Oral Health Antibiotic Toolkit

WISCONSIN DEPARTMENT of HEALTH SERVICES

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Introduction

Antibiotics are important tools to manage odontogenic infections and prevent complications from invasive dental procedures. However, antibiotics are frequently over-prescribed which can lead to antibiotic resistance and avoidable antibiotic-related side effects, including *Clostridioides difficile* diarrhea.

Antibiotic stewardship is the effort to:

- Measure antibiotic prescribing.
- Improve how antibiotics are prescribed by clinicians.
- Ensure that the right drug, dose, and duration are selected when an antibiotic is needed.

To support antibiotic safety in Wisconsin dental practices, the Wisconsin Department of Health Services (DHS) has created the Oral Health Antibiotic Toolkit. This toolkit contains information and tools to assist dentists and dental professionals in making informed, evidence-based antibiotic prescribing decisions and effectively communicate them with patients and their medical team.

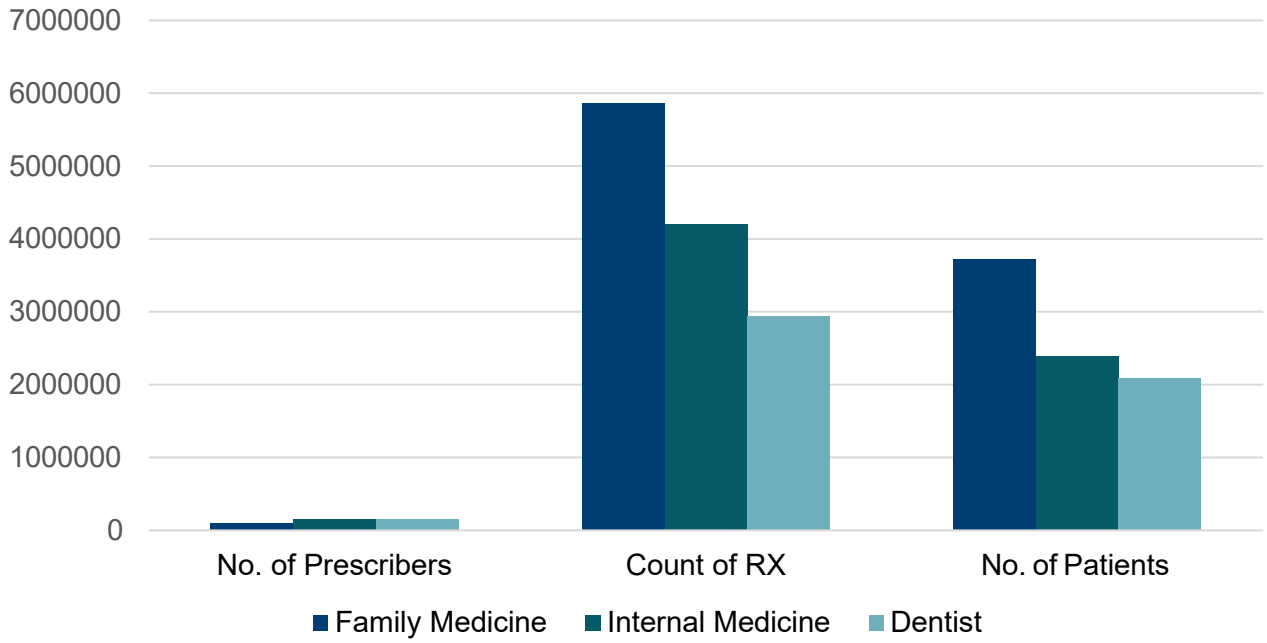
What do we know about antibiotic prescribing in dentistry?

A study evaluating prescribing practices in the United States linked 90% of antibiotic prescriptions to outpatient and/or ambulatory settings. Of those, an estimated 30–50% were considered unnecessary.[1] Several dental studies noted similar findings of up to 85% of antibiotic prescriptions as suboptimal or not indicated.[2]

Safety, quality, and care concerns prompted the American Dental Association (ADA) to participate in a “White House Forum on Antibiotic Stewardship” in 2015. That Forum led to an ADA endorsement for member antibiotic stewardship and improved prescribing practices.[3] Dentists account for 1 in 10 antibiotic prescriptions in the outpatient setting, which makes them the third to fourth highest antibiotic prescribers by volume following family medicine, internal medicine, and pediatrics.[4,5] A Journal of the American Dental Association (JADA) study conducted in British Columbia found that while physician antibiotic prescribing decreased 18% from 1996 to 2013, prescribing by dentists increased by 62% over this same period.[6,7]

Family medicine providers prescribed the highest count of prescriptions.

