture.[4]
    - UTI is unlikely if urinalysis is normal (e.g. negative nitrites, leukocyte esterase and no pyuria or bacteriuria).[4]
    - A bagged urine sample may be used for urinalysis but not for urine culture.[4]

- **Management of acute uncomplicated cystitis**
  - Provide advice about managing symptoms with self-care.
    - Consider acetaminophen or ibuprofen for pain.
    - Maintain adequate fluid intake.
    - No evidence of benefit for cranberry products to treat a lower UTI.

Antibiotic	PEDIATRIC (age > 2 months; empiric) Acute Uncomplicated Cystitis	Cost/kg/day
Cephalexin	50 mg/kg/day divided PO QID (max 2000 mg/day)	$0.26
Cefixime[a]	8 mg/kg/day PO once daily (max 400 mg/day)	$0.16
SMX/TMP[a]	8 mg/kg/day divided PO BID (max 160 mg TMP/dose) Dose based on trimethoprim (TMP) component	$0.21
Duration: 5 to 7 days[b]		

[a] Option if patient has experienced an IgE mediated amoxicillin reaction

[b] Recommended duration if afebrile, not systemically ill, not recurrent, normal urinary tract anatomy, normal renal function and no history of resistant pathogens.

Antibiotic[a]	ADULT & Post-Pubertal Girls (empiric) Acute Uncomplicated Cystitis	Cost/course
NO host risk factors for complicated infection[f]		
Nitrofurantoin Monohydrate/Macrocrystals[b,e]	100 mg PO BID x **5 days**	$3.98
SMX/TMP[c,e]	800 mg/160 mg (1 DS tablet) PO BID x **3 days**	$1.35
Cephalexin	500 mg PO QID x **5-7 days**	$3.46 – 4.85
Fosfomycin[d,e]	3 g PO x **1 dose**	$15.23
Amox/Clav *If high risk of resistance*	875 mg PO BID x **5-7 days**	$5.55 – 7.77
Host risk factors for complicated infection[f]**, excluding pregnancy**		
Nitrofurantoin Monohydrate/Macrocrystals[b,e]	100 mg PO BID x **7 days**	$5.58
SMX/TMP[c,e]	800 mg/160 mg (1 DS tab) PO BID x **7 days**	$3.15
Cephalexin	500 mg PO QID x **7 days**	$4.85
Fosfomycin[d,e]	3 g PO q72h x **2 to 3 doses**	$30.46 – 45.69
Amox/Clav *If high risk of resistance*	875 mg PO BID x **7 days**	$7.77

[a] Other antibiotics are appropriate if culture confirms susceptibility. Moxifloxacin should not be used because it does not attain sufficient concentration in the urine.

[b] Nitrofurantoin should not be used in patients with CrCl < 30 ml/min, or pyelonephritis or prostatitis due to poor distribution into serum and tissue

[c] Regular monitoring of kidney function and electrolytes are recommended for patients at risk of hyperkalemia, such as those with baseline renal dysfunction, age > 65 years, prolonged duration of SMX/TMP therapy, concomitant therapy with ACE inhibitors, angiotensin receptor blockers, or potassium sparing diuretics.

[d] Fosfomycin should not be used in patients with pyelonephritis due to poor distribution into serum and tissue.

[e] Option if patient has experienced an IgE-mediated amoxicillin reaction.

[f] Risk factors: Immunosuppression, poorly controlled diabetes, catheter use, delayed/impaired voiding, structural/functional abnormality of urinary tract, recent urogenital procedure, individuals with a penis

Antibiotic	In PREGNANCY (empiric) Acute Uncomplicated Cystitis	Cost/Course
Cephalexin	500 mg PO QID x **7 days**	$4.85
Nitrofurantoin Monohydrate/Macrocrystals[a,b]	100 mg PO BID X **5 days** *DO NOT USE In Late 3rd Trimester*	$3.98
SMX/TMP[b]	800 mg/160 mg (1 DS tablet) PO BID x **3 days** *DO NOT USE in 1st OR 3rd trimester*	$1.35

[a] Nitrofurantoin should not be used in patients with CrCl < 30 ml/min.
[b] Option if patient has experienced an IgE-mediated amoxicillin reaction or is unable to take any β-lactam (e.g. history of a delayed, severe, non-IgE mediated hypersensitivity reaction).

- During pregnancy, it is important to repeat urine culture at appropriate interval for test of cure.

References:
1. Nova Scotia Health. Nova Scotia Health FirstLine App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/78-nova-scotia-health-authority
2. Isaak Walton Killam Health Centre. Isaak Walton Killam Health Centre Firstline App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/7-iwk-health-centre .
3. Bent S, Nallamothu BK, et.al. Does this woman have an acute uncomplicated urinary tract infection? JAMA 2002; 287(20):2701-10.
4. Robinson JL, Finlay JC, Lang ME, Bortolussi R. Canadian Paediatric Society, Community Paediatrics Committee, Infectious Diseases and Immunization Committee. Urinary tract infection in infants and children: Diagnosis and management. Paediatr Child Health 2014;19(6):315-19.

Recurrent Uncomplicated UTI (rUTI) in Adults

This section is based on the Recurrent Uncomplicated Urinary Tract Infections in Women: AUA/CUA/SUFU Guideline (2022), NSH Firstline, and Sonali et al.[1-3]

- The **management** of recurrent *uncomplicated* UTI (rUTI) in adults is discussed in this document.
  - In reporting treatment recommendations for rUTI, we recognize that many studies report "the epidemiology, pathogenesis, diagnosis, and treatment considerations for recurrent uncomplicated cystitis in the adult female population. Data on transgendered populations are lacking...[T]he impact of race, ethnicity and socioeconomic factors is poorly understood as most studies involve White female patients, or in many instances, demographics are not reported."[3]

- Recurrence is typically defined as ≥ 2 uncomplicated, culture positive UTIs in 6 months or ≥ 3 in 12 months.

- **Risk factors** for rUTI include:
  - Sexual activity
  - Spermicides
  - Genetics may play a role (e.g., 1st UTI prior to age 15, maternal history of UTI, first degree female relative with UTI)
  - Urinary incontinence
  - Post void residual
  - Vulvovaginal atrophy

- **Initial evaluation of rUTI:**
  - Evaluation of a patient with rUTI should include a focused history to assess symptoms and frequency of infections. A urine culture is required to distinguish rUTI from other conditions, such as overactive bladder, bladder pain syndrome, and genitourinary syndrome of menopause.
  - Assess for other urinary syndromes that put patients at risk of rUTI such as genitourinary atrophy, bladder outlet obstruction, incomplete voiding and vaginal prolapse.
  - If the above symptoms are present or uncertain, a pelvic exam should be performed.
  - If history suggests incomplete emptying or if history is uncertain, post-void residual (PVR) should be assessed by catheterization or bladder scan. In neurologically intact women a PVR > 150 mL is considered abnormal.
  - Upper tract imaging and urological evaluation are not routinely required but may be recommended if symptoms do not improve with appropriate treatment or if the history and physical exam suggests structural or functional abnormalities of the genitourinary tract.

- **Distinguishing rUTI from relapse:**
  - Relapse is classified as a recurrent episode within 2 weeks of a previous UTI.
    - This may be due to failure of antimicrobial therapy or a persisting nidus of infection, such as pyelonephritis or renal abscess.

- Requires repeat urine culture to assess for pathogen-drug mismatch and may need further evaluation for anatomical or functional abnormalities of the urinary tract.

- **Management of acute episode of rUTI:**
  - Antibiotic regimens and duration are the same as for uncomplicated cystitis (see page 36).
  - If empiric therapy is used initially, it should be tailored according to urine culture results.
  - A watch and wait strategy can be used for some patients with a prescription for antibiotics to fill, should symptoms worsen while awaiting culture results.
  - Patient-initiated ("pill-in-pocket") UTI treatment at the onset of symptoms may be appropriate for those with uncomplicated recurrence. Patients should contact their provider if symptoms are not completely resolved by 48 hours.

- **Optimize preventative strategies for rUTI:**
  - Adequate fluid intake with target of 2-3 liters daily
  - Pelvic floor physical therapy – if pelvic floor dysfunction causing incomplete emptying
  - Avoid spermicides
  - Vaginal estrogen should be considered during peri- and post-menopause. The selection of estrogenic products should be based on individual preference.
    - Systemic estrogen has not been shown to be effective in decreasing rUTI; however, the addition of vaginal estrogen can be used in people already taking systemic estrogen.
    - Vaginal estrogen has not been shown to increase risk of cancer recurrence in people undergoing treatment for or with a personal history of breast cancer; it can be considered as a prevention strategy in coordination with the individual's oncologist.
  - Cranberry products may decrease the proportion of rUTI. Recommended dose: 36-72 soluble proanthocyanidins (PACs) per day. Patients are advised to check labeling on cranberry products: representative doses of cranberry products studied range from ½-3 cups of juice daily or 500 mg tablet/day.

References:
1. Anger JT, Bixler BR, Holmes RS, Lee UJ, Santiago-Lastra Y, Selph SS. Updates to Recurrent Uncomplicated Urinary Tract Infections in Women: AUA/CUA/SUFU Guideline. J Urol. 2022 Sep;208(3):536-541.
2. Nova Scotia Health. Nova Scotia Health FirstLine App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/78-nova-scotia-health-authority
3. Advani SD, Thaden JT, Perez R, Stair SL, Lee UJ, Siddiqui NY. State-of-the-Art Review: Recurrent Uncomplicated Urinary Tract Infections in Women. Clin Infect Dis. 2025 Mar 17;80(3):e31-e42.

