

2. Act



Dentists can implement policies and interventions to promote appropriate antibiotic prescribing.

- Use evidence-based diagnostic criteria and treatment recommendations

Evidence Based Practices

- Checklist for Antibiotic Prescribing in Dentistry (page 10)
 - Download here: <http://tinyurl.com/dentalabxlist>
- Combating Antibiotic Resistance (page 11)
- Antibiotic Prophylaxis Update 2017 (page 15)

Treatment Guidelines

- Guideline on the use of Antibiotic Therapy for Pediatric Patients (page 18)
- Management of Patients with Prosthetic Joints – Chairside Guide (page 21)
- Nonsurgical Treatment of Chronic Periodontitis by Scaling and Root Planing with or without Adjuncts: Clinical Practice Guideline (page 22)

- Review communications skills training for clinicians

- Drexel University College of Medicine Physician Communication Modules: interactive modules designed to enhance physician and patient communication and address patient attitudes and beliefs that more care is better care.
 - Link to modules: <http://tinyurl.com/cwmodules>

Checklist for Antibiotic Prescribing in Dentistry



Pretreatment

- Correctly diagnose an oral bacterial infection.
- Consider therapeutic management interventions, which may be sufficient to control a localized oral bacterial infection.
- Weigh potential benefits and risks (i.e., toxicity, allergy, adverse effects, *Clostridium difficile* infection) of antibiotics before prescribing.
- Prescribe antibiotics only for patients of record and only for bacterial infections you have been trained to treat. **Do not** prescribe antibiotics for oral viral infections, fungal infections, or ulcerations related to trauma or aphthae.
- Implement national antibiotic prophylaxis recommendations for the medical concerns for which guidelines exist (e.g., cardiac defects).
- Assess patients' medical history and conditions, pregnancy status, drug allergies, and potential for drug-drug interactions and adverse events, any of which may impact antibiotic selection.

Prescribing

- Ensure evidence-based antibiotic references are readily available during patient visits. **Avoid** prescribing based on non-evidence-based historical practices, patient demand, convenience, or pressure from colleagues.
- Make and document the diagnosis, treatment steps, and rationale for antibiotic use (if prescribed) in the patient chart.
- Prescribe only when clinical signs and symptoms of a bacterial infection suggest systemic immune response, such as fever or malaise along with local oral swelling.
- Revise empiric antibiotic regimens on the basis of patient progress and, if needed, culture results.
- Use the most targeted (narrow-spectrum) antibiotic for the shortest duration possible (2-3 days after the clinical signs and symptoms subside) for otherwise healthy patients.
- Discuss antibiotic use and prescribing protocols with referring specialists.

Patient Education

- Educate your patients to take antibiotics exactly as prescribed, take antibiotics prescribed only for them, and not to save antibiotics for future illness.

Staff Education

- Ensure staff members are trained in order to improve the probability of patient adherence to antibiotic prescriptions.

Combating antibiotic resistance

ADA COUNCIL ON SCIENTIFIC AFFAIRS

For the past 70 years, antibiotic therapy has been a mainstay in the treatment of bacterial infectious diseases. However, widespread use of these drugs by the health professions and the livestock industry has resulted in an alarming increase in the prevalence of drug-resistant bacterial infections.

Worldwide, many strains of *Staphylococcus aureus* exhibit resistance to all medically important antibacterial drugs, including vancomycin,^{1,2} and methicillin-resistant *S. aureus* is one of the most frequent nosocomial pathogens.³ In the United States,

Any perceived potential benefit of antibiotic prophylaxis must be weighed against the known risks of antibiotic toxicity, allergy and the development, selection and transmission of microbial resistance.

the proportion of *Streptococcus pneumoniae* isolates with clinically significant reductions in susceptibility to β lactam antimicrobial agents has increased more than threefold.^{4,5} Even more alarming is the rate at which bacteria develop resistance; microorganisms exhibiting resistance to new drugs often are isolated soon after the drugs have been introduced.⁶ This growing problem has contributed significantly to the morbidity and mortality of infectious diseases, with death rates for communicable diseases such as tuberculosis rising again.^{7,8}

Disease etiologies also are changing. In recent studies, staphylococci, particularly *S. aureus*, have surpassed viridans streptococci as the most common cause of infective endocarditis.⁹ Resistance among bacteria of the oral microflora is

increasing as well. During the past decade, retrospective analyses of clinical isolates have clearly documented an increase in resistance in the viridans strep-

Background. The ADA Council on Scientific Affairs developed this report to provide dental professionals with current information on antibiotic resistance and related considerations about the clinical use of antibiotics that are unique to the practice of dentistry.

Overview. This report addresses the association between the overuse of antibiotics and the development of resistant bacteria. The Council also presents a set of clinical guidelines that urges dentists to consider using narrow-spectrum antibacterial drugs in simple infections to minimize disturbance of the normal microflora, and to preserve the use of broad-spectrum drugs for more complex infections.

Conclusions and Practice

Implications. The Council recommends the prudent and appropriate use of antibacterial drugs to prolong their efficacy and promotes reserving their use for the management of active infectious disease and the prevention of hematogenously spread infection, such as infective endocarditis or total joint infection, in high-risk patients.

tococci.¹⁰ Further, strains of virtually every oral microorganism tested exhibit varying degrees of resistance to various antibacterial agents.¹¹

This increase in antibacterial resistance has been attributed primarily to two different processes. First, reduced susceptibility may develop via genetic mutations that spontaneously confer a newly resistant phenotype.¹² Alternatively, the exchange of resistant determinants between sensitive and resistant microorganisms (of the same or different species) may occur.¹³ Regardless of the genetic basis of resistance, the selective pressure exerted by widespread use of antibacterial drugs is the driving force behind this public health problem. It is only through the prudent and appropriate use of antibacterial drugs that their efficacy may be prolonged.

Antibacterial drugs should be

TABLE 1

NARROW-SPECTRUM* ANTIMICROBIAL AGENTS ENCOUNTERED IN DENTISTRY.†

GENERIC NAME	CHARACTERISTICS‡	COMMON INDICATIONS FOR USE
Clindamycin	Bacteriostatic (bactericidal at higher doses); active against some aerobic gram-positive cocci (including <i>Staphylococcus aureus</i> , <i>S. epidermidis</i> , streptococci and pneumococci), some anaerobic gram-negative bacilli, many anaerobic gram-positive non-spore-forming bacilli, many anaerobic gram-positive cocci and clostridia	Indicated for the treatment of infections caused by susceptible microorganisms; used as a prophylactic antibiotic in high-risk patients allergic to penicillin for the prevention of both bacterial endocarditis and infections of total joint replacements
Metronidazole	Bactericidal; active against most anaerobic cocci and both gram-negative bacilli and gram-positive spore-forming bacilli	Has been used as adjunct in treatment of periodontitis and acute necrotizing ulcerative gingivitis; commonly coprescribed with amoxicillin (Note: its combined use with amoxicillin or amoxicillin/clavulanic acid has not been approved by the U.S. Food and Drug Administration)
Penicillin V Potassium	Bactericidal; cell-wall synthesis inhibitor that is active primarily against gram-positive cocci (including <i>S. aureus</i>), gram-positive and gram-negative bacilli, and spirochetes	Use is limited to treatment of minor infections such as ulcerative gingivostomatitis, and to the prophylaxis and continued treatment of streptococcal infections

* Active against a small number of organisms.

† Adapted in part from Ciancio.¹⁷

‡ Bactericidal drugs directly kill an infecting organism; bacteriostatic drugs inhibit the proliferation of bacteria by interfering with an essential metabolic process.

reserved for the management of active infectious disease and considered for the prevention of hematogenously spread infection, such as infective endocarditis or total joint infection, in high-risk patients (as defined by the American Heart Association¹⁴ and the American Dental Association and the American Academy of Orthopedic Surgeons¹⁵). One example of their use in managing infectious disease is in the treatment of aggressive periodontal disease, which use has become well-accepted for optimal control of the disease process.¹⁶ The Council encourages further research on the appropriate use of antibacterial therapy in the management of oral diseases.

