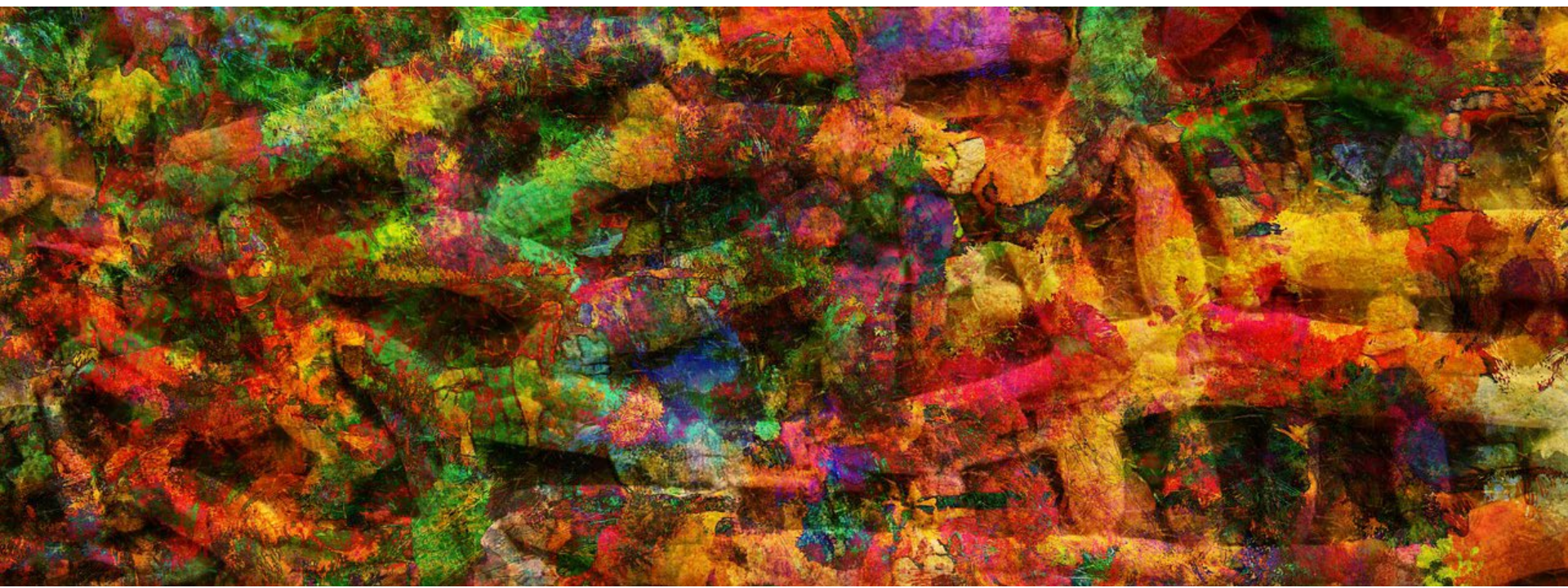


# ANTIBIOTIC STEWARDSHIP IN PEDIATRIC DENTISTRY

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UT Health San Antonio

January 16th, 2025



# OUTLINE

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1. Overview of Antimicrobial Resistance
2. Antibiotic Use in the Pediatric Population – Unique Challenges
3. Overview of the Use of Antibiotics in Dentistry
4. Antibiotic Stewardship & Principles for Judicious Antibiotic Use in Pediatric Dentistry

# ANTIMICROBIAL RESISTANCE – GLOBAL IMPACT