ASYMPTOMATIC BACTERIURIA (ASB)

This section is based on IDSA 2019 Guidelines & NSH Antimicrobial Handbook unless otherwise noted.[1-2]

- ASB is the presence of bacteria in the bladder **without symptoms** (dysuria, urgency, frequency, suprapubic or costovertebral pain or tenderness). Therefore, it is **NOT AN INFECTION**.

- Prescribing antibiotics for ASB does not improve outcomes and increases the risk of adverse drug reactions, CDI, and promotes the development of AMR.

- ASB is common in:
  - Long term care residents
    - ≥ 15%-50% of men
    - ≥ 25%-50% of women
  - Catheterized patients
  - Patients with an abnormal urinary tract

- **Screening for ASB and treating ASB with antibiotics are not recommended except in pregnancy or prior to an invasive genitourinary procedure**.[3,4]
  - Pregnant women should be screened once at the first prenatal visit with urine culture for asymptomatic bacteriuria.[3]
  - The treatment options for pregnant women with UTIs apply to the treatment of ASB in pregnancy (page 37).
  - It is important to repeat testing at an appropriate interval to check for cure.[5]

- Pyuria accompanying ASB is not an indication for antimicrobial treatment.[6]

- A patient with a chronic indwelling catheter will frequently have bacteriuria, but antibiotic treatment is only warranted if symptomatic.

- Changes in the character of the urine such as odor, color, or turbidity are associated with bacteriuria, but are not a reliable predictor of UTI and are usually due to other reasons, such as dehydration.[7]

- Acute symptoms may be difficult to recognize because of impaired communication, dementia, or comorbid illnesses.

- For older adults (non-catheterized or catheterized), without localizing urinary tract symptoms, the following signs/symptoms do NOT necessarily warrant investigation or treatment for UTI [7]:
  - Increased falls
  - Decreased appetite
  - Altered behavior
  - Confusion/disorientation

- Before attributing delirium to a UTI, always consider the following conditions[8]:
  - Dehydration
  - New medication/drug interactions
  - Trauma
  - Hypoxia
  - Hypoglycemia
  - Infections other than UTI

References

1. Nicolle LE, Gupta K, Bradley SF, Colgan R, DeMuri GP, Drekonja D, Eckert LO, Geerlings SE, Köves B, Hooton TM, Juthani-Mehta M, Knight SL, Saint S, Schaeffer AJ, Trautner B, Wullt B, Siemieniuk R. Clinical Practice Guideline for the Management of Asymptomatic Bacteriuria: 2019 Update by the Infectious Diseases Society of America. Clin Infect Dis. 2019 May 2;68(10):1611-1615.
2. Nova Scotia Health. Nova Scotia Health Antimicrobial Handbook Asymptomatic Bacteriuria [Internet]. Nova Scotia, Canada; May 2024 [cited 2025 Mar 28]. Available from: https://library.nshealth.ca/ld.php?content_id=34803542.
3. Reproductive Care Program of Nova Scotia. Guidelines for Antenatal Screening and Testing [Internet]. Nova Scotia, Canada; July 2024 [cited 2025 Mar 27]. Available from: http://rcp.nshealth.ca/clinical-practice-guidelines/antenatal-laboratory-screening-testing.
4. Nova Scotia Health Firstline app https://app.firstline.org/en/clients/78-nova-scotia-health-authority
5. Isaak Walton Killam's Health Centre's Firstline app https://app.firstline.org/en/clients/7-iwk-health-centre.
6. Fekete T, Lazarus J. Asymptomatic bacteriuria in adults [Internet]. UpToDate; 2024 [cited 2025 Mar 28]. Available from: https://www.uptodate.com/contents/asymptomatic-bacteriuria-in-adults
7. Blondel-Hill E, Patrick D, Nott C, Abbass K, Lau T, German G. AMMI Canada position statement on asymptomatic bacteriuria. Official Journal of the Association of Medical Microbiology and Infectious Disease Canada. March 2018;3(1):4-7.
8. Blondel-Hill E. Understanding Asymptomatic Bacteriuria [Internet]. British Columbia, Canada: BC Provincial Academic Detailing Service; April 2016 [cited March 28, 2025]. Available from: https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/provincial-academic-detailing-service/asymptomatic-bacteriuria-newsletter.pdf .

SKIN AND SOFT TISSUE INFECTIONS (SSTI)

This section is based on the advice of NSH & IWK Infectious Diseases & AMS experts, NSH & IWK Firstline, & NSH Antimicrobial Handbook unless otherwise noted.[1-3]

- SSTIs are classified as uncomplicated (simple) or complicated (necrotizing or non-necrotizing) and can involve the skin (epidermis and dermis), subcutaneous tissue (hypodermis), fascia, and muscle. SSTIs can also be grouped by purulent or non-purulent infections. This section focuses on *uncomplicated SSTIs.*

- Predisposing risks for SSTIs include:
  - Trauma (laceration, abrasion, shaving injury, bite)
  - Underlying skin condition (ulcer, tinea infections, psoriasis)
  - Vascular disease (peripheral arterial disease, venous stasis)
  - Prior SSTI
  - Lymphedema
  - Saphenous vein harvesting
  - Diabetes, obesity

- **RED FLAGS** for complicated SSTI include:
  - Signs of rapid deterioration, septicemia, shock or confusion
  - Rapid onset of severe pain, especially if out of proportion to the clinical findings
  - Loss of sensation in the affected area
  - Significant periorbital involvement
  - Immunosuppression and asplenia
  - Animal or human bite
  - Rapid progression despite antibiotic use
  - Induration, necrosis, hemorrhagic bullae, crepitus

- SSTIs treated in the outpatient setting are typically uncomplicated (no red flags) and limited to skin and subcutaneous tissue involvement.

- **Impetigo**
  - Involves the epidermis
  - Most common in children aged 2-5 years
  - Classified as
    - **Non-bullous impetigo:** Honey-colored crusted lesions or
    - **Bullous impetigo:** Fluid-filled vesicles and flaccid bullae
  - Most common pathogens are GAS (*Streptococcus pyogenes*) and *S. aureus;* Group B, C/G streptococci are less common.
  - **Management of impetigo:**
    - A 5-to-7-day course[4-5] of **topical antibiotic** is **preferred** for impetigo that is limited and localized (e.g. 2 to 3 small areas).
      - Mupirocin 2% (Bactroban) ointment applied TID ($17/30g tube)
      - Fusidic acid 2% (Fucidin) cream applied TID-QID ($17/30g tube)

- Wash lesions with soap and water to help gently remove crusts.
- Situations indicating the need for a different diagnosis and/or treatment (e.g., oral antibiotics – see page 47) include:
  - Limited or localized infection unresponsive to topical antibiotic > 24 to 48 hours
  - Recurrent or widespread infection (numerous or large lesions)

➢ **Erysipelas, Cellulitis, Purulent SSTI (skin abscess)**

- Erysipelas
  - Predominately caused by GAS (*Streptococcus pyogenes*)
  - Superficial tissues involved
  - Raised border that is sharply demarcated from the adjacent normal skin
  - Commonly involves the bridge of the nose and cheeks
  - Can be difficult to distinguish from cellulitis
- Cellulitis (without abscess)- non purulent
  - Involves skin and subcutaneous tissue
  - GAS is the main cause; *S. aureus* is less common
- Purulent SSTI*(skin abscess)
  - Cutaneous abscesses, furuncles, carbuncles
    - **Furuncle**: Infection of the hair follicle extending into the subcutaneous tissue
    - **Carbuncles**: Cluster of furuncles, extending deeper into the subcutaneous fat
  - May be associated with surrounding cellulitis
  - Main pathogens
    - Methicillin-sensitive *S. aureus* (MSSA)
    - Methicillin-resistant *S. aureus* (MRSA)
      - Risk factors for MRSA include
        - History of MRSA colonization or infection
        - Recent hospitalization
        - Injection drug use
        - Poor response to initial antibiotic
    - Pathogens may differ if a bite wound or nail puncture is involved, and in cases involving water or soil exposure or recent travel.

* Purulence: presence of thick and cloudy fluid that may be draining or contained in an abscess.

Presentation and Diagnosis

➢ SSTIs are characterized by heat, pain, tenderness, erythema, swelling and should be differentiated from conditions with similar signs and symptoms:

- Charcot foot (neuropathic arthropathy)
- Deep vein thrombosis
- Erythema migrans (EM) - Lyme disease – see page 57
- Venous stasis dermatitis
- Gout
- Lymphedema

- Bilateral SSTI is rare and should prompt consideration of an alternate diagnosis.[6]

- Superficial skin swabs are **NOT** recommended unless drainage can be obtained from a purulent lesion by aspiration or puncture. Aspiration from non-purulent cellulitis is not recommended.

Classification

- Various classification schemes have been developed to assist the clinician in deciding the severity of the infection and the most appropriate therapy.

- None of these schemes have been validated and they are meant for general guidance only. For example, not every immunocompromised patient has severe SSTI and some patients with mild systemic signs may go on to develop a severe infection if the diagnosis and treatment are delayed.