GUIDELINES FOR PRESCRIBING ANTIBIOTICS

The following guidelines should be observed when prescribing antibacterial drugs:

- (1) make an accurate diagnosis;
- (2) use appropriate antibiotics and dosing schedules;
- (3) consider using narrow-spectrum antibacterial drugs (Table 1) in simple infections to minimize disturbance of the normal microflora, and preserve the use of broad-spectrum drugs (Table 2) for more complex infections¹⁷;
- (4) avoid unnecessary use of antibacterial drugs in treating viral infections;
- (5) if treating empirically, revise treatment regimen based on patient progress or test results;
- (6) obtain thorough knowledge of the side effects and drug interactions of an antibacterial drug before prescribing it;
- (7) educate the patient regarding proper use of the drug

and stress the importance of completing the full course of therapy (that is, taking all doses for the prescribed treatment time).

Furthermore, the diagnosis and antibiotic selection should be based on a thorough history (medical and dental) to reveal or avoid adverse reactions, such as allergies and drug interactions. Any perceived potential benefit of antibiotic prophylaxis must be weighed against the known risks of antibiotic toxicity, allergy and the development, selection and transmission of microbial resistance.¹⁵

It remains incumbent on dental practitioners, as health care providers, to use antibacterial drugs in a prudent and appropriate manner. Adherence to the principles outlined here will aid in extending the efficacy of the antibacterial drugs that form the treatment foundation for many infectious diseases. ■

TABLE 2

BROAD-SPECTRUM* ANTIMICROBIAL AGENTS ENCOUNTERED IN DENTISTRY.†

GENERIC NAME	CHARACTERISTICS‡	COMMON INDICATIONS FOR USE
Amoxicillin (Semisynthetic Penicillin)	Bactericidal; active against many gram-negative and gram-positive organisms; not effective against β -lactamase-producing bacteria	Commonly used as an empirical antibiotic for oral infections, sinusitis and skin infections; used as a prophylactic antibiotic in high-risk patients for the prevention of bacterial endocarditis and infections of total joint replacements
Amoxicillin With Clavulanic Acid	Bactericidal; active against a wide spectrum of gram-negative and gram-positive organisms, including β -lactamase-producing bacteria	Used for the treatment of sinus, oral and respiratory infections
Ampicillin (Semisynthetic Penicillin)	Bactericidal; active against many gram-negative and gram-positive organisms; not effective against β -lactamase-producing bacteria	Commonly used as an empirical antibiotic for oral infections, sinusitis and skin infections; used as a prophylactic antibiotic in high-risk patients unable to take oral medication for the prevention of both bacterial endocarditis and total joint infections
Cefadroxil (First-Generation Cephalosporin)	Bactericidal; active against β -hemolytic streptococci, staphylococci, <i>Streptococcus pneumoniae</i> , <i>Escherichia coli</i> , <i>Proteus mirabilis</i> , <i>Klebsiella</i> and <i>Moraxella</i>	Indicated for the treatment of infections caused by susceptible microorganisms; used as a prophylactic antibiotic in high-risk patients for the prevention of bacterial endocarditis and infections of total joint replacements; caution should be exercised when prescribing cephalosporins for patients sensitive to penicillin§
Cefazolin (First-Generation Cephalosporin)	Bactericidal; active against group A β -hemolytic streptococci, <i>Haemophilus influenzae</i> , <i>S. pneumoniae</i> , <i>E. coli</i> , <i>Enterobacter aerogenes</i> , <i>P. mirabilis</i> and <i>Klebsiella</i>	Used for the treatment of respiratory, urinary tract, skin and biliary infections and for the treatment of septicemia and endocarditis; used as a prophylactic antibiotic in high-risk patients who are unable to take oral medications for the prevention of both bacterial endocarditis and infections of total joint replacements; caution should be exercised when prescribing cephalosporins for patients sensitive to penicillin§
Cephalexin (First-Generation Cephalosporin)	Bactericidal; active against β -hemolytic streptococci, staphylococci, <i>S. pneumoniae</i> , <i>E. coli</i> , <i>P. mirabilis</i> , <i>Klebsiella</i> and <i>Moraxella</i>	Indicated for the treatment of infections caused by susceptible microorganisms; used as a prophylactic antibiotic in high-risk patients for the prevention of bacterial endocarditis and infections of total joint replacements; caution should be exercised when prescribing cephalosporins for patients sensitive to penicillin§
Cephadrine (First-Generation Cephalosporin)	Bactericidal; active against group A β -hemolytic streptococci, <i>H. influenzae</i> , <i>S. pneumoniae</i> , <i>E. coli</i> , <i>E. aerogenes</i> , <i>P. mirabilis</i> and <i>Klebsiella</i>	Used as a prophylactic antibiotic in high-risk patients for the prevention of bacterial endocarditis and infections of total joint replacements; caution should be exercised when prescribing cephalosporins for patients sensitive to penicillin§
Azithromycin (Macrolide)	Bactericidal; active against a wide range of aerobic gram-negative and gram-positive organisms	Indicated for the treatment of mild-to-moderate infections caused by susceptible microorganisms; used as a prophylactic antibiotic in high-risk patients allergic to penicillin for the prevention of bacterial endocarditis
Clarithromycin (Macrolide)	Bactericidal; active against a wide spectrum of aerobic and anaerobic gram-positive and gram-negative organisms	Indicated for the treatment of mild-to-moderate infections caused by susceptible microorganisms; used as a prophylactic antibiotic in high-risk patients allergic to penicillin for the prevention of bacterial endocarditis
Erythromycin (Macrolide)	Bacteriostatic; active against gram-positive bacteria, particularly gram-positive cocci; provides limited activity against gram-negative bacteria	Indicated for the treatment of infections of upper and lower respiratory tract, skin and soft-tissue infections of mild-to-moderate severity; alternative to penicillin G and other penicillins for treatment of gram-positive coccoid infections in patients with hypersensitivity to penicillins; used as a prophylactic antibiotic in high-risk patients allergic to penicillin for the prevention of bacterial endocarditis
Tetracycline (Doxycycline, Minocycline)	Bacteriostatic; active against gram-positive and gram-negative bacteria, mycoplasmas, rickettsial and chlamydial infections	Indicated for the treatment of periodontitis and acute necrotizing ulcerative gingivitis (Note: to avoid the gastrointestinal side effects of oral tetracyclines, localized delivery systems of doxycycline and minocycline are marketed for the treatment of periodontitis)

* Used as empirical antibiotics or when culture and sensitivity testing are not available.

† Adapted in part from Ciancio.¹⁷

‡ Bactericidal drugs directly kill an infecting organism; bacteriostatic drugs inhibit the proliferation of bacteria by interfering with an essential metabolic process.

§ Cross-hypersensitivity has been documented and will occur in up to 10 percent of patients who have a history of penicillin allergy.¹⁸

Address reprint requests to ADA Council on Scientific Affairs, 211 E. Chicago Ave., Chicago, Ill. 60611.

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Distribution Information

AAE members may reprint this position statement for distribution to patients or referring dentists.

About This Document

This paper is designed to provide scientifically based guidance to clinicians regarding the use of antibiotics in endodontic treatment.

Thank you to the Special Committee on Antibiotic Use in Endodontics: Ashraf F. Fouad, Chair, B. Ellen Byrne, Anibal R. Diogenes, Christine M. Sedgley and Bruce Y. Cha.

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Antibiotic Prophylaxis 2017 Update

AAE Quick Reference Guide

Endocarditis Prophylaxis Recommendations

These recommendations are taken from 2017 American Heart Association and American College of Cardiology focused update of the 2014 AHA/ADA Guideline for Management of Patients with Valvular Disease (1) and cited by the ADA (2).