FIGURE 1. Top three antibiotic prescribing provider specialties in the U.S., ranked by count of prescriptions*, 2015.[5]



*Number of antibiotic prescriptions in Express Scripts database, 38,988,099 prescriptions examined.

Antibiotic use by Wisconsin dentists

Trends in Dental Antibiotic Prescribing in Wisconsin 2018–2021 provides a local lens to dental antibiotic prescribing. There were 34 antibiotics prescriptions per 1,000 patients per year. Reviewing all dental and pharmacy claims data, less than 1% of all dental services were associated with an oral antibiotic prescription.

Penicillins were the most commonly prescribed antibiotic associated with qualifying dental services.

FIGURE 2. Total number of antibiotic prescriptions by therapeutic class, 2018–2021.

When focusing on antibiotic class, the most commonly prescribed antibiotic was amoxicillin. However, the second most commonly prescribed antibiotic was clindamycin and 21% of antibiotics were for a non-penicillin antibiotic, despite amoxicillin being listed as first line. This raises the question if reported penicillin allergies could be driving prescription of non-first line antibiotics.

Antibiotic Resistance

Antibiotic resistance is when bacteria no longer respond to antibiotics. Antibiotic resistance is a naturally occurring process; however, it is promoted by a combination of increased exposure to antibiotics and the spread of those resistant organisms and their resistance mechanisms. Antibiotic resistance can occur by multiple mechanisms.

TABLE 1. Resistance mechanisms

Resistance Mechanisms	Description	Example
Restrict access of the antibiotic	Bacteria restrict access by changing the entryways or limiting the number of entryways.	Gram-negative bacteria's outer membrane can selectively keep antibiotics from entering the cell.
Expel the antibiotic or antifungal	Organisms can use pumps in their cell walls to remove antibiotics that enter.	Some Pseudomonas aeruginosa can produce efflux pumps that expel multiple drug classes, including fluoroquinolones and beta-lactams.
Change or destroy the antibiotic	Bacteria can produce enzymes that break down the drug.	Some *Klebsiella pneumoniae* isolates produce enzymes called carbapenemases, which break down carbapenem drugs and most other beta-lactam drugs.
Change the targets for the antibiotic	Many antibiotic drugs are designed to single out and destroy specific parts of a bacteria. Mutations can lead to changes in the antibiotic's target so that the drug no longer binds.	*Escherichia coli* with the mcr-1 gene can add a compound to the outside of the cell wall so that colistin, an antibiotic, cannot latch onto it.
Bypass the effects of the antibiotic	Bacteria can develop new cell processes that avoid using the antibiotic's target.	Some *Staphylococcus aureus* bacteria can bypass the drug effects of trimethoprim.

General Guidance of Antibiotic Prescribing in Oral Health

We can all promote antibiotic safety through improved antibiotic awareness. Antibiotic prescribing is complex, made up of multiple decisions. Here is a guide to support navigating reported penicillin allergy.

Diagnosis

- Correctly diagnose an oral bacterial infection.
- Some infections can be managed by **dental intervention alone** and do not require antibiotics.
- Make sure antibiotics are necessary, such as ensuring your patient has a condition that qualifies for antibiotic prophylaxis.

Drug choice

- Use the most narrow spectrum antibiotic; most can be treated with penicillin or amoxicillin.
- Proper management of reported penicillin allergy.
- Most commonly prescribed antibiotic for dental infections is amoxicillin.
- Second line agents include amoxicillin-clavulanate and cephalexin with or without the addition of metronidazole for anaerobic coverage.
- Clindamycin is associated with high rate *C. difficile* infection.

Dose

- Appropriate antibiotic dose varies by each antibiotic. It is important to refer to guidelines when writing an antibiotic prescription.
- Some patient conditions, specifically decreased renal function, require changes in renal dosing. If in doubt, please refer to your pharmacist.

Duration

- Antibiotic prophylaxis should only be one dose preprocedural.
- For dental infections, please use the shortest recommended duration possible, at most seven days.