Mild	Moderate	Severe
• No systemic signs of infection	• Systemic signs of infection (e.g., fever, chills, nausea) • Lymphangitis and/or rapidly advancing edge	• SIRS* • Immunocompromise • Deep infection: bullae, skin sloughing • End organ dysfunction

*SIRS (Systemic Inflammatory Response Syndrome) = two or more of temp > 38°C or < 36°C, respiratory rate > 24 breaths per min, heart rate > 90 beats per min, WBC > 12 or < 4 x 10^9/L

Treatment

- **Cellulitis/Erysipelas:**
  - **IV** antibiotics are **rarely indicated** for **mild** cases.
  - *Adults:* Treat moderate cases with IV antibiotics initially, but transition to oral therapy when systemic symptoms are resolved for at least 24 hours (in absence of *S. aureus* bacteremia).
  - *Children > 3 months of age and no red flags:* Outpatient oral antibiotic therapy is preferred.
    - The management of children with moderate to severe cellulitis potentially requiring IV antibiotic therapy is outside the scope of this document.

Antibiotic	ADULT CELLULITIS/ERYSIPELAS	Cost/day
	MILD	
Cephalexin	500-1000 mg PO QID	$0.69 – 1.38
Cefuroxime[a]	500 mg PO BID	$1.66
Clarithromycin[b]	500 mg PO BID	$1.66
	Duration: 5 days if mild and quick response, otherwise **7 days**	
	MODERATE	
Cefazolin[a,c]	Inpatient: 2 g IV q8h Outpatient: 2 g IV q12-24h[d] & 1 g probenecid PO 30 min before	$16.18 $10.78 + probenecid
Cloxacillin[c]	2 g IV q4h	$191.28
Ceftriaxone[c]	1 g IV q24h	$12.50
Daptomycin[b,c]	4-6 mg/kg IV q24h Dose based on ABW* in people with obesity; Round to nearest 50 mg	$97.41 - 146.12/75 kg
Vancomycin[b,c]	15 mg/kg IV Q12H Round to nearest 250 mg; Max 2 g/dose	$219.32/75 kg
	Duration: 7 days	
	SEVERE: Immediate expert consultation, broad spectrum antimicrobials	

[a] 1st line option if patient has experienced an IgE-mediated amoxicillin reaction.
[b] Option if unable to take any β-lactam (e.g. history of a delayed, severe, non-IgE-mediated hypersensitivity reaction)
[c] May transition to PO therapy when systemic symptoms are resolved for at least 24 hours (unless *S. aureus* bacteremia).
NOTE: PO Cloxacillin is poorly absorbed and tolerated and should not be used.
[d] q12h interval preferred for people with obesity or significant inflammation
*ABW = adjusted body weight = Ideal body weight (IBW) + 0.4 x (actual body weight – IBW); IBW in men = 50 kg + 2.3 kg x (height in inches – 60) and IBW in women = 45.5 kg + 2.3 kg x (height in inches – 60)

- **Purulent SSTI (Cutaneous abscesses, Furuncles, Carbuncles)**
  - **Incision and drainage** (I & D) is the cornerstone of management; antibiotics do not replace the need for incision and drainage.
  - **Mild, uncomplicated** cases
    - I & D alone may be sufficient for clinical cure
  - **Moderate** cases
    - I & D should be accompanied by a course of antibiotics
    - Antibiotic selection is dependent on whether the patient has risk factors for MRSA
  - Warm compresses are recommended several times daily for furuncles and carbuncles to promote drainage prior to I & D.

Antibiotic	ADULT Purulent SSTI I & D is the cornerstone of management	Cost/day
NO MRSA CONCERNS[a]		
MILD with abscess diameter ≤ 2 cm		
No antibiotics required		
MILD with abscess diameter > 2 cm or other indication for antibiotic[b]		
Cephalexin	500 mg – 1000 mg PO QID	$0.69 – 1.38
SMX/TMP[c]	1-2 DS tabs PO BID Higher dose preferred if weight > 70 kg & no contraindications	$0.45 – 0.90
Doxycycline[c]	100 mg PO BID	$0.93
Clindamycin[c]	300-450 mg PO QID	$1.88 – 2.82
MODERATE		
Cefazolin[d,e]	Inpatient: 2 g IV q8h Outpatient: 2 g IV q12h & 1 g probenecid PO 30 min before	$16.18 $10.78+ Probenecid
Vancomycin[c,e]	15 mg/kg IV q12h Round to nearest 250 mg; max 2 g/dose	$42.26/*75 kg*
Daptomycin[b,d]	4-6 mg/kg IV q24h Dose based on adjusted body weight[g] in people with obesity; round to nearest 50 mg	$97.41-146.12/*75/kg*
SEVERE: Immediate expert consultation & broad-spectrum antibiotics		
MRSA CONCERNS[a]		
MILD with abscess diameter ≤ 2 cm		
	No antibiotics required	
MILD with abscess diameter > 2 cm or other indication for antibiotic[b]		
SMX/TMP[c]	1-2 DS tabs PO BID Higher dose preferred if weight > 70 kg & no contraindications	$0.45 – 0.90
Doxycycline[c]	100 mg PO BID	$0.93
Clindamycin[c,f]	300-450 mg PO QID	$1.88 – 2.82
MODERATE		
Vancomycin[c,e]	15 mg/kg IV q12hr Round to nearest 250 mg; max 2 g/dose	$42.26/*75 kg*
Daptomycin[c,e]	4-6 mg/kg IV q24h Dose based on adjusted body weight[g] in people with obesity; round to nearest 50 mg	$97.41-146.12/*75 kg*
SEVERE: Immediate expert consultation & broad-spectrum antibiotics		
Duration: 7-10 days		

[a] MRSA risk factors include history of MRSA colonization or infection, recent hospitalization, injection drug use, poor response to initial antibiotics

[b] May add antibiotic therapy if: Multiple abscesses, lack of response to I & D alone (current or in past), surrounding cellulitis, located in an area where I & D difficult (face, hands or groin), extremes of age, impaired host defenses, indwelling medical device at a non-contiguous site isolated from infected field (e.g. pacemaker, vascular graft)

[c] Option if unable to take any β-lactams (e.g. history of a delayed, severe, non-IgE-mediated hypersensitivity reaction).

[d] 1st line option if patient experienced an IgE-mediated amoxicillin reaction.

[e] May transition to oral therapy when systemic symptoms are resolved for at least 24 hours (in absence of *S. aureus* bacteremia)

[f] Clindamycin remains an option for community-acquired MRSA which is more susceptible than hospital-acquired strains.

[g] Adjusted body weight = ideal body weight (IBW) + 0.4 x (actual body weight - IBW); IBW (men) = 50 kg + 2.3 kg x (height in inches – 60) and IBW (women) = 45.5 kg + 2.3 kg (height in inches – 60)

Antibiotic	PEDIATRIC (age > 3 months) Uncomplicated Outpatient CELLULITIS	Cost/kg/day
Cephalexin[a]	50 mg/kg/day divided PO QID (max 4000 mg/day)	$0.26
Cefuroxime[a,b]	30 mg/kg/day divided PO q12h (max 1000 mg/day)	$0.22
SMX/TMP[c]	8-12 mg/kg/day divided PO BID (max 320 mg TMP/dose) Dose based on TMP component	$1.66
Clindamycin[d]	20 mg/kg/day divided PO TID (max 1800 mg/day)	$1.66
Duration: 5 days if mild and quick response, otherwise **7-10 days**		

[a] For GAS and MSSA; does NOT cover MRSA.
[b] 1st line option if patient has experienced an IgE-mediated amoxicillin reaction; does not cover MRSA.
[c] For community acquired MRSA and MSSA (does NOT cover GAS) if patient has experienced an IgE-mediated amoxicillin reaction or is unable to take any β-lactams (history of a delayed, severe, non-IgE-mediated hypersensitivity reaction).
[d] For GAS if unable to take any β-lactam (e.g., history of delayed, severe, non-IgE-mediated hypersensitivity reaction).

- **Treatment considerations**
  - Visible improvement of clinical manifestations may take up to 72 hours; erythema and extension often progress in first 24 hours of treatment (pain often improves even if visible erythema does not).
  - If present, systemic symptoms usually improve in 24-48 hours if on appropriate treatment.
  - Residual skin discoloration or defect may be present at end of antibiotic course. Full skin healing may take at least an additional 1-2 weeks.
  - Residual limb edema may persist for several weeks/months after other signs of infection resolve.
  - Oral cloxacillin is poorly absorbed and tolerated so it should not be used.
  - Avoid clindamycin in adults due to poor efficacy and high risk of CDI.
  - Consult ID for cases of recurrent pustules.