Prophylaxis against infective endocarditis is reasonable before dental procedures that involve manipulation of gingival tissue, manipulation of the periapical region of teeth, or perforation of the oral mucosa in patients with the following:

In 2017, the AHA and American College of Cardiology (ACC) published a focused update (5) to their previous guidelines on the management of valvular heart disease. This reinforced their previous recommendations that AP is reasonable for the subset of patients at increased risk of developing IE and at high risk of experiencing adverse outcomes from IE (5). Their key recommendations were:

1. Prosthetic cardiac valves, including transcatheter-implanted prostheses and homografts.
2. Prosthetic material used for cardiac valve repair, such as annuloplasty rings and chords.
3. Previous IE.
4. Unrepaired cyanotic congenital heart disease or repaired congenital heart disease, with residual shunts or valvular regurgitation at the site of or adjacent to the site of a prosthetic patch or prosthetic device.
5. Cardiac transplant with valve regurgitation due to a structurally abnormal valve.

The guidance in this statement is not intended to substitute for a clinician's independent judgment in light of the conditions and needs of a specific patient.

In 2017, the ADA reaffirmed the recommended regimen as follows.

			Regimen: Single Dose 30 to 60 min. Before Procedure
Situation	Agent	Adults	Children
Oral	Amoxicillin	2 g	50 mg/kg
Unable to take oral medication	Ampicillin	2 g IM* or IV+	50 mg/kg IM or IV
	OR Cefazolin or ceftriaxone	1 g IM or IV	50 mg/kg IM or IV
Allergic to penicillins or ampicillin—oral	Cephalexin ϕ δ	2 g	50 mg/kg
	OR Clindamycin	600 mg	20 mg/kg
	OR Azithromycin or clarithromycin	500 mg	15 mg/kg
Allergic to penicillins or ampicillin and unable to take oral medication	Cefazolin or ceftriaxone δ	1 g IM or IV	50 mg/kg IM or IV
	OR Clindamycin	600 mg IM or IV	20 mg/kg IM or IV

*IM: Intramuscular
 +IV: Intravenous
 ϕ Or other first- or second-generation oral cephalosporin in equivalent adult or pediatric dosage.
 δ Cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema, or urticaria with penicillins or ampicillin.

The ADA and AHA have a downloadable wallet card available to providers at no cost to educate patients who may be at risk for IC. http://www.heart.org/idc/groups/heart-public/@wcm/@hcm/documents/downloadable/ucm_448472.pdf

Patients with Joint Replacement

The following recommendation is taken from the *ADA Chairsides Guide* (© ADA 2015)

- In general, for patients with prosthetic joint implants, prophylactic antibiotics are not recommended prior to dental procedures to prevent prosthetic joint infection.
- 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

Additional Considerations

The practitioner and patient should consider possible clinical circumstances that may suggest the presence of a significant medical risk in providing dental care without antibiotic prophylaxis, as well as the known risks of frequent or widespread antibiotic use. As part of the evidence-based approach to care, this clinical recommendation should be integrated with the practitioner's professional judgment in consultation with the patient's physician, and the patient's needs and preferences.

- These considerations include, but are not limited to:
- Patients with previous late artificial joint infection
- Increased morbidity associated with joint surgery (wound drainage/hematoma)
- Patients undergoing treatment of severe and spreading oral infections (cellulitis)
- Patient with increased susceptibility for systemic infection
- Congenital or acquired immunodeficiency
- Patients on immunosuppressive medications
- Diabetics with poor glycemic control
- Patients with systemic immunocompromising disorders (e.g. rheumatoid arthritis, lupus erythematosus)
- Patient in whom extensive and invasive procedures are planned
- Prior to surgical procedures in patients at a significant risk for medication-related osteonecrosis of the jaw.

Special Circumstances

The 2007 AHA guidelines state that an antibiotic for prophylaxis should be administered in a single dose before the procedure (3,4). However, in the event that the dosage of antibiotic is inadvertently not administered before the procedure, it may be administered up to two hours after the procedure. For patients already receiving an antibiotic that is also recommended for IE prophylaxis, then a drug should be selected from a different class; for example, a patient already taking oral penicillin for other purposes may likely have in their oral cavity viridans group streptococci that are relatively resistant to beta-lactams.

In these situations, clindamycin, azithromycin or clarithromycin would be recommended for AP. Alternatively if possible, treatment should be delayed until at least 10 days after completion of antibiotic to allow re-establishment of usual oral flora. In situations where patients are receiving long-term parenteral antibiotic for IE, the treatment should be timed to occur 30 to 60 min after delivery of the parenteral antibiotic; it is considered that parenteral antimicrobial therapy is administered in such high doses that the high concentration would overcome any possible low-level resistance developed among oral flora (3,4).

APPENDIX C REFERENCES

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Use of Antibiotic Therapy for Pediatric Dental Patients

Review Council

Council on Clinical Affairs

Latest Revision

2014

Purpose

The American Academy of Pediatric Dentistry (AAPD) recognizes the increasing prevalence of antibiotic-resistant microorganisms. This guideline is intended to provide guidance in the proper and judicious use of antibiotic therapy in the treatment of oral conditions.¹

Methods

This guideline was originally developed by the Council on Clinical Affairs and adopted in 2001. This document is a revision of the previous version, last revised in 2009. The revision was based upon a new systematic literature search of the PubMed®/MEDLINE database using the terms: antibiotic therapy, antibacterial agents, antimicrobial agents, dental trauma, oral wound management, orofacial infections, periodontal disease, viral disease, and oral contraception; fields: all; limits: within the last 10 years, humans, English, clinical trials, birth through age 18. One hundred sixty-five articles matched these criteria. Papers for review were chosen from this search and from hand searching. When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

Background

Antibiotics are beneficial in patient care when prescribed and administered correctly for bacterial infections. However, the widespread use of antibiotics has permitted common bacteria to develop resistance to drugs that once controlled them.¹⁻³ Drug resistance is prevalent throughout the world.³ Some microorganisms may develop resistance to a single antimicrobial agent, while others develop multidrug-resistant strains.^{2,3} To diminish the rate at which resistance is increasing, health care providers must be prudent in the use of antibiotics.¹

Recommendations

Conservative use of antibiotics is indicated to minimize the risk of developing resistance to current antibiotic regimens.^{2,3} Practitioners should adhere to the following general principles when prescribing antibiotics for the pediatric population.

Oral wound management

Factors related to host risk (e.g., age, systemic illness, malnutrition) and type of wound (e.g., laceration, puncture) must be evaluated when determining the risk for infection and subsequent need for antibiotics. Wounds can be classified as clean, potentially contaminated, or contaminated/dirty. Facial lacerations may require topical antibiotic agents.⁴ Intraoral lacerations that appear to have been contaminated by extrinsic bacteria, open fractures, and joint injury have an increased risk of infection and should be covered with antibiotics.⁴ If it is determined that antibiotics would be beneficial to the healing process, the timing of the administration of antibiotics is critical to supplement the natural host resistance in bacterial killing. The drug should be administered as soon as possible for the best result. The most effective route of drug administration (intravenous vs. intramuscular vs. oral) must be considered. The clinical effectiveness of the drug must be monitored. The minimal duration of drug therapy should be five days beyond the point of substantial improvement or resolution of signs and symptoms; this is usually a five- to seven-day course of treatment dependent upon the specific drug selected.⁵⁻⁷ In light of the growing problem of drug resistance, the clinician should consider altering or discontinuing antibiotics following determination of either ineffectiveness or cure prior to completion of a full course of therapy.⁸ If the infection is not responsive to the initial drug selection, a culture and susceptibility testing of isolates from the infective site may be indicated.

Special conditions

Pulpitis/apical periodontitis/draining sinus tract/localized intra-oral swelling

Bacteria can gain access to the pulpal tissue through caries, exposed pulp or dentinal tubules, cracks into the dentin, and defective restorations. If a child presents with acute symptoms of pulpitis, treatment (i.e., pulpotomy, pulpectomy, or extraction) should be rendered. Antibiotic therapy usually is not indicated if the dental infection is contained within the pulpal tissue or the immediate surrounding tissue. In this case, the

ABBREVIATION

AAPD: American Academy Pediatric Dentistry.

child will have no systemic signs of an infection (i.e., no fever and no facial swelling).^{9,10}

Consideration for use of antibiotics should be given in cases of advanced non-odontogenic bacterial infections such as staphylococcal mucositis, tuberculosis, gonococcal stomatitis, and oral syphilis. If suspected, it is best to refer patients for culture, biopsy, or other laboratory tests for documentation and definitive treatment.