Disposal

- Expired or no longer indicated antibiotics should be disposed of properly. Antibiotics should be disposed of through your local pharmacy or through drug drop boxes. Visit the DHS Safe Disposal of Medications webpage to locate the closest disposal center.

Penicillin Allergy

The facts on penicillin allergy

- Approximately 10% of all U.S. patient reports having an allergic reaction to a penicillin class antibiotic in their past.
- However, many patients who report penicillin allergies do not have true IgE-mediated reaction. In fact, fewer than 1% of the population are truly allergic to penicillins.[8]
- Approximately 80% of patients with IgE-mediated penicillin allergy lose their sensitivity after 10 years.
- Broad-spectrum antibiotics, including clindamycin, are often used as alternatives to penicillins.
- Patients labelled as penicillin-allergic are more likely to receive antibiotics that are **not** recommended as first-line therapy, which are associated with:
    - Reduced efficacy.
    - More adverse reactions, including *C diff* diarrhea.
    - Increased risk of antibiotic resistance.
    - Higher health care costs.
- Cross-reactivity to cephalosporins is very low–only 2% of true penicillin allergic patients will have hypersensitivity to cephalosporins. It is generally safe to prescribe cephalosporins for patients with a low-risk history of penicillin allergy.
- Correctly identifying those who are not truly penicillin-allergic can decrease unnecessary use of broad-spectrum antibiotics. This is particularly important prior to oral surgery.

How to obtain a penicillin history

When obtaining a penicillin history from a patient, you may utilize these questions to determine if they should be referred for a penicillin allergy assessment. These questions could also be incorporated into the patient medical history questionnaire to best capture information about a possible penicillin allergy.

Questions to ask:

- Have you previously had a reaction to an antibiotic?
- Which medication were you taking when the reaction occurred?
    - Oral versus injected medication?
    - Date of the reaction?
    - Time it took for the reaction of occur?
    - Describe the reaction.

- How was the reaction managed?
    - Did you need to be hospitalized?
- Have you ever been formally tested for the reaction?
- Have you received other antibiotics since? If yes, which ones?

Characteristics of an IgE mediated reaction (Type 1)

- Reactions that occur immediately or usually within one hour.
- Hives/urticaria: Multiple pink or red raised areas of skin that are intensely itchy.
- Angioedema: Localized edema/swelling without hives affecting the abdomen, face, extremities, genitalia, oropharynx, or larynx.
- Wheezing and shortness of breath.
- Anaphylaxis.

Anaphylaxis must have signs or symptoms in at least two of the following systems:

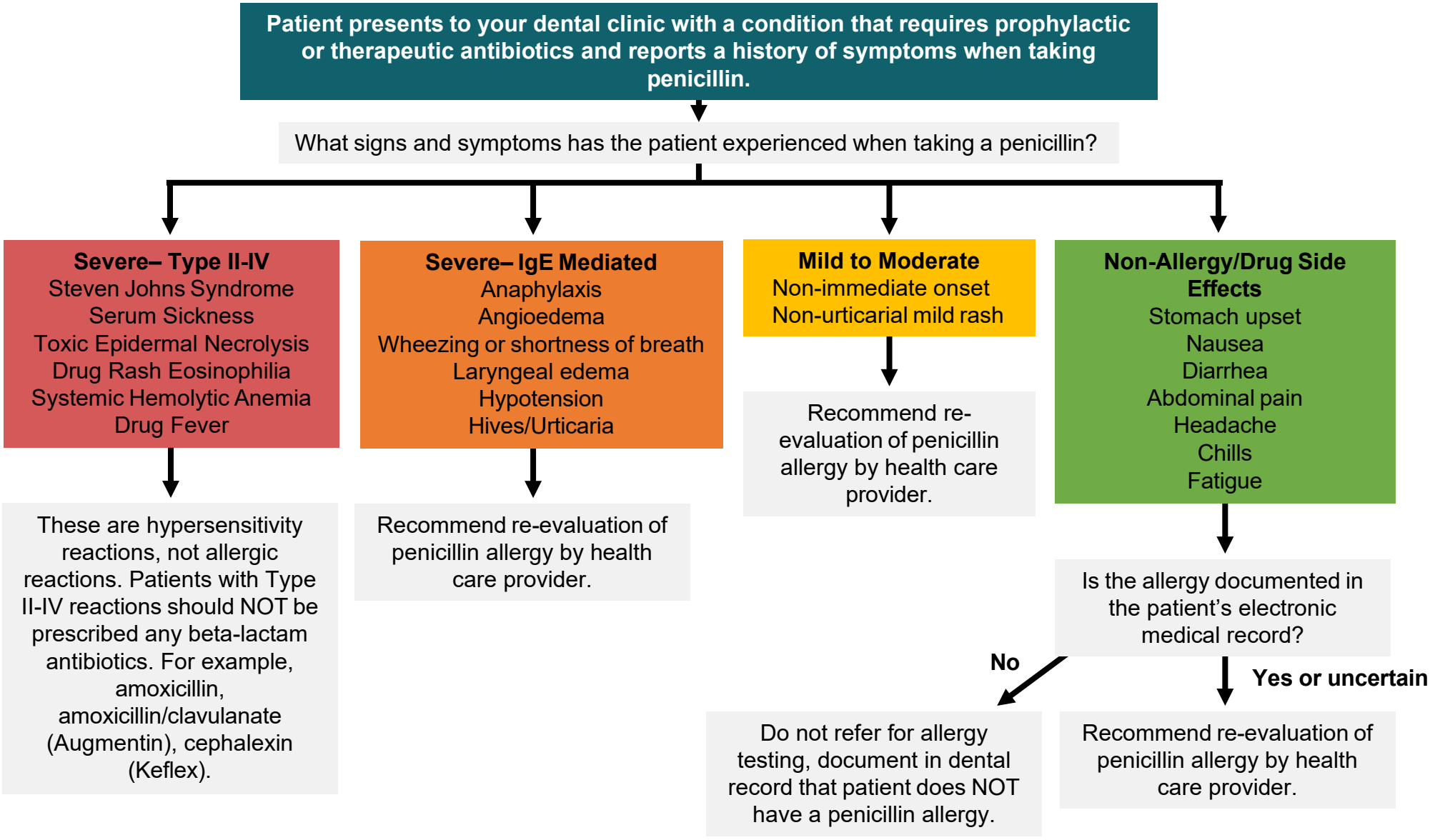
- Skin: Hives, flushing, itching, and/or angioedema.
- Respiratory: Cough, nasal congestion, shortness of breath, chest tightness, wheeze, sensation of throat closure or choking, and/or change in voice-quality (laryngeal edema).
- Cardiovascular: Hypotension, faintness, tachycardia or bradycardia, tunnel vision, chest pain, sense of impending doom and/or loss of consciousness.
- Gastrointestinal: Nausea, vomiting, abdominal cramping, and diarrhea.

Severe, non-IgE hypersensitivity syndrome:

- Stevens-Johnson syndrome
- Toxic epidermal necrolysis
- Serum sickness
- Acute interstitial nephritis
- Hemolytic anemia
- Drug rash with eosinophilia and systemic symptoms (DRESS)

The information above and flowchart below can aid in decision making.

FIGURE 3. Should your patient be referred for penicillin-allergy assessment?



This tool has been modified from a tool produced by the Association for Dental Safety and the Michigan Antibiotic Resistance Reduction Coalition