- **Adjuvant management recommendations**
  - **Elevation** of the affected area (above level of heart for majority of the day) is **essential.**
  - The skin should be sufficiently hydrated to avoid dryness and cracking without interdigital maceration.
  - Treat underlying conditions (e.g., venous stasis, tinea pedis, onychomycosis)
  - Blood cultures if systemic symptoms
  - Assess vascular supply if suspicion of arterial insufficiency (e.g., ankle-brachial index)
  - Long-term management of chronic venous insufficiency and chronic lymphedema with compression

Reference

1. Nova Scotia Health. Nova Scotia Health FirstLine App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/78-nova-scotia-health-authority
2. Isaak Walton Killam Health Centre. Isaak Walton Killam Health Centre Firstline App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/7-iwk-health-centre .
3. Nova Scotia Health. Nova Scotia Health Antimicrobial Handbook Cellulitis (non-purulent) [Internet]. Nova Scotia, Canada; June 2020 [cited 2025 Mar 28]. Available from: https://library.nshealth.ca/ld.php?content_id=34900093 .
4. Stevens DL, Bisno AL, Chambers HF, Dellinger EP, Goldstein EJ, Gorbach SL, Hirschmann JV, Kaplan SL, Montoya JG, Wade JC; Infectious Diseases Society of America. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. Clin Infect Dis. 2014 Jul 15;59(2):e10-52.
5. Bugs and Drugs: https://www.bugsanddrugs.org/91C12EDD-0C23-4EB8-B480-DACC5C1D3318 (cited June 6, 2025).
6. Bugs and Drugs: https://www.bugsanddrugs.org/7F845AA3-C8DA-49C4-9AEB-436757253249 (cited May 8, 2025).

INFECTIVE ENDOCARDITIS PROPHYLAXIS BEFORE DENTAL PROCEDURES

This section is based on the American Health Association Scientific Statement on the Prevention of Viridans Group Streptococcal Infective Endocarditis, the Canadian Dental Association Position on Prevention of Infective Endocarditis, Choosing Wisely Canada and Dalhousie University's Antibiotics in Dentistry Document unless otherwise noted.[1-4]

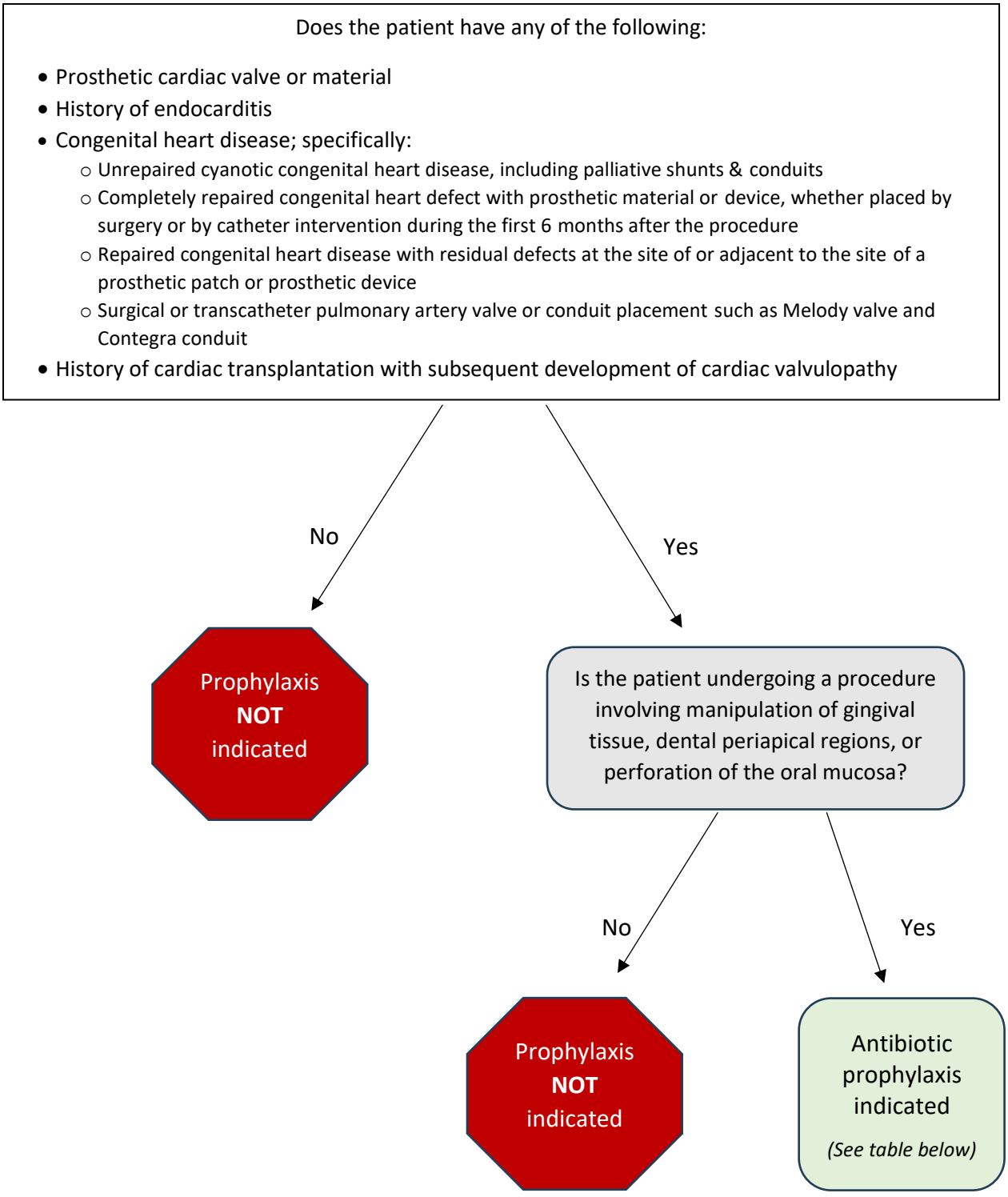
- Historically, preventative antibiotics were prescribed to patients with a range of heart conditions undergoing dental procedures, as transient bacteremia induced by the procedure from oral bacteria like viridans group streptococci was felt to significantly increase the risk of infective endocarditis (IE) or other infections. Evidence and guidance have changed with time.
    - In general, antibiotic prophylaxis is **not recommended for** those with **prosthetic joints undergoing dental procedures to prevent prosthetic joint infection.**[5]

- Most people with a cardiovascular condition **do not require routine preventative antibiotics before a dental procedure** to reduce the risk of IE.
    - The risks of adverse effects of antibiotics and development of drug resistance generally outweigh the potential benefits of prophylaxis.

- IE is more likely to develop from routine activities like toothbrushing and chewing food than from infrequent dental procedures.
    - Recommend **regularly scheduled dental visits and daily oral hygiene** to all patients to decrease the incidence of bacteremia associated with these activities.

- A single dose of antibiotic prophylaxis is only recommended for the highest risk patients undergoing the highest risk procedures, in keeping with the following flow chart.

Figure 3: Indications for Infective Endocarditis Prophylaxis Prior to Dental Procedures



Antibiotic prophylaxis[1,3-4,6]

Give as a single dose 30 to 60 minutes pre-procedure.

Antibiotic	ADULT		PEDIATRIC	
	Dose	Cost	Dose	Cost
ORAL REGIMEN				
Amoxicillin	2 g PO	$0.52	50 mg/kg (max 2000 mg) PO	$0.05/kg
Cefuroxime[a]	500 mg PO	$0.83	10 mg/kg (max 500 mg) PO	$0.07/kg
Doxycycline[b]	100 mg PO	$0.47	2.2 mg/kg (max 100 mg) PO	$0.46 or less
UNABLE TO TAKE ORAL MEDICATION				
Ampicillin	2 g IV	$11.23	50 mg/kg (max 2000 mg) IV	$0.28/kg
Ceftriaxone[a]	1 g IV	$12.50	50 mg/kg (to max 1000 mg) IV	$0.62/kg
Clindamycin[b,c]	600 mg IV	$15.88	20 mg/kg (to max 600 mg) IV	$0.53/kg

[a] 1st line option if patient has experienced an IgE mediated amoxicillin reaction.

[b] Option if patient is unable to take any β-lactam (e.g., history of a delayed, severe, non-IgE-mediated hypersensitivity reaction).

[c] **Reserve** for when every alternative is contraindicated due to high risk of CDI associated with clindamycin use. **The American Heart Association no longer recommends clindamycin for this use.**

References

1. Wilson WR, Gewitz M, Lockhart PB, Bolger AF, DeSimone DC, Kazi DS, et al. Prevention of Viridans Group Streptococcal Infective Endocarditis: A Scientific Statement from the American Heart Association. Circulation. 2021;143(20):e963-78.
2. CDA Board of Directors. CDA Position on Prevention of Infective Endocarditis, revised February 2024. Available at: https://www.cda-adc.ca/en/about/position_statements/infectiveendocarditis/
3. Choosing Wisely Canada: Taking the Bite out of Tooth Pain. A Toolkit on Using Antibiotics Wisely for Managing Tooth Pain in Adults. November 2024. https://choosingwiselycanada.org/toolkit/taking-the-bite-out-of-tooth-pain/
4. Chao T, Lee C, Faculty of Dentistry, Dalhousie University. Antibiotics in Dentistry.
5. Joint Canadian Orthopedic Association, Canadian Dental Association and Association of Medical Microbiology and Infectious Disease Canada Consensus Statement: Dental Patients With Total Joint Replacement, 2016. Available at https://www.cda-adc.ca/en/about/position_statements/jointreplacement/ .
6. Bugs & Drugs. Antimicrobial Regimens for Endocarditis Prophylaxis. https://www.bugsanddrugs.org/9B0A4BED-F93F-4B0E-8D99-8BDA8155E4BD (cited May 8, 2025).