Acute facial swelling of dental origin

A child presenting with a facial swelling or facial cellulitis secondary to an odontogenic infection should receive prompt dental attention. In most situations, immediate surgical intervention is appropriate and contributes to a more rapid cure.¹² The clinician should consider age, the ability to obtain adequate anesthesia (local vs. general), the severity of the infection, the medical status, and any social issues of the child.^{11,12} Signs of systemic involvement (i.e., fever, asymmetry, facial swelling) warrant emergency treatment. Intravenous antibiotic therapy and/or referral for medical management may be indicated.⁹⁻¹¹ Penicillin remains the empirical choice for odontogenic infections; however, consideration of additional adjunctive antimicrobial therapy (i.e., metronidazole) can be given where there is anaerobic bacterial involvement.⁸

Dental trauma

Systemic antibiotics have been recommended as adjunctive therapy for avulsed permanent incisors with an open or closed apex.¹⁴⁻¹⁷ Tetracycline (doxycycline twice daily for seven days) is the drug of choice, but consideration of the child's age must be exercised in the systemic use of tetracycline due to the risk of discoloration in the developing permanent dentition.^{13,14} Penicillin V or amoxicillin can be given as an alternative.^{14,15,17} The use of topical antibiotics to induce pulpal revascularization in immature non-vital traumatized teeth has shown some potential.^{14,15,17,18} However, further randomized clinical trials are needed.¹⁹⁻²¹ For luxation injuries in the primary dentition, antibiotics generally are not indicated.^{22,23} Antibiotics can be warranted in cases of concomitant soft tissue injuries (see **Oral wound management**) and when dictated by the patient's medical status.

Pediatric periodontal diseases

Dental plaque-induced gingivitis does not require antibiotic therapy. Pediatric patients with aggressive periodontal diseases may require adjunctive antimicrobial therapy in conjunction with localized treatment.²⁴ In pediatric periodontal diseases associated with systemic disease (e.g., severe congenital neutropenia, Papillon-Lefèvre syndrome, leukocyte adhesion deficiency), the immune system is unable to control the growth of periodontal pathogens and, in some cases, treatment may involve antibiotic therapy.^{24,25} The use of systemic antibiotics has been recommended as adjunctive treatment to mechanical debridement in patients with aggressive periodontal disease.^{24,25} In severe and refractory cases, extraction is indicated.^{24,25} Cul-

ture and susceptibility testing of isolates from the involved sites are helpful in guiding the drug selection.^{24,25}

Viral diseases

Conditions of viral origin such as acute primary herpetic gingivostomatitis should not be treated with antibiotic therapy unless there is strong evidence to indicate that a secondary bacterial infection exists.²⁶

Salivary gland infections

Many salivary gland infections, following confirmation of bacterial etiology, will respond favorably to antibiotic therapy. Acute bacterial parotitis has two forms: hospital acquired and community acquired.²⁷ Both can be treated with antibiotics. Hospital acquired usually requires intravenous antibiotics; oral antibiotics are appropriate for community acquired. Chronic recurrent juvenile parotitis generally occurs prior to puberty. Antibiotic therapy is recommended and has been successful.²⁷ For both acute bacterial submandibular sialadenitis and chronic recurrent submandibular sialadenitis, antibiotic therapy is included as part of the treatment.²⁷

Oral contraceptive use

Whenever an antibiotic is prescribed to a female patient taking oral contraceptives to prevent pregnancy, the patient must be advised to use additional techniques of birth control during antibiotic therapy and for at least one week beyond the last dose, as the antibiotic may render the oral contraceptive ineffective.^{28,29} Rifampicin has been documented to decrease the effectiveness of oral contraceptives.^{28,29} Other antibiotics, particularly tetracycline and penicillin derivatives, have been shown to cause significant decrease in the plasma concentrations of ethinyl estradiol, causing ovulation in some individuals taking oral contraceptives.^{28,29} Caution is advised with the concomitant use of antibiotics and oral contraceptives.^{28,29}

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Management of patients with prosthetic joints undergoing dental procedures

Clinical Recommendation:

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

For patients with a history of complications associated with their joint replacement surgery who are undergoing dental procedures that include gingival manipulation or mucosal incision, prophylactic antibiotics should only be considered after consultation with the patient and orthopedic surgeon.* To assess a patient's medical status, a complete health history is always recommended when making final decisions regarding the need for antibiotic prophylaxis.

Clinical Reasoning for the Recommendation:

- There is evidence that dental procedures are not associated with prosthetic joint 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 risk for 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.

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ADA Center for Evidence-Based Dentistry™

* 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.

Nonsurgical Treatment of Chronic Periodontitis by Scaling and Root Planing with or without Adjuncts: Clinical Practice Guideline^{1,2}

Strength of recommendations: Each recommendation is based on the best available evidence. The level of evidence available to support each recommendation may differ.

Strong	In Favor	Weak	Expert Opinion For	Expert Opinion Against	Against
Evidence strongly supports providing this intervention. There is a high level of certainty of benefits, and the benefits outweigh the potential harms.	Evidence favors providing this intervention. Either there is a high level of certainty of benefits, but the benefits are balanced with the potential harms OR there is a moderate level of certainty of benefits, and the benefits outweigh the potential for harms.	Evidence suggests implementing this intervention only after alternatives have been considered. There is a moderate level of certainty of benefits, and either the benefits are balanced with potential harms or there is uncertainty in the magnitude of the benefit.	Expert Opinion suggests this intervention can be implemented, but there is a low level of certainty of benefits and there is uncertainty in the benefit to harm balance.	Expert Opinion suggests this intervention NOT be implemented because there is a low level of certainty that there is no benefit or the potential harms outweigh benefits.	Evidence suggests not implementing this intervention or discontinuing ineffective procedures. There is moderate or high certainty that there are no benefits and/or the potential harms outweigh the benefits.

Clinical Recommendation

Scaling and root planing (no adjuncts)

For patients with chronic periodontitis, clinicians should consider scaling and root planing (SRP) as the initial treatment.

SRP with systemic sub-antimicrobial dose doxycycline

For patients with moderate to severe chronic periodontitis, clinicians may consider systemic sub-antimicrobial dose doxycycline (20 mg twice a day) for 3 to 9 months as an adjunct to SRP with a small net benefit expected.

SRP with systemic antimicrobials

For patients with moderate to severe chronic periodontitis, clinicians may consider systemic antimicrobials as an adjunct to SRP with a small net benefit expected.

SRP with locally-delivered antimicrobials

For patients with moderate to severe chronic periodontitis, clinicians may consider locally delivered chlorhexidine chips as an adjunct to SRP with a moderate net benefit expected.

For patients with moderate to severe chronic periodontitis, clinicians may consider locally delivered doxycycline hyclate gel as an adjunct to SRP, but the net benefit is uncertain.

For patients with moderate to severe chronic periodontitis, clinicians may consider locally delivered minocycline microspheres as an adjunct to SRP, but the net benefit is uncertain.

18

¹ Smiley CJ, Tracy SL, Abt E, Michalowicz B, et al. Evidence-Based Clinical Practice Guideline on the Nonsurgical Treatment of Chronic Periodontitis by Scaling and Root Planing with or without Adjuncts. *JADA* 2015; 146 (7):525-535.
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Nonsurgical Treatment of Chronic Periodontitis by Scaling and Root Planing with or without Adjuncts: Clinical Practice Guideline^{1,2}

Strength of recommendations: Each recommendation is based on the best available evidence. The level of evidence available to support each recommendation may differ.