Clinical Recommendations for Antibiotic Prescribing in Dentistry

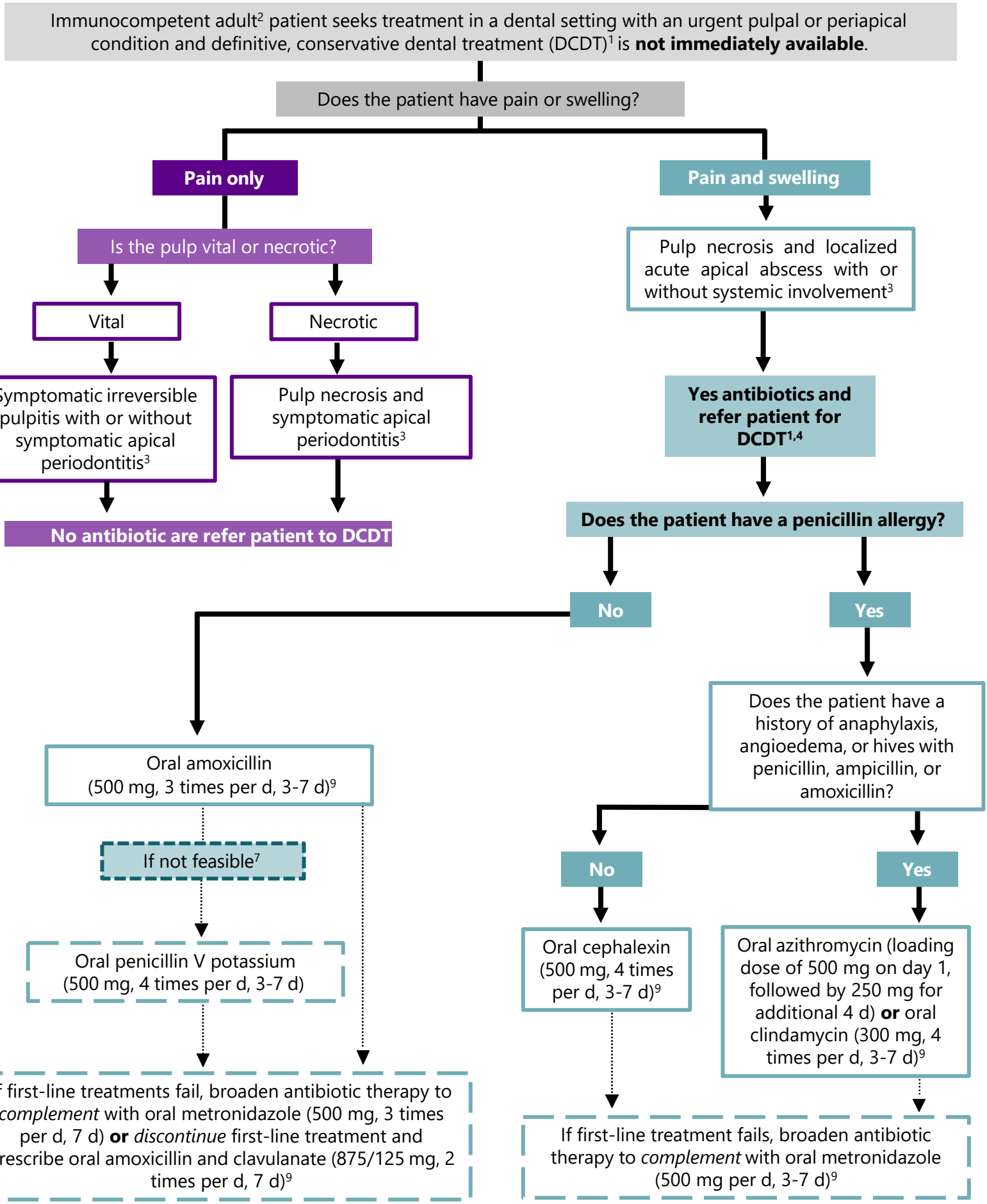
In 2019, the ADA published antibiotic evidence-based guidelines for treating patients in acute dental pain.[9] A set of decision-making trees were developed, one for patients where definitive treatment is not available and one for patients where definitive treatment is available.

Please note, that usually necrotic tissue ceases to receive blood supply, therefore systemic antibiotics may not reach the site of infection–thus the importance of debridement and drainage. The guideline recommends against using antibiotics for most pulpal and periapical conditions and instead recommends only the use of dental treatment, and if needed, over the counter pain relievers such as acetaminophen and ibuprofen. Instead of prescribing antibiotics, dentists should prioritize dental treatments such as pulpotomy, pulpectomy, nonsurgical root canal treatment, or incision and drainage for symptomatic irreversible pulpitis, symptomatic apical periodontitis, and localized acute apical abscess in adult patient who is not severely immunocompromised.

For both decision trees, amoxicillin is first-line treatment if antibiotics are recommended. If the patient describes a penicillin allergy, please take further history. With the limited cross-reactivity between penicillins and cephalosporins, patients with a non-severe penicillin allergy can be safely treated with oral cephalexin (or other first-generation cephalosporin, such as cefadroxil, which has an easier dosing frequency of twice daily).