DENTAL ABSCESS in Adults

This section is based on Bugs and Drugs and Dalhousie University's Antibiotics in Dentistry Document unless otherwise noted.[1-2]

- Dental abscess is characterized by spontaneous pain, formation of purulent material, and localized swelling in the mouth and is caused by an infection of the dental pulp (nerve inside the tooth). It is distinct from irreversible pulpitis, or a toothache, which occurs when the dental pulp becomes inflamed (not infected) due to decay, trauma, or large fillings.[3]

- The mainstay of therapy for acute dental abscess is **definitive conservative dental treatment (DCDT)**, e.g., incision and drainage, root canal therapy, or extraction.
    - Antimicrobials prescribed before or after DCDT do NOT appear to improve outcomes like pain or swelling during the procedure.[4]

- In addition to urgent referral for DCDT**, antimicrobials are only recommended if systemic complications are present (e.g., fever, lymphadenopathy, or spreading infection, trismus), or for an immunocompromised patient.** Antimicrobials are NOT indicated for toothache or localized dental abscess without systemic symptoms.[5]

- If DCDT is not imminently available (within 1-2 days) or not feasible in a patient with no systemic symptoms, a delayed antibiotic prescription may be considered. Patients may be instructed to fill the antibiotic if systemic symptoms develop while awaiting DCDT.

- The primary bacteria implicated in odontogenic infections are
    - Viridans group streptococci
        - *S. mutans*
        - *S. sanguinis*
        - *S. mitis*
        - *S. salivarius*
        - Streptococcus anginosus group (*S. anginosus, S. intermedius, S. constellatus*)
    - Anaerobes

- Narrow-spectrum penicillins are typically the antibiotic of choice, but additional anaerobic coverage should be considered if little improvement is observed after 48 hours.

Antibiotic	ADULT - Dental Abscess with systemic symptoms	Cost/day
Amoxicillin	500 mg PO TID	$0.39
Penicillin VK	300-600 mg PO QID	$0.97 – 1.94
Cefuroxime[a]	500 mg PO BID	$1.66
Doxycycline[b,c]	100 mg PO BID	$0.93
If little improvement after 48 hours, consider additional anaerobic coverage		
Metronidazole	500 mg PO BID	$1.86
Duration[5]: 5 days as adjunct to DCDT[d] (may discontinue 24 hours after symptoms resolve[6])		

[a] 1st line option if patient has experienced an IgE mediated amoxicillin or penicillin reaction.
[b] Option if patient is unable to take any β-lactam (e.g., history of a delayed, severe, non-IgE-mediated hypersensitivity reaction).
[c] Doxycycline has less activity for oral pathogens compared to beta-lactams.
[d] DCDT = definitive, conservative dental treatment

- If none of the recommended antibiotic regimens above can be used, **alternatives of last resort** include **macrolides** like azithromycin (which locally have high rates of resistance to oral pathogens), **or clindamycin** (which carries a high risk of CDI[7]).

- Note that although amoxicillin/clavulanic acid covers anaerobes, it is excessively broad for treatment of most dental abscesses. Amoxicillin with metronidazole is the preferred alternative.

- Although Choosing Wisely Canada and the American Dental Association recommend cephalexin as an alternative for this indication,[5-6] local antimicrobial stewardship experts caution against its use due to poor Viridans group streptococci coverage.

- Refer to the hospital or consult specialists in Oral Maxillofacial or Ears, Nose, Throat if **RED FLAGS** identified:
  - Stridor
  - Odynophagia
  - Rapid progression
  - Involvement of multiple spaces and secondary anatomic spaces

References

1. Bugs and Drugs. Recommended Empiric Therapy of Selected Dental Infections. https://www.bugsanddrugs.org/
2. Antibiotics in Dentistry. Tai-Yu (Debby) Chao, HBSc; Chris Lee, DDS, MSc Pharm, GPR. Faculty of Dentistry, Dalhousie University
3. The Canadian Association of Hospital Dentists. Choosing Wisely Canada.: Hospital Dentistry – Eight Tests and Treatments to Question. May 2024. https://choosingwiselycanada.org/recommendation/hospital-dentistry/
4. Cope AL, Francis N, Wood F, Thompson W, Chestnutt IG. Systemic antibiotics for symptomatic apical periodontitis and acute apical abscess in adults. Cochrane Database of Systematic Reviews 2024, Issue 5. Art. No.: CD010136. DOI:10.1002/14651858.CD010136.pub4.
5. Choosing Wisely Canada: Taking the Bite out of Tooth Pain. A Toolkit on Using Antibiotics Wisely for Managing Tooth Pain in Adults. November 2024. https://choosingwiselycanada.org/toolkit/taking-the-bite-out-of-tooth-pain/
6. Lockhart PB, et al. Evidence-based clinical practice guideline on antibiotic use for the urgent management of pulpal-and periapical-related dental pain and intraoral swelling: A report from the American Dental Association. The Journal of the American Dental Association. 2019 Nov 1;150(11):906-21.
7. Brown KA, et al. Meta-analysis of antibiotics and the risk of community-associated Clostridium difficile infection. Antimicrob Agents Chemother 2013;57(5):2326-32.

CLOSTRIDIOIDES DIFFICILE INFECTION (CDI) in Adults

This section is based on the NSH Antimicrobial Handbook and NSH and IWK Firstline content unless otherwise noted.[1-3]

- *Clostridioides difficile* infection (CDI) causes diarrhea and inflammation of the colon, often in association with antimicrobial use and recent hospitalization.
  - Risk is greater with high doses, longer duration, and greater number of antibiotics used.
  - Odds of CDI vary by drug class and are highest with clindamycin[4]
    - **Clindamycin – OR 16.8**
    - Cephalosporins and carbapenems – OR 5.7
    - Fluoroquinolones – OR 5.5
    - Macrolides and penicillins – OR 2.7
    - Sulfonamides and trimethoprim – OR 1.8
    - Tetracyclines – OR 0.9

Diagnosis

- CDI is defined by the presence of unexplained and new onset of ≥ 3 watery stools* in 24 hours *AND* stool tests positive for *C. difficile* toxin *OR* colonoscopic or histopathologic findings of pseudomembranous colitis.
  **Patients with severe disease may not have loose stools if they have toxic mega-colon or ileus.*

- CDI may be classified by severity
  - Mild to moderate
    - WBC ≤ 15 x 10^9/L and
    - Creatinine ≤ 1.5 times baseline and
    - Age ≤ 60 years
  - Severe, uncomplicated
    - WBC > 15 x 10^9/L or
    - Creatinine > 1.5 times baseline or
    - Age > 60 years or
    - Hypoalbuminemia
  - Severe, complicated
    - Hypotension
    - Shock
    - Ileus
    - Megacolon

- Do not test asymptomatic patients or perform tests of cure, as false-positive results may lead to unnecessary treatment.

- Upon presentation, other infectious and non-infectious causes of diarrhea should also be considered, such as Crohn's disease, ulcerative colitis and viral gastroenteritis.

Management

- Individuals with suspected or confirmed CDI and their close contacts should be advised to wash hands with soap and water (*hand sanitizer is not adequate*), avoid shared washrooms (if possible), and disinfect surfaces to prevent transmission.

- When possible, discontinue/avoid interventions that may further aggravate the infection, including:
  - Systemic antibiotics, or consider switching to an agent with lower risk of CDI
  - Opioids and antimotility agents, such as loperamide
  - Unnecessary proton pump inhibitors
  - Laxatives

- Empiric therapy may be initiated while awaiting testing if substantial laboratory delay is expected or the patient's symptoms are consistent with severe disease.

- **RED FLAGS** for severe or fulminant disease:
  - WBC greater than 15 x 10^9/L
  - Creatinine greater than 1.5 times baseline
  - Hypovolemia, hypotension or shock
  - Ileus
  - Toxic mega-colon

- Provided there is no ileus, antimicrobial treatment for CDI is not required if diarrhea has resolved.

- Treatment options for outpatients with mild or uncomplicated severe disease are listed below.

Category	Antibiotic	Dose & Duration	Cost/*Course*
First Episode	Vancomycin	125 mg PO QID for **10 days**	$207.20
	Metronidazole	500 mg PO TID for **10 days** For mild-moderate disease when cost of vancomycin is prohibitive	$27.90
First Recurrence (2nd episode) Mild to moderate	Vancomycin	125 mg PO QID for **14 days**	$290.08
	Fidaxomicin[a]	200 mg PO BID for **10 days** For high risk of recurrence[b] and when cost not prohibitive	$2052.82
	Metronidazole	500 mg PO TID for **14 days** When initial episode was not treated with metronidazole and cost of vancomycin and fidaxomicin is prohibitive	$39.06
First Recurrence (2nd episode) Severe, uncomplicated	Vancomycin	125 mg PO QID for **14 days**	$290.08
	Fidaxomicin[a]	200 mg PO BID for **10 days** For high risk for recurrence[b] and when cost not prohibitive	$2052.08
Second or Subsequent Recurrence (3rd episode)	Vancomycin Taper	• 125 mg PO QID for 14 days then • 125 mg PO TID for 7 days then • 125 mg PO BID for 7 days then • 125 mg PO daily for 7-14 days then • 125 mg PO every 2 or 3 days for 2-8 weeks	$533.54 – 688.66
	Fidaxomicin[a]	200 mg PO BID for **10 days**	$2052.82

[a] There is increased risk of fidaxomicin hypersensitivity with history of macrolide allergy

[b] Risk factors for recurrent CDI include age greater than 60 years, significant immunocompromise, hospitalization for severe CDI within previous 3 months, and current use of antibiotics, proton pump inhibitors, antimotility agents and opioids.