Strong	In Favor	Weak	Expert Opinion For	Expert Opinion Against	Against
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Clinical Recommendation	Strength
<p>SRP with nonsurgical use of lasers For patients with moderate to severe chronic periodontitis, clinicians may consider photodynamic therapy (PDT) using diode lasers as an adjunct to SRP with a moderate net benefit expected.</p>	Weak
<p>For patients with moderate to severe chronic periodontitis, clinicians should be aware that the current evidence shows no net benefit from diode (non-PDT) lasers when used as an adjunct to SRP.</p>	Expert Opinion Against
<p>For patients with moderate to severe chronic periodontitis, clinicians should be aware that the current evidence shows no net benefit from Nd:YAG lasers when used as an adjunct to SRP.</p>	Expert Opinion Against
<p>For patients with moderate to severe chronic periodontitis, clinicians should be aware that the current evidence shows no net benefit from erbium lasers when used as an adjunct to SRP.</p>	Expert Opinion Against

CHAPTER 2: SUPPLEMENTAL MATERIAL

These materials were compiled by CDPH to supplement the Act Section of the IDPH Antibiotic Stewardship Toolkit.

Included:

- 1. CDC Handout: 7 Ways Dentists Can Act Against Antibiotic Resistance**
Quick checklist on how dental providers can take action against antimicrobial resistance.
- 2. BC CDC Handout: Management of Penicillin/Amoxicillin Allergic Patients in Dental Practice**
Resources for beta-lactam allergy management, specific to dental providers prescribing patterns.
- 3. BC CDC Handout: Penicillin/Amoxicillin Allergy Reference List**
Publications across the spectrum of health-care related to appropriate prescribing of beta-lactams.
- 4. Successful Implementation of an Antibiotic Stewardship Program in an Academic Dental Practice (2019)**
<https://tinyurl.com/stewardshippuccess>
Literature from University of Illinois Chicago (UIC) on how to successfully implement an ASP in any outpatient dental setting, following the guidance from an academic dental practice's success.

Additional Links:

- 5. The use and misuse of antibiotics in dentistry (2018)**
<https://tinyurl.com/misuseantibiotics>
Meta-analysis of 118 studies (1982-2017) that concluded dentists prescribed a wide variety of antibiotic regimens for various clinical and nonclinical indications.
- 6. Antibiotics: The good, the bad, and the ugly (2016)**
<https://tinyurl.com/antibioticsgoodbad>
Highlights core, CDC-derived strategies to implement sustainable antimicrobial stewardship programs in all outpatient settings.
- 7. Dentists' prescribing of antibiotics and opioids to Medicare Part D beneficiaries: Medications of High Impact to Public Health (2018)**
<https://tinyurl.com/antibioticsopioids>
Retrospective cross-sectional analytics approach utilizing national 2014 Medicare Part D Prescriber Public Use File data demonstrated that of the 6,724,372 dental prescription claims submitted, 58.7% were for antibiotics and 19.5% were for opioids.

- 8. Antibiotic Use in Dentistry—What We Know and Do Not Know (2019)**
<https://tinyurl.com/antibioticusedentistry>
Concise guide for dentists which describes appropriate antibiotic use.
- 9. Assessment of the Appropriateness of Antibiotic Prescriptions for Infection Prophylaxis Before Dental Procedures, 2011 to 2015 (2019)**
<https://tinyurl.com/infectionprophylaxis>
Cohort study that highlighted, of 91 438 patients who received antibiotic prophylaxis for 168,420 dental visits from 2011 to 2015, 80.9% of antibiotic prophylaxis prescriptions were discordant with guidelines.
- 10. Medicare Access and CHIP Reauthorization Act of 2015 (MACRA)**
<https://tinyurl.com/cmsmacra>
Important information on Advanced Alternative Payment Models (AAPMs) and the MACRA basics. Navigate through this site to find more information about AAPMs, MACRA, CHIP, PQRS, VBPM, MU, IA, MIPA, SGR, etc.
- 11. Antibiotic Stewardship in the Management of Endodontic Infections (2018)**
<https://tinyurl.com/stewardshipendodontic>
Additional information on the management of endodontic infections.
- 12. Association Between Outpatient Antibiotic Prescribing Practices and Community-Associated *Clostridium difficile* Infection (2015)**
<https://tinyurl.com/antibioticscdi>
Study showing that modest reduction of 10% in outpatient antibiotic prescribing can have a disproportionate impact on reducing community-associated CDI rates.

7 Ways Dentists Can Act Against Antibiotic Resistance



Dentists are uniquely positioned to play a role in preventing the spread of antibiotic resistance. Here are seven simple “how-tos” for safe, appropriate antibiotic prescribing and use when treating dental infections.



1. **MAKE** an accurate diagnosis.



2. When prescribing an antibiotic, **CHOOSE** the right drug for the right dose and duration.



3. **USE** narrow-spectrum antibiotics for simple infections and preserve broad-spectrum drugs for more complex infections.



4. **AVOID** prescribing antibiotics for viral infections.



5. For empiric treatment, **REVISE** treatment regimen based on patient progress and/or test results.



6. **KNOW** the side effects and drug interactions of an antibiotic before prescribing.



7. **TEACH** your patients about appropriate antibiotic use and emphasize the importance of taking antibiotics exactly as prescribed.



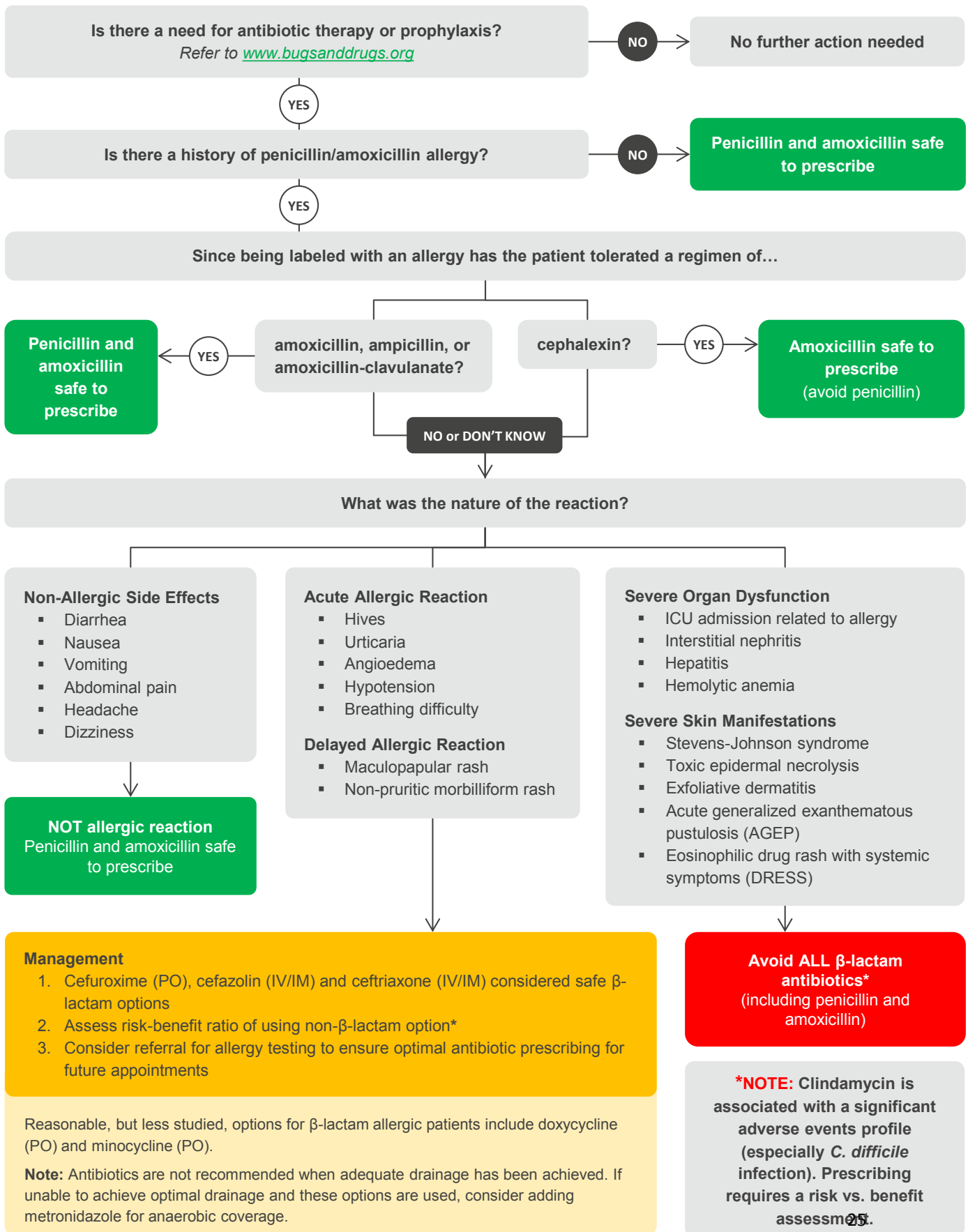
**BE
ANTIBIOTICS
AWARE**

SMART USE, BEST CARE

www.cdc.gov/antibiotic-use



Management of Penicillin/Amoxicillin Allergic Patients in Dental Practice



Guide to Penicillin/Amoxicillin Allergy Management Tool

1 Refer to www.bugsanddrugs.org for best practice recommendations and to confirm whether your patient requires an antibiotic.