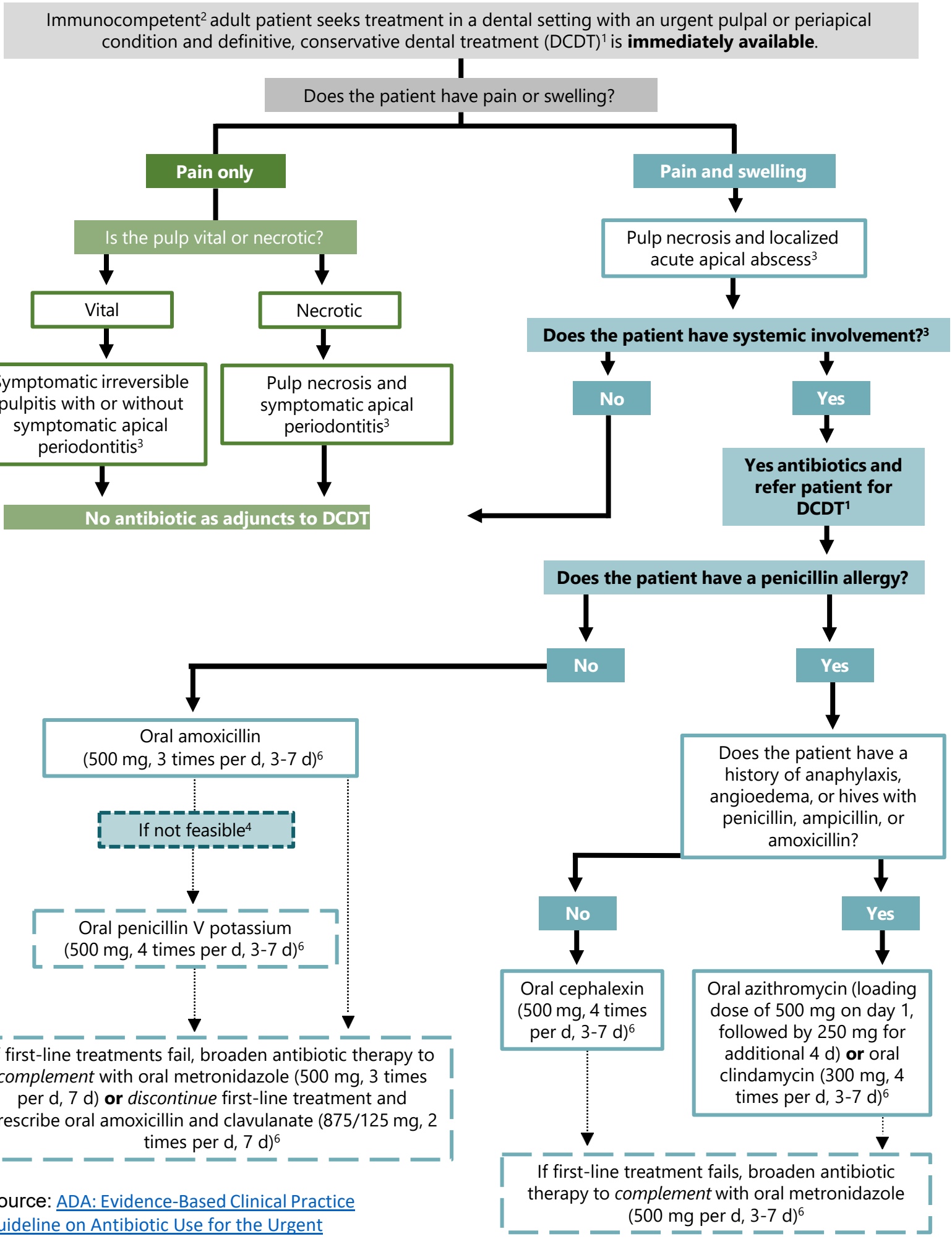
See below the evidence-based clinical practice guidelines on antibiotic use for the urgent management of pulpal- and periapical-related dental pain and intraoral swelling.

Figure 4. For patients where definitive treatment is **not immediately available.**



Source: ADA: Evidence-Based Clinical Practice Guideline on Antibiotic Use for the Urgent

Figure 5. For patients where definitive treatment is **immediately available.**



Source: [ADA: Evidence-Based Clinical Practice Guideline on Antibiotic Use for the Urgent]

Antibiotic prophylaxis for heart conditions

Since 2007, prophylactic antibiotic administration guidelines have evolved to reduce the risk of acquiring bacterial endocarditis among patients with cardiac conditions. Antibiotic prophylaxis is **not** recommended for routine dental procedures, such as anesthetic injections through noninfected tissue, taking dental radiographs, or placement of removable prosthodontic or orthodontic appliances. Patients with pacemakers or defibrillators are **not** considered to have a heart condition that requires routine antibiotic prophylaxis.[10] The current standard is summarized below.[11,12,13] Note that clindamycin has been removed as a choice of antibiotic since 2007.