- Consider consulting Infectious Diseases following one failed vancomycin taper.

- May consider vancomycin in patients who require subsequent systemic antibiotics if recent history (within 90 days) of CDI and
  - History of multiple recurrences requiring vancomycin taper **or**
  - Severe complicated CDI (e.g., hospitalized, hypotension, shock, ileus, or megacolon)
    - Vancomycin 125 mg PO BID for the duration of antibiotic treatment plus an additional week as secondary CDI prophylaxis

CDI in Pediatrics

Choosing Wisely Canada says, "***Don't routinely collect or process specimens for Clostridium difficile testing in infants less than one year of age with diarrhea***."[5] The rationale and guidance provided include the following[6-7]:

- 14 to 36% of infants are asymptomatic carriers of *C. difficile* but clinical illness is rarely reported before 1 – 2 years of age.
- It has been hypothesized that neonates and infants may not have the cellular mechanism necessary to bind and process *Clostridium* toxin.
- Consider alternative diagnoses in infants with diarrhea, even if they test positive for *C. difficile*.
- Limit testing to immunosuppressed infants or those with underlying intestinal conditions (e.g. Hirschsprung disease, inflammatory bowel disease) when other etiologies have been ruled out.

For treatment of older children with CDI refer to IWK Firstline.

References:

1. Nova Scotia Health. Nova Scotia Health Antimicrobial Handbook Clostridioides (Clostridium) difficile infection in Adults [Internet]. Nova Scotia, Canada; November 2023 [cited 2025 Mar 28]. Available from: https://library.nshealth.ca/ld.php?content_id=34900083 .
2. Nova Scotia Health. Nova Scotia Health FirstLine App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/78-nova-scotia-health-authority .
3. Isaak Walton Killam Health Centre. Isaak Walton Killam Health Centre Firstline App [Internet]. Firstline App. Available from: https://app.firstline.org/en/clients/7-iwk-health-centre .
4. Brown KA, Khanafer N, Daneman N, Fisman DN. Meta-analysis of antibiotics and the risk of community-associated Clostridium difficile infection. Antimicrob Agents Chemother. 2013 May;57(5):2326-32.
5. Choosing Wisely Canada*:* Medical Microbiology Recommendations. Available from: *https://choosingwiselycanada.org/recommendation/medical-microbiology/?highlight=urinary+tract+infections* .
6. Schutze GE, Willoughby RE; Committee on Infectious Diseases; American Academy of Pediatrics. Clostridium difficile infection in infants and children. Pediatrics. 2013 Jan;131(1):196-200.
7. Allen UD; Canadian Paediatric Society, Infectious Diseases and Immunization Committee. Clostridium difficile in paediatric populations. Paediatr Child Health. 2014 Jan;19(1):43-54.

TICK BORNE INFECTIONS: LYME DISEASE

This section is based on information from the Nova Scotia Department of Health and Wellness and IDSA guidelines unless otherwise noted.[1-2]

Lyme Disease

- Lyme disease is the most common tick-borne infection (TBI) in Nova Scotia (NS); it is endemic throughout the entire province.

- Caused by the bacteria *Borrelia burgdorferi*, which is transmitted by the deer/blacklegged tick (*Ixodes* spp.); however, many people with Lyme disease do not remember being bitten by a tick.

- Ticks are active anytime the temperature reaches 4°C or higher, with the greatest risk during the summer months.

- Lyme is a notifiable disease in NS *when confirmed by laboratory testing*. The microbiology lab notifies public health of positive cases. See figure 4 to determine when testing is recommended.

Risk Reduction

- **Reduce contact in high-risk environments** such as near wooded or forested areas, shrubs, long grass, leaf litter, urban parks, and gardens.

- **Wear light-coloured, long-sleeved shirts and pants, and closed-toed shoes.** Tuck shirt into pants and pants into socks.

- May use **insect repellants** according to instructions. For more information: https://www.canada.ca/en/health-canada/services/about-pesticides/insect-repellents.html

- **Immediate and correct tick removal** is key to prevent TBIs:
  - Perform regular body checks of self, family members and pets following outdoor activities.
  - Demonstration of appropriate removal technique is shown here: https://www.canada.ca/en/public-health/services/video/lyme-disease-properly-remove-tick.html

- Examining the tick after removal to identify species may be helpful, but analysis of the removed tick for *B. burgdorferi* or other TBIs is **not** recommended. Useful tools include:
  - https://www.etick.ca/
  - https://www.canada.ca/en/health-canada/services/pest-control-tips/blacklegged-deer-ticks.html

- Additional guidance to avoid tick bites is available here: https://novascotia.ca/dhw/cdpc/lyme.asp

- Prescribe antibiotic prophylaxis in suitable candidates.

Antimicrobial Prophylaxis

- Only recommended when all the following conditions are met:
  - Dose can be given within 72 hours of removal of a high-risk tick.
  - Tick was attached for 36 hours or more, based on the degree of engorgement or by certainty about the time of tick acquisition.
  - The tick bite occurred in an endemic area, which includes all of NS.

- The attached tick was an identified adult or nymphal blacklegged tick (*Ixodes spp*.).
- In children, a wait-and-watch approach is an alternative to chemoprophylaxis.

- Antibiotic prophylaxis options: Note – amoxicillin is not recommended due to its short half-life.
  - *Adults*: Doxycycline 200 mg PO as a single dose.
  - *Children of any age*: Doxycycline 4 mg/kg to a maximum of 200 mg PO [round dose to nearest 25 mg (1/4 tablet)] as a single dose OR wait-and-watch approach.

- If these criteria are not met a **wait-and-watch** approach is recommended.
  - Advise patient to monitor daily for the development of an expanding erythematous lesion at the site of the tick bite or other skin sites, fever, or any unexplained illnesses for 3-30 days after the tick bite and seek medical attention should one of these symptoms occur.

- **Testing patients for Lyme is not recommended at the time of tick removal.**
  - Patients who are treated, either prophylactically or for early Lyme disease, may have delayed seroconversion or may never seroconvert.

Clinical Manifestations

- Timing of symptoms is not always specific to a particular stage of infection. Clinical manifestations can overlap and form a continuum in some untreated patients.

- Generally, Lyme disease may be classified as[3]
  - ***Early localized Lyme disease*** (3 to 30 days):
    - Acute flu-like symptoms such as fever, arthralgias/ myalgias, headache; lymphadenopathy; erythema migrans (EM) rash.
  - ***Early disseminated Lyme disease*** (less than 3 months):
    - If untreated can disseminate with multiple secondary annular lesions and systemic symptoms, including fever, arthralgias, headache, lymphadenopathy, carditis, and neurological abnormalities (e.g., aseptic meningitis or cranial nerve abnormalities).
    - Multiple EM lesions may appear anywhere on the body.
  - ***Late disseminated Lyme disease*** (more than 3 months):
    - Most commonly presents as chronic arthritis, and more rarely, as chronic neuroborreliosis.

- Erythema Migrans (EM)
  - Any expanding oval erythematous rash, particularly on body sites that would be atypical for cellulitis (e.g., torso, behind the knee, back, neck).
  - Larger than 5 cm, usually **non-tender** and **non-pruritic.**
  - Usually solid or homogenous patch **or** central clearing with target-like (bull's eye) lesion.
  - See examples here https://www.canada.ca/en/public-health/services/diseases/lyme-disease/health-professionals-lyme-disease.html#a2

Table 5: Clinical features of Erythema Migrans (EM) versus insect bite hypersensitivity reactions and bacterial cellulitis

	Erythema migrans (EM)	Insect bite hypersensitivity reaction	Bacterial cellulitis
Character	Lesions are usually painless and non-pruritic. Incubation period is 3 to 30 days	Often itchy, local edema/induration within 24-48 hours of arthropod bite	Hot, tender/painful, edematous, red
Morphology	Red papule/macule with oval/circular enlargement, lack of peripheral scale/crust +/- central clearing +/- central punctum *May not have classic "bull's-eye" Variations: central blistering, blue-purple hue, variable shapes	Typically uniform erythematous lesions +/- single punctum or dual puncta +/- blistering	Homogenous red/ erythematous lesions +/- lymphangitic streaks
Size	Larger than 5 cm (5-70cm, median 16cm)	5 cm or smaller	Variable
Location	Early localized: at bite site, including sites unusual for cellulitis (e.g., back, groin, abdomen, axilla, popliteal fossa) Early disseminated: multiple lesions, can occur anywhere on the body	At bite site	Extremities are the most common

- Neurological Symptoms
  - Acute cranial neuropathies (particularly **VII**, VIII, less commonly III, V, VI and others)
  - Meningitis
  - Painful radiculoneuritis
  - Mononeuropathy multiplex including confluent mononeuropathy multiplex
  - Uveitis
  - Spinal cord (or rarely, brain) inflammation

- Lyme Arthritis
  - Late manifestation consisting of intermittent episodes of pain and/or swelling in one or more joints, particularly the **knees** and other large joints leading to chronic arthritis.

- Lyme Carditis
  - Dyspnea, edema, palpitations, light-headedness, chest pain, and syncope
  - Atrioventricular (AV) block, ranging from first degree to high degree A-V Block
  - Sinus node dysfunction
  - Myocarditis/pericarditis

Diagnosis

- *Early Lyme disease* in patients presenting with *localized EM* in season is a clinical diagnosis. Serology tests have poor sensitivity during the first four weeks of infection and are not recommended.