2 If your patient states they have a penicillin allergy, consider asking the following questions:

Do you have an allergy to penicillin?

- True penicillin allergy is infrequent. About 10% of people report allergy to penicillin but less than 1% of people have a true allergy.
- Penicillin allergies are not genetic; a relative with an allergy does not prohibit use.

When was the last time you had penicillin? Half of patients with IgE-mediated penicillin allergy lose their sensitivity after five years (80% after 10 years).

What was the nature of your reaction? In children, a rash occurring during a viral infection and concurrent amoxicillin therapy is not indicative of an allergy.

Have you previously tolerated amoxicillin, ampicillin, amoxicillin-clavulanate, or cephalexin? See reverse side for recommendations in prescribing based on past history of antibiotic use.

Were you ever hospitalized due to a penicillin reaction? See reverse side for contraindications for penicillin based on medical history.

3 Use the patient information to follow the allergy management tool on the reverse side.

4 Provide the patient with education materials (available at www.dobugsneeddrugs.org).

Seven actions you can take to fight antibiotic resistance

- Don't prescribe antibiotics for irreversible pulpitis.
- Don't prescribe antibiotics for acute dental abscess without signs of systemic involvement.
- Don't give prophylactic antibiotics prior to dental procedures with total joint replacement.
- Limit pre-operative antibiotics to a single dose.
- Don't give prophylactic antibiotics to patients with non-valvular cardiac or other indwelling devices.
- Use penicillin rather than amoxicillin as drug of first choice for most indications.
- Use this allergy management tool to avoid over-use of clindamycin.

For more information

- Patient information resources available to print from www.dobugsneeddrugs.org
- References available at www.dobugsneeddrugs.org
- Please direct any comments or feedback on allergy management tool to dbnd@bccdc.ca

Penicillin/Amoxicillin Allergy Reference List

The following references were used to inform the creation of the *Penicillin/Amoxicillin Allergy Management Tool for Dentists* and the *Penicillin Allergy Fact Sheet for Patients*.

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Successful Implementation of an Antibiotic Stewardship Program in an Academic Dental Practice

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Background. Most antibiotic use in the United States occurs in the outpatient setting, and 10% of these prescriptions are generated by dentists. The development of comprehensive antibiotic stewardship programs (ASPs) in the dental setting is nascent, and therefore we describe the implementation of a dental ASP.

Methods. A collaborative team of dentist, pharmacist, and physician leaders conducted a baseline needs assessment and literature evaluation to identify opportunities to improve antibiotic prescribing by dentists within Illinois' largest oral health care provider for Medicaid recipients. A multimodal intervention was implemented that included patient and provider education, clinical guideline development, and an assessment of the antibiotic prescribing rate per urgent care visit before and after the educational interventions.

Results. We identified multiple needs, including standardization of antibiotic prescribing practices for patients with acute oral infections in the urgent care clinics. A 72.9% decrease in antibiotic prescribing was observed in urgent care visits after implementation of our multimodal intervention (preintervention urgent care prescribing rate, 8.5% [24/283]; postintervention, 2.3% [8/352]; $P < .001$).

Conclusions. We report the successful implementation of a dental ASP that is concordant with the Centers for Disease Control and Prevention Core Elements of Antibiotic Stewardship in the Outpatient Setting. Our approach may be adapted to other dental practices to improve antibiotic prescribing.

Keywords. antibiotic stewardship; dentistry.

Increasing antibiotic resistance is a global health threat that is associated with increased mortality and increased health care costs [1–4]. In fact, the United Nations General Assembly met to address this threat in September 2016; this was only the fourth time since the inception of the United Nations that a health topic was discussed in this forum [4]. In addition to resistance, antibiotics are a common cause of severe adverse effects, including *Clostridioides difficile* infection (CDI; formerly known as *Clostridium difficile*) [5, 6]. The principal means to decrease antibiotic resistance and adverse effects is to minimize unnecessary antibiotic use. To mitigate suboptimal antibiotic use and improve patient outcomes, antibiotic stewardship programs (ASPs) have been advocated for by the

World Health Organization, the Centers for Disease Control and Prevention (CDC), The Joint Commission, the Centers for Medicare and Medicaid Services (CMS), the Infectious Diseases Society of America, and others [2, 3, 7–9].

Historically, the focus of ASPs has been on the inpatient setting; however, the majority of antibiotic use in the United States occurs in the outpatient setting [10]. In the community, 10% of all antibiotics are prescribed by dentists [11, 12]. Dentists frequently prescribe antibiotics for indications including prophylaxis before dental procedures, postsurgery, and for the treatment of oral infections. Available data suggest that there is a significant opportunity for improvement, given that 30%–85% of antibiotics prescribed by dentists may be suboptimal or not indicated [13, 14]. Importantly, as much as 42% of CDI occurs in the outpatient setting, and antibiotics prescribed by dentists have been associated with CDI in multiple reports [6, 15–18]. Notably, dentists are the leading prescriber of clindamycin in the United States, which is among the highest-risk agents for CDI [12].

To encourage the implementation of ASPs, CMS now requires ASPs in nursing homes, and The Joint Commission requires ASPs in acute care facilities [8, 9]. The CDC has also developed recommendations for various settings, including the Core

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DOI: 10.1093/ofid/ofz067

Elements of Outpatient Antibiotic Stewardship, which includes dental providers and dental practices and can be freely accessed from the CDC [19]. The CDC Core Elements of Outpatient Antibiotic Stewardship include making a commitment to optimizing antibiotic use, implementing a policy or practice to improve prescribing, tracking prescribing and related outcomes of the intervention(s) and feeding this information back to clinicians, providing education to prescribers and patients, and ensuring access to expertise needed to improve antibiotic prescribing. Comprehensive national guidelines exist for the development of ASPs in inpatient settings, but these specifically exclude outpatient settings [20]. However, multiple clinical treatment guidelines and a systematic approach for assessing overprescribing of antibiotics are available to inform the implementation and assessment of antibiotic stewardship in outpatient medical settings [21, 22]. In dentistry, a lack of consensus guidelines in the United States for the treatment of oral infections contributes to the difficulty of standardizing practice and assessing the appropriateness of antibiotic use in dental practices. A few studies describe the outcomes of interventions to improve antibiotic use in dentistry; these have found a lack of patient education and dentist guideline adherence to be barriers to appropriate antibiotic use. These studies, primarily in the United Kingdom, are encouraging but do not describe the implementation of comprehensive ASPs [13, 23–25].

Given the need to improve antibiotic prescribing in dental clinics and the lack of description in the literature regarding the development and implementation of systematic ASPs in dentistry, we describe our experience implementing an ASP based on the CDC Core Elements of Outpatient Antibiotic Stewardship in the dental practice setting.

METHODS/RESULTS

Setting

The University of Illinois at Chicago (UIC) College of Dentistry provides treatment to >30 000 patients each year and is Illinois' largest oral health care provider for Medicaid recipients. UIC dental clinics provide comprehensive services, including comprehensive general dental care, urgent dental care, endodontics, oral medicine and orofacial pain, oral and maxillofacial surgery, orthodontics, pediatric dentistry, periodontics, and prosthodontics. Predoctoral students, residents, and faculty provide care at the college in its 19 general and specialty clinics. Dentists in Illinois prescribe 79.6 antibiotic prescriptions per 1000 people, higher than the national average [26].