Conditions in which antibiotic prophylaxis is still recommended for dental procedures[1]	Conditions in which antibiotic prophylaxis is not recommended for dental procedures[1]
• Prosthetic cardiac valves, including transcatheter-implanted protheses (TVAR) and homografts • Prosthetic material used for cardiac valve repair, such as annuloplasty rings, chords, or clips • Previous infectious endocarditis • Cardiac transplant with valve regurgitation due to structurally abnormal valve • Unrepaired cyanotic congenital heart defect (CHD) or repaired CHD, with residual shunts or valvular regurgitation at the site of or adjacent to the site of prosthetic path or prosthetic device • Any repaired congenital heart defect with residual shunts or valvular regurgitation at the site of or adjacent to the site of the prosthetic patch or device	• Pacemakers • Defibrillators • Mitral valve prolapse • Rheumatic heart disease • Bicuspid valve disease • Calcified aortic stenosis • Congenital heart conditions, including hypertrophic cardiomyopathy, ventricular septal defect, or atrial septal defect[2]

1. Dental procedures that include the manipulation of gingival tissue, manipulation of periapical region of teeth, perforation of the oral mucosa
2. When in doubt, please connect with patient's cardiologist

Table 2. Antibiotic regimens for a dental procedure: Single dose 30 to 60 minutes before procedure

Situation	Agent	Adult	Children
Oral	Amoxicillin	2 g	50 mg/kg
Unable to take oral medication	Ampicillin	2 g IM or IV	50 mg/kg IM[1] or IV[2]
	Cefazolin or ceftriaxone	1 g IM or IV	50 mg/kg IM or IV
Allergic to penicillin or ampicillin–oral	Cephalexin[3]	2 g	50 mg/lg
	Azithromycin or clarithromycin	500 mg	15 mg/kg
	Doxycycline	100 mg	<45 kg–2.2 mg/kg >45 kg–100 mg
Allergic to penicillin or ampicillin and unable to take oral medication	Cefazolin or ceftriaxone[4]	1 g IM or IV	50 mg/kg IM or IV

Note: Clindamycin is no longer recommended for antibiotic prophylaxis for a dental procedure

1. IM indicates intramuscular
2. IV indicates intravenous
3. Or other first- or second-generation oral cephalosporin in equivalent adult or children dosing
4. Cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema, or urticarial with penicillin or ampicillin

Dental prophylaxis decision script

Decision support tools have been helpful for guiding judicious and appropriate antibiotic prescribing for viral upper respiratory infections (URIs) and can provide patients with both written and verbal instruction.[14] This decision support tool can also help navigate antibiotic decision making around dental antibiotic prophylaxis, as up to 92% of dental prophylaxis are the wrong antibiotic choice, dose, or duration.[15] The Dental Prophylaxis Decision Script can be used to help determine if a patient has both dental and medical risk factors for antibiotic prophylaxis and guide to which antibiotic and the dose.

Dental Prophylaxis Decision Script

Patient name: _____ Date:_____

Step 1. Does the patient have a qualifying dental intervention?

The dental intervention involves **gingival or peri-apical tissue manipulation**, with some degree of bleeding expected.

Examples include:
- Tooth extractions
- Dental cleanings
- Scaling and root planning
- Root canal treatment beyond the apex

Proceed to step 2.

The dental procedure occurs **above the gumline and not associated with bleeding**.

Examples include:
- Routine fillings
- Simple root canals
- Suture removal
- Shedding of primary teeth

Prophylaxis is not recommended.

Step 2. Does the patient have an underlying medical condition?

The patient has a:

- ❑ Prosthetic heart valve
- ❑ Prosthetic material used to repair valve (annuloplasty)
- ❑ History of infective endocarditis
- ❑ Unrepaired congenital heart defect
- ❑ Repaired congenital heart defect with residual shunt or regurgitation
- ❑ Heart transplant with valvular regurgitation

Prophylaxis is recommended. See recommended antibiotic regimens.