- **Recollection of a tick bite is NOT required to make a Lyme diagnosis.**
  - Nymphs (young ticks) are very small, and tick bites are usually painless, so often people are unaware they were bitten.
  - Symptoms may develop weeks after a bite, so symptoms may not be associated with the bite.

Figure 4: Lyme Disease TESTING

Nova Scotia Health uses the validated modified two-tiered testing (MTTT) algorithm with 2 enzyme immunoassays (EIAs) to determine Lyme serology status.

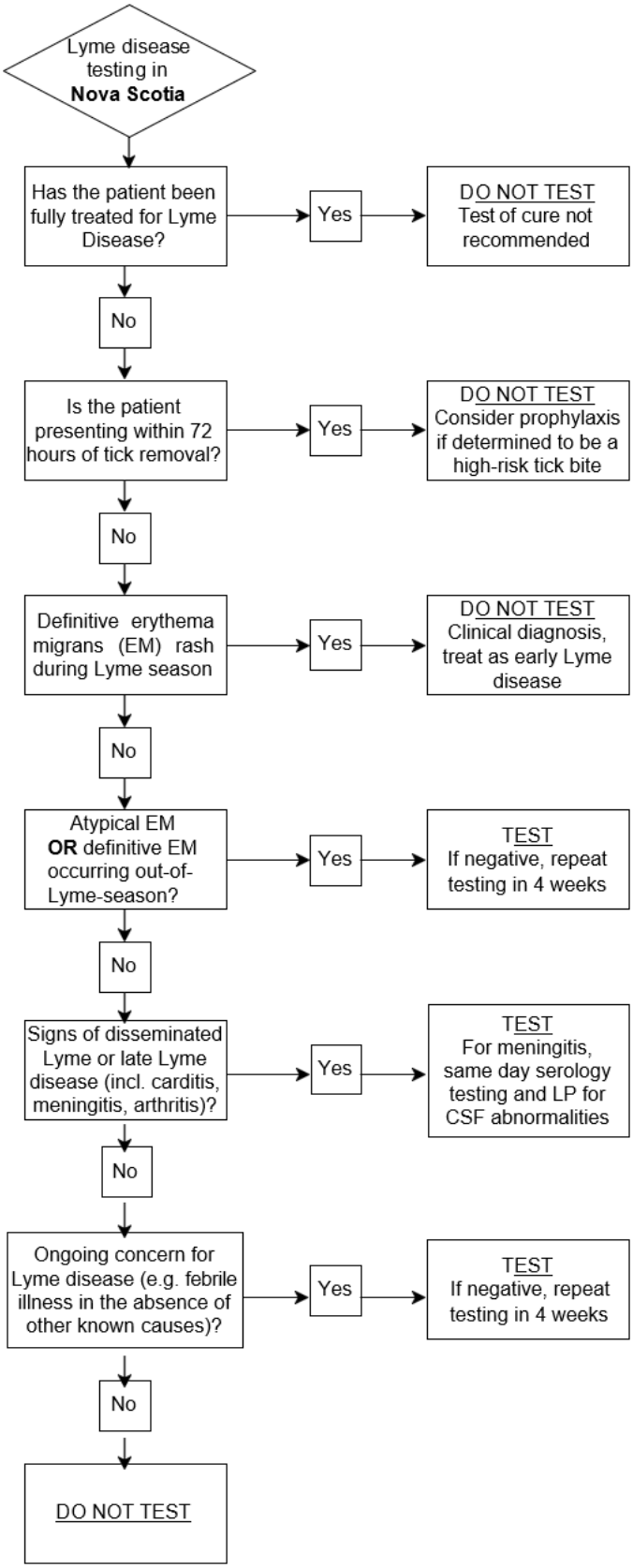
- Sensitivity of this testing increases with later stages of infection
- Testing is highly specific in patients with Lyme disease who have had symptoms for greater than 4 weeks

Serologic testing is helpful in cases of

- Suspected disseminated or late Lyme disease, including Lyme carditis, meningitis and arthritis
- Summertime influenza-like illness without EM rash:
  - Reasonable to watch-and-wait when possible, for ongoing or worsening symptoms or development of new symptoms
  - Reasonable to test. If it is negative and ongoing concern of Lyme disease, can retest in 2-3 weeks to look for seroconversion, which would be consistent with recent Lyme infection
  - Rash suggestive of, but atypical for EM; if test is negative, repeat in 2-3 weeks
  - EM-like rash out of season; if test is negative, repeat in 2-3 weeks

Other Instances Testing Not Recommended

- Absence of symptoms
- Asymptomatic persons who have had a blacklegged tick bite



Clinical Pearls

- Laboratory diagnosis of repeat infection is difficult since testing remains positive; discuss with Medical Microbiology.
- If there was an exposure in Europe, notify Microbiology on the lab requisition.

Treatment

Syndrome	ADULT Lyme Disease	Duration	Cost/*Course*
Erythema migrans (EM)	Doxycycline* 100 mg PO BID	10 days	$9.30
	Amoxicillin 500 mg PO TID	14 days	$5.46
	Cefuroxime 500 mg PO BID	14 days	$23.24
	Azithromycin 500 mg PO once daily *Alternative if other antibiotics contraindicated*	7 days	$13.17
Cranial Nerve Palsy (e.g., Facial nerve palsy)	Doxycycline* 100 mg PO BID	14-21 days	$13.02 – 19.53
Meningitis or radiculopathy (IV therapy for severe disease, including encephalitis)	Doxycycline* 100 mg PO BID	14-21 days	$13.02 – 19.53
	Ceftriaxone 2g IV daily	14-21 days	$482.79 – 724.18
Lyme disease-related parenchymal involvement of the brain or spinal cord	**Consult Infectious Diseases (ID) Service**		
Carditis Consider ID consult	Ceftriaxone 2 g IV daily	14-21 days	$482.79 – 724.18
	Doxycycline* 100 mg PO BID	14-21 days	$13.02 – 19.53
	Amoxicillin 500 mg PO TID	14-21 days	$5.46 – 8.19
	Cefuroxime 500 mg PO BID	14-21 days	$23.24 – 34.86
Arthritis (initial)	Doxycycline* 100 mg PO BID	28 days	$26.04
	Amoxicillin 500 mg PO TID	28 days	$10.92
	Cefuroxime 500 mg PO BID	28 days	$46.48
Arthritis (recurrent or refractory) Referral to Rheumatology if no improvement after 8 weeks of total treatment including trial of IV therapy	Ceftriaxone 2 g IV once daily	14 days *(May extend to 28 days if inflammation not resolving)*	$482.79 – 724.18
	Doxycycline* 100 mg PO BID	28 days	$26.04
	Amoxicillin 500 mg PO TID	28 days	$10.92
	Cefuroxime 500 mg PO BID	28 days	$46.48

*A systematic review of doxycycline use in pregnancy found no increased risk of teratogenicity, permanent teeth staining, hepatoxicity or permanent inhibitory effects on bone growth in the developing fetus.[4]

Syndrome	Age in Years	*Pediatric* Lyme Disease	Duration (days)	Cost/Course
Erythema migrans	≥ 8	Doxycycline 4.4 mg/kg/day PO divided q12h (max 200 mg/day) Round to nearest 25 mg = 1/4 tablet	10	$9.12 or less
	< 8	Amoxicillin 50 mg/kg/day PO divided q8h (max 1.5 g/day)	14	$0.76/kg
	All peds	Cefuroxime 30 mg/kg/day PO divided q12h (max 1 g/day)[a]	14	$3.08/kg
Isolated facial palsy[b] Consult ID	All peds	Doxycycline 4.4 mg/kg/day PO divided q12h (max 200 mg/day) Round to nearest 25 mg = 1/4 tablet	14	$12.77 or less
Meningitis Consult ID	All peds	Doxycycline 4.4 mg/kg/day PO divided q12h (max 200 mg/day) Round to nearest 25 mg = 1/4 tablet	14	$12.77 or less
	All peds	Ceftriaxone 50-75 mg/kg/day IV q24h (max 2 g/day)	14	$8.68 – 13.12/kg
Carditis or Atrioventricular block Consult ID	≥ 8	Doxycycline 4.4 mg/kg/day PO divided q12h (max 200 mg/day) Round to nearest 25 mg = 1/4 tablet	14-21	$6.38 (or less) – 19.15
	< 8	Amoxicillin 50 mg/kg/day PO divided q8h (max 1.5 g/day)	14-21	$0.76 – 1.14/kg
	< 8	Ceftriaxone[c] 50-75 mg/kg/day IV q24h (max 2g/day)	14-21	$8.68 – 19.68/kg
	All peds	Cefuroxime 30 mg/kg/day PO divided q12h (max 1 g/day)	14-21	$3.01 – 4.52/kg
	All peds	Ceftriaxone[c] 50-75 mg/kg/day IV q24h (max 2 g/day)	14-21	$8.68 – 19.68/kg
Lyme Arthritis, Initial Consult ID or Rheumatology	≥ 8	Doxycycline 4.4 mg/kg/day PO divided q12h (max 200 mg/day) Round to nearest 25 mg = 1/4 tablet	28	$25.52 or less
	< 8[d]	Amoxicillin 50 mg/kg/day PO divided q8h (max 1.5 g/day)	28	$1.52/kg
	All peds	Cefuroxime 30 mg/kg/day PO divided q12h (max 1 g/day)	28	$6.02/kg
Lyme Arthritis, Persistent Consult ID or Rheumatology	≥ 8	Doxycycline 4.4 mg/kg/day PO divided q12h (max 200 mg/day) Round to nearest 25 mg = 1/4 tablet	28	$25.52 or less
	< 8[d]	Amoxicillin 50 mg/kg/day PO divided q8h (max 1.5 g/day)	28	$1.52/kg
	All peds	Cefuroxime 30 mg/kg/day PO divided q12h (max 1 g/day)	28	$6.02/kg
	All peds	For *worsening* arthritis: Ceftriaxone 50-75 mg/day IV q24h (max 2 g/day)	14-28	$8.68 – 26.24/kg

[a] 1st line option if patient has experienced an IgE mediated amoxicillin reaction.
[b] Amoxicillin has not been studied for treatment of facial palsy related to Lyme disease.
[c] Once stable and symptoms have resolved, may change to oral therapy to finish the course.
[d] There are limited safety data on the use of doxycycline for more than 21 days in children < 8 years of age
Peds = Pediatrics

Clinical Pearl:

Patients who remain febrile after 48 hours of treatment with doxycycline should be investigated for other causes, including consideration for infection with human granulocytic anaplasmosis and babesia.