The UIC College of Dentistry partnered with the already formalized ASP at The University of Illinois Hospital and Health Sciences System (UIH). The UIH ASP is co-led by 1 FTE infectious diseases pharmacist (A.E.G.) and 0.15 FTE infectious diseases physician (S.C.B.). The UIHASP's goal is to empower front-line providers to use anti-infectives appropriately and thus

optimize patient outcomes. These aims are facilitated through educational initiatives such as: facility-specific treatment guidelines, annual antibiograms, grand rounds presentations, and an institutional antibiotic stewardship webpage with comprehensive information. Prospective audit with intervention and feedback is conducted for patients receiving formulary-restricted anti-infectives and for patients with specific syndromes (eg, real-time rapid diagnostic-tied stewardship interventions for patients with bloodstream infections). Although historically the scope of the UIH ASP has focused mostly on inpatients, in 2016 ASP interventions were implemented in the outpatient medical setting, focusing primarily on inappropriate prescribing for acute upper respiratory tract infections in internal medicine and family medicine clinics. The current study was approved by the UIC Institutional Review Board.

Implementation of the Core Elements of Outpatient Antibiotic Stewardship at UIC Dental Practices

Commitment

In late 2016, after discussion with leadership at the UIC College of Dentistry, the UIH ASP provided a 1-hour continuing education session for the College of Dentistry clinical providers. This session introduced key concepts including the need for antibiotic stewardship in dentistry, recommendations related to the optimal use of antibiotic prophylaxis for common dental procedures, and possible mechanisms for effecting change. In the Summer of 2017, a meeting was held with representatives of the UIH ASP, College of Pharmacy Faculty, and representatives from the College of Dentistry. The aims of the meeting were to briefly review the CDC Core Elements of Outpatient Antibiotic Stewardship and discuss the feasibility of establishing an ASP at the UIC dental practices. The Associate Dean for Clinical Affairs (S.A.R., responsible for all clinical operations) at the College of Dentistry made a commitment to facilitate the development of a College of Dentistry ASP. To gain broad commitment among the dentists, the College of Dentistry ASP was discussed at a Clinical Operations Committee Meeting, and an email was sent to all College of Dentistry clinical providers highlighting the harms of antibiotic misuse and requesting that all dentists stand together in using antibiotics appropriately. Furthermore, in their annual plan, the UIH ASP included "assist with the development of the Dental ASP" as a new strategic initiative.

Action for Policy and Practice

In the Fall of 2017, a subsequent meeting between faculty from the College of Dentistry, UIH ASP pharmacist, and College of Pharmacy was held to discuss perceptions about the use of prophylactic antibiotics and antibiotics for acute oral infections, the choice of antibiotics, dose, and duration. It was suggested that there might be differences in antibiotic prescribing practices among surgical specialties. Furthermore, there may be areas for

improvement in antibiotic use related to third molar extraction, bone/soft tissue grafting, and surgical implants.

In late 2017, the group reviewed baseline antibiotic prescribing data from September 2017 prepared by the College of Dentistry. First, a search for all prescriptions generated during September 2017 was completed, and from this, systemic antibiotic drugs were selected. These antibiotic prescriptions were then cross-referenced with the patient visit, Dental Procedures and Nomenclature (CDT) codes entered that day, the prescribing provider (student/resident/faculty), and the provider who approved (resident/faculty) the prescription. With this information, the electronic dental record was reviewed to identify presenting symptoms. Although studies related to the efficacy of utilizing pre- and postsurgical antibiotics have mixed conclusions, if the procedure has significant risk for and incidence of postoperative infection, antibiotics are generally indicated [27, 28].

With these data, we identified a few potential areas for improvement. First, we found that the prescribing rate for patients with acute dentoalveolar conditions (eg, periapical abscess) in the urgent care clinic was likely an area for improvement. We concluded this given that the prescribing rate varied widely among individual dentists, and antibiotics are often unnecessary for this indication in the absence of extraoral swelling, diffuse intraoral swelling, or systemic symptoms such as fever. We found that there was a significant number of antibiotic prescriptions generated with the CDT code “D0140 limited oral evaluation – problem focused” with student providers. This code is primarily used by student providers on rotation in the College of Dentistry’s Urgent Care Program. Furthermore, we observed variability in the choice of antibiotics for patients with acute dentoalveolar conditions. Amoxicillin was often used; however, the more narrow-spectrum agent, penicillin, was also prescribed. The second patient population identified for possible improvement per our baseline data was patients undergoing surgical placement of dental implants. Pre- and postsurgical placement prescribing patterns also varied between providers and specialty groups.

For our first practice intervention, we decided to focus on 1 area that was feasible, amenable to change primarily through education, not expected to be controversial, and likely to decrease antibiotic use for a significant portion of patients. We decided to first focus on standardizing antibiotic use for acute dentoalveolar conditions, given that this diagnosis met all of the aforementioned criteria, was identified as a need in our baseline assessment, and is a common condition in our practice.

A systematic literature search was conducted to identify literature supporting best practices for antibiotic prescribing in patients with acute dentoalveolar conditions [29–31]. After a review of the available literature and international guidelines, the College of Dentistry faculty led the development of an evidence-based institutional guideline. To obtain broad input from fellow dentists and ensure buy-in, input and consensus for the

guideline were gained among general dentists, endodontists, and oral and maxillofacial surgeons. The resulting guideline was designed to assist clinicians in identifying patients where antibiotics may be used based on patient symptoms (Figure 1). When antibiotics were indicated, this guideline also included preferred and alternative antibiotic therapy and a suggested duration. This guideline was reviewed and endorsed by the College’s Clinical Operations Committee and disseminated to all dentists, residents, and postgraduate and predoctoral clinical providers via email and posted in the dental clinics in March 2018.

Education and Expertise

In addition to the institutional consensus guideline for the management of acute dentoalveolar conditions, multiple other educational interventions were implemented. In early 2018, weekly emails were sent to the College of Dentistry by the Office of Clinical Affairs that provided 1-minute updates on clinical guidelines, safety measures, and general reminders. These “Monday Minutes” focused on antibiotic stewardship in oral health for the first 12 weeks. Example educational topics each week included an overview of antibiotic stewardship, antibiotic use in dentistry including Illinois-specific prescribing data, clinical checklists to improve antibiotic prescribing in dentistry, and the 2017 updates for antibiotic prophylaxis against infective endocarditis [32, 33]. Furthermore, the recording of the previously provided 1-hour continuing education presentation was posted on the College of Dentistry’s faculty development website and was made available to all clinical providers and staff. Educational signs directed at dentists were also placed throughout the college and clinics and included the CDC tip sheets: “Seven Ways Dentists Can Act Against Antibiotic Resistance” [32, 34]. Finally, patient-facing educational posters that focused on when antibiotics may or may not be indicated at the dentist and the potential harms of antibiotics were placed in exam rooms [35].