The patient has a:

- ❑ History of total hip and/or total knee replacement[1]
- ❑ Extensive and invasive procedure planned
- ❑ Immunosuppressed (history of transplant, leukemia, Crohn's disease)
- ❑ Risk of osteoradionecrosis of the jaw from bisphosphonates

Prophylaxis is not recommended.

Recommended antibiotic regimens[2]

Antibiotic[3]	Adult	Children
Amoxicillin	❑ 2 g	❑ 50 mg/kg
Penicillin allergic		
Cephalexin	❑ 2 g	❑ 50 mg/kg
Azithromycin	❑ 500 mg	❑ 15 mg/kg
Unable to take oral medication		
Ampicillin	❑ 2 g IM or IV	❑ 50 mg/kg IM or IV
Cefazolin or ceftriaxone[4]	❑ 1 g IM or IV	❑ 50 mg/kg IM or IV

1. Consider discussing with patient's orthopedics or physician, underlying morbidity risk. In cases where antibiotics are deemed necessary, it is most appropriate that the orthopedic surgeon recommend the appropriate antibiotic regimen and, when reasonable, write the prescription.
2. Recommendations by the American Heart Association and the American Dental Association
3. Single dose 30–60 minutes prior to the procedure
4. Cephalosporins should not be used in those with penicillin-related anaphylactic history, angioedema, or urticaria.

Position on antibiotic stewardship in patients with prosthetic joints undergoing dental procedures

In general, for patients with prosthetic joint implants, prophylactic antibiotics are **not** recommended prior to dental procedures to prevent prosthetic joint infections (PJI).

The American Dental Association recommends that dental professionals, in conjunction with their patients, limit use of antibiotic prophylaxis among patients with prosthetic joints and promote dental antibiotic stewardship among their patients.

Clinical reasoning for the recommendation[16,17,18,19,20]

There is evidence that dental procedures are not associated with prosthetic implant infections.

- There is evidence that antibiotics provided before oral care do not prevent prosthetic joint implant infections.
- There are potential harms of antibiotics including anaphylaxis, antibiotic resistance, and opportunistic infections like *Clostridium difficile*.
- The benefits of antibiotic prophylaxis may not exceed the harms for most patients.
- The individual patient's circumstances and preferences should be considered when deciding whether to prescribe prophylactic antibiotics prior to dental procedures.

The Association for Dental Safety provides a customizable letter to a patient's surgeon that can be used to communicate the updated guidance and coordinate care.

Supporting Safe Antibiotic Prescribing

We encourage oral health practitioners to make an office or clinic statement on antibiotic use. Engaging health care workers is an important component to improving antibiotic use, but shifting the facility's culture and conveying this to patients is the key to lasting change. Patients should be encouraged to commit to improving antibiotic use as well. Pledging improvement can mean more than simply raising awareness.

We encourage clinics to post commitments within view of their front desk, waiting areas, and possibly even exam rooms. Wisconsin DHS provides samples patient waiting rooms and employee breakrooms.

Additional resources

- ADA, Clinical Evaluators (ACE) Panel Report: Antibiotic Use in Endodontic Infections
- CDC, Checklist for Antibiotic Prescribing in Dentistry
- CDC, Antibiotic Prescribing and Use Patient Education Resources
- DHS, Antibiotics Before Dental Procedures in Patients with Artificial Joints: Patient Fact Sheet
- Association for Dental Safety, Antibiotic Stewardship for Prescribers

Antibiotic Stewardship Guidance Limitations

The Wisconsin Antibiotic Stewardship Program provides materials and guidance with the understanding and recognition that information on antibiotic use is continuously evolving. Consensus statements, peer-reviewed articles, and evidence-based guidelines can have limitations. The following resource should not be construed as a care directive because individual needs are unique to each patient and circumstance. Conversations about antibiotic stewardship guidance should include informed clinical consideration, including informed judgement, to ensure common understanding.

Prior to the implementation of a guideline, stakeholders, oral health providers, and health care organizations should conduct a review per their policies, procedures, and quality assurance functions to ensure guidelines comply with local, regional, and national requirements for patient care, safety, and quality.

Contact Information

Statewide Antibiotic Stewardship Coordination is available through the Wisconsin Department of Health Services, Healthcare-Associated Infections (HAI) Prevention Program.

Phone: 608-267-7711

Email: DHSWIHAIPreventionProgram@dhs.wisconsin.gov

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