Coinfections

- Human granulocytic anaplasmosis (HGA)
  - Co-infection with Anaplasma has been documented
  - In NS, all samples submitted for Lyme are also tested for Anaplasma

- Babesia
  - Less common in NS
  - Co-infection with Babesia is based on blood smear
  - Consider if patient has persistent fever despite 48 hours of doxycycline treatment, or if there are other signs of Babesia

Nova Scotia Guidance:

See *Guidance for Primary Care and Emergency Medicine Providers in the Management of Lyme Disease, Human Granulocytic Anaplasmosis, Babesiosis and Powassan virus infection in Nova Scotia, available at* https://novascotia.ca/dhw/cdpc/infectious-disease-expert-group.asp

References:

1. Nova Scotia Department of Health and Wellness. Nova Scotia Infectious Diseases Expert Group. Guidance for the Primary Care and Emergency Medicine Providers in the Management of Lyme Disease, Human Granulocytic Anaplasmosis, Babesiosis and Powassan virus infection in Nova Scotia. 2024. Available from: https://novascotia.ca/dhw/cdpc/documents/statement-management-ld-hga-b-pvi.pdf .
2. Lantos PM, Rumbaugh J, Bockenstedt LK, Falck-Ytter YT, Aguero-Rosenfeld ME, Auwaerter PG, et al. Clinical Practice Guidelines by the Infectious Diseases Society of America (IDSA), American Academy of Neurology (AAN), and American College of Rheumatology (ACR): 2020 Guidelines for the Prevention, Diagnosis and Treatment of Lyme Disease. CID 2021;72(1):e1-e48.
3. Public Health Agency of Canada. Lyme disease: For health professionals. November 2024. Available from: https://www.canada.ca/en/public-health/services/diseases/lyme-disease/health-professionals-lyme-disease.html (cited April 11, 2025)
4. Cross R, Ling C, Day NP, McGready R, Paris DH. Revisiting doxycycline in pregnancy and early childhood--time to rebuild its reputation? Expert Opin Drug Saf. 2016;15(3):367-82.

TICK BORNE INFECTIONS: HUMAN GRANULOCYTIC ANAPLASMOSIS

This section is based on the Guidance for Primary Care and Emergency Medicine Providers in the Management of Lyme Disease, Human Granulocytic Anaplasmosis, Babesiosis and Powassan virus infection in Nova Scotia document prepared by the Nova Scotia Infectious Diseases Expert Group.[1]

- Human Granulocytic Anaplasmosis (HGA, anaplasmosis) is caused by the bacterium *Anaplasma phagocytophilum* which is transmitted by the blacklegged/ deer tick (*Ixodes* spp.).
  - The same tick transmits *Borrelia burgdorferi*, the bacterium that causes Lyme disease.

- HGA is a notifiable disease in Nova Scotia.

- HGA usually presents within 7-14 days of a tick bite and has an incubation period of 5-21 days.

- Early presentation of HGA often mimics an influenza-like illness occurring during the summertime, with no other cause of illness identified.
  - Possible signs and symptoms include fever, chills, headache, nausea, vomiting, loss of appetite, abdominal pain, arthralgias, myalgias, general malaise, and cough.[2]

- The following biochemical abnormalities are common in HGA, but NOT in Lyme disease:
  - Mild to moderate elevation in transaminases (usually 2- to 4-fold increase)
  - Thrombocytopenia, leukopenia, neutropenia or anemia

- 90% of patients have at least one of the **classic triad** signs: thrombocytopenia, leukopenia, or elevated aminotransferase levels.

- In Nova Scotia, HGA testing by polymerase chain reaction (PCR) is performed automatically with all Lyme tests.
  - PCR is the most sensitive test for HGA within the first two weeks of infection.

- Intragranulocytic clusters or morulae can be detected in peripheral blood in 25 to 75% of acute infections.

- In rare cases of delayed testing, serology may be used to document prior infection **in discussion with an infectious disease specialist or microbiologist**.

Prevention

- The best mode of defense is avoidance of tick bites. Additional guidance to avoid deer/blacklegged tick bites: https://novascotia.ca/dhw/cdpc/lyme.asp

- Antibiotic prophylaxis is not recommended for HGA.

Treatment

- Beta-lactams are **NOT** effective.

Adults:

- Doxycycline 100 mg PO BID for 10 days
  - If enteral administration not possible, Health Canada Special Access Program authorization is required to access IV doxycycline.
  - Infectious Diseases should be consulted in cases where doxycycline is contraindicated or if IV doxycycline is felt to be absolutely needed.
  - Response to treatment is usually rapid (within 24 to 48 hours) except in severe cases requiring ICU care. Fever persisting beyond 48 hours should prompt consideration for infections not susceptible to doxycycline, including other TBIs such as babesiosis.

- Rifampin 300 mg PO BID x 7 to 10 days[3] is an alternative for mild cases but there is limited supporting evidence, significant side-effects and drug interactions, and in cases of co-infection it is not effective for Lyme disease.

Children:

- Consider consulting ID.

- Doxycycline 4.4 mg/kg/day PO divided BID (max 200 mg/day) for 10 days, including age < 8 years.[4]

- Rifampin 20 mg/kg PO divided BID (max 600 mg/day) for 7 to 10 days is an alternative for mild cases, but evidence is limited, side-effects and drug interactions are significant, and in cases of co-infection it is not effective for Lyme disease.[3]

References

1. Nova Scotia Department of Health and Wellness. Nova Scotia Infectious Diseases Expert Group. Guidance for the Primary Care and Emergency Medicine Providers in the Management of Lyme Disease, Human Granulocytic Anaplasmosis, Babesiosis and Powassan virus infection in Nova Scotia. 2024. Available from: https://novascotia.ca/dhw/cdpc/documents/statement-management-ld-hga-b-pvi.pdf .
2. Public Health Agency of Canada. Anaplasmosis Symptoms and Treatment. 2024. Available from: https://www.canada.ca/en/public-health/services/diseases/ticks-tick-borne-diseases/anaplasmosis.html (Cited April 16, 2025).
3. Rifampin. In: Lexi-Drugs App. Wolters Kluwer Clinical Drug Information, Inc. Accessed April 15, 2025. Subscription required.
4. Doxycycline. In: Lexi-Drugs App. Wolters Kluwer Clinical Drug Information, Inc. Accessed April 25, 2025. Subscription required.

APPENDIX

APPENDIX 1: *Glossary of Evidence Based Medicine Terms*

Relative Risk (RR) (synonym Risk Ratio)
The ratio (quotient) of the risk that an event will occur among the subjects exposed to a given factor and the risk that this event will occur among the subjects not exposed to this factor. **Note:** A relative risk (RR) of 1 indicates that the risk is equal in the groups compared, and RR > 1 indicates that the factor increases the risk, and an RR < 1 indicates that the factor decreases the risk.[1]

Odds Ratio (OR)
The odds ratio is a measure of the effect of treatment that compares the probability of suffering an event in the treatment group with the probability of suffering it in the control group. For example, if the results of a trial indicate that the probability of death in the control group is 25% and the probability of death in the treatment group is 10%, the odds ratio would be 0.10 ÷ (1.0 – 0.10) ÷ (0.25 ÷ (1.0 – 0.25) = 0.33.[1]

95% Confidence Interval (95% CI)
A 95% confidence interval indicates that there is a 95% probability that the confidence interval calculated from a particular study includes the true value of the parameter. If the interval includes a null value (a difference in means of 0, and odds ratio or a relative risk of 1, or a correlation coefficient of 0, for example), the null hypothesis cannot be rejected. A narrow confidence interval around a point estimate indicates a more precise estimate than a wide confidence interval.[1]

Numbers Needed to Harm (NNH)
The NNH is defined as the number of people that need to be exposed to a therapeutic factor for the stated treatment duration to achieve a harmful outcome in one patient.[2]

References:
1. HtaGlossary.net | Reception
2. Ajetunmobi, Olajide. *Making Sense of Critical Appraisal.* Oxford University Press Inc, 2002.