Tracking and Reporting

The CDC Core Elements of Outpatient Antibiotic Stewardship suggests that 1 potential initial metric is tracking the percentage of all visits associated with an antibiotic [19]. In May 2018, after implementation of our educational “Monday Minutes,” signage and clinical provider and staff discussions focused on antibiotic stewardship in dentistry, antibiotic prescribing rates in faculty-supervised urgent care clinic visits were assessed and compared with baseline data from September 2017. Among all providers, the antibiotic prescribing rate per urgent care visit decreased by 72.9% before and after the multimodal intervention (preintervention urgent care prescribing rate [September 2017], 8.5% [24/283]; postintervention [May 2018], 2.3% [8/352]; $P < .001$). These data suggest that our initial interventions may have decreased antibiotic prescribing; these data were reported back to the College of Dentistry. During practice

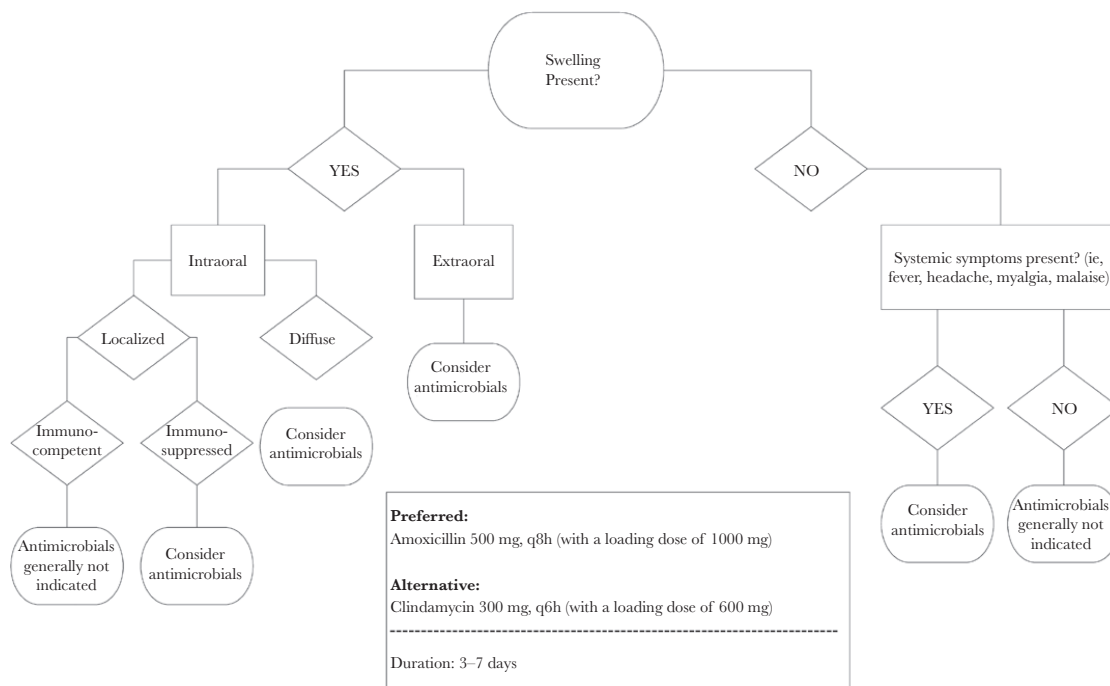


Figure 1. Clinical decision support tool; evidence-based recommendations for antimicrobial use for acute dentoalveolar conditions.

meetings where these data were discussed, clinical providers expressed that anecdotally they had become more conscious of appropriate antibiotic prescribing since the implementation of the educational interventions.

DISCUSSION

We have described our experience establishing a multidisciplinary ASP in an academic dental practice based on the CDC Core Elements of Outpatient Antibiotic Stewardship. To our knowledge, this is the first description of the implementation of a comprehensive antibiotic stewardship program in a dental practice. Our initial results suggest that simple educational interventions may decrease antibiotic prescribing in this setting. Although the results of our educational quality improvement initiative are limited by a lack of reporting of patient and prescriber characteristics, the metric we used is recommended by the CDC and is easily operationalized by our dental practices. Furthermore, a recent systematic review and international consensus study recommended that this metric be used in the outpatient setting for internal benchmarking purposes [36]. In addition, our dental providers have indicated an increased awareness of the appropriate use of antibiotics due to our educational efforts.

When considering which intervention to implement first with a new ASP, it is important to consider feasibility, impact,

and likelihood of success [37]. Our interventions were simple, not controversial, evidence-based, and targeted one of the most common reasons for antibiotic use as identified by our baseline assessment. Our multimodal communication likely increased adoption of the educational content, given that the components were easily accessible by clinical providers, associated with continuing education credit, and included evidence-based clinical support tools. Analogous to our efforts, the aforementioned factors have been associated with facilitating physician participation in training programs related to appropriate antibiotic use for upper respiratory tract infections [38].

As part of our comprehensive stewardship program, we initially selected a high-impact target. Available data suggest that there are many potential opportunities for specific antibiotic use interventions in dentistry [14, 39–41]. In the United Kingdom, peer clinical audits of antibiotic prescribing among dentists have been used effectively for broad education and practice change purposes, including the need for better assessment of systemic signs of infection (availability and use of thermometers in dental practices) and for identifying the specific patient populations in which antibiotics are appropriate [24]. A randomized trial of audit and feedback based on local antibiotic use guidelines in Scotland has also been shown to decrease antibiotic use; however, qualitative data on common reasons for misuse were not collected [23].

Another study from the UK assessed the appropriateness of antibiotic use in dentistry based on adherence to Scottish and UK guidelines [25]. This cross-sectional study included patients with a pulpal, apical, or periodontal pathology, and data were collected including clinical presentation, signs and symptoms, diagnosis, antibiotic choice, dose, and duration. The authors found that 57% of the 568 enrolled patients received an antibiotic and only 19% of antibiotics were prescribed according to local guidelines. Furthermore, factors associated with an antibiotic prescription in the absence of an infection included previous operative treatment failure, presence of an acute periodontal condition, patient refusal of definitive operative treatment, dentist report of insufficient time to conduct definitive operative treatment, and patient request for antibiotics. These data suggest time resource limitations in these practices as a cause for inappropriate antibiotic use, but also factors related to patient education. Educating patients verbally and/or through educational posters in exam rooms on the harms of antibiotics and their appropriate use may decrease inappropriate use in this setting. Antibiotic prophylaxis is another potential target given that the implementation of national guidelines into practice is often delayed; recent US data have found regional variability in the rates of antibiotic prescribing and antibiotic prophylaxis, and this suggests another opportunity for improvement and standardization [41, 42].

In the future, we plan to expand the Dental ASP to other areas. We plan on mandating indications when prescribing antibiotics and integrating clinical decision tools into computerized medication order entry to further facilitate appropriate antibiotic use [38]. We will target other potential indications for antibiotics including acute periodontal conditions, infective endocarditis and orthopedic implant prophylaxis, and antibiotic prescribing associated with surgical treatment. The sustainability of our simple educational intervention will also be assessed in the future; other data suggest that simple educational interventions in the outpatient setting including easily accessible treatment guidelines for antibiotic prescribing can have a sustained decrease in antibiotic use even 3 years after dissemination [43]. We also plan on implementing peer comparison of prescribing rates in the urgent care setting. Finally, we are implementing antibiotic stewardship topics in the core College of Dentistry curriculum and believe this is likely an area that can be improved at other Colleges of Dentistry.

Although our Dental ASP is in an academic setting and was able to partner with a preexisting ASP, the resources required for ASP implementation were minimal and are likely to be similarly feasible and effective in community dental practices. Resources from the CDC and the Illinois Department of Public Health were helpful and were used in our ASP [32, 44]. Other state health departments may also be interested in partnering with dental practices to facilitate local ASP development.

Our report has some limitations. Reviewing and improving prescribing of dental providers is an emerging area in dentistry, and therefore queries by prescriptions cross-referenced with procedure codes are not a standard report in our electronic health record. We collaborated with our information services staff to generate a custom report to compile our data, and this also required manual review and classification of medication prescribed that may be subject to misclassification. Furthermore, the search to identify urgent care visits was based on CDT Codes, and visits may have been missed based on coding errors. The number of patient visits evaluated in the 2 time periods was significant, but the number of patient visits per provider was varied, and some providers had very few visits during the months queried. A longer time frame would be required to make conclusions about individual provider-level data and confirm the continued impact of the intervention. Furthermore, we have so far only assessed 1 quantitative outcome. However, about 13% of our 30 000 annual patient encounters occur in the urgent care clinic; thus this represents a significant portion of our patient encounters. This initial outcome was based on our practice's identified needs, and future interventions and metrics tied to those will provide further evidence of the success of the ASP.

CONCLUSIONS

In conclusion, dentists prescribe a significant amount of antibiotics, and the implementation of systematic dental practice ASPs can facilitate appropriate antibiotic use to mitigate unintended consequences, such as antibiotic resistance and CDI. We have presented an approach to implementing a formalized ASP consistent with the CDC Core Elements of Outpatient Antibiotic Stewardship. We have discussed potential opportunities to improve antibiotic use and barriers and facilitators to effecting change so that others may potentially adapt lessons learned to implement antibiotic stewardship in their dental practices.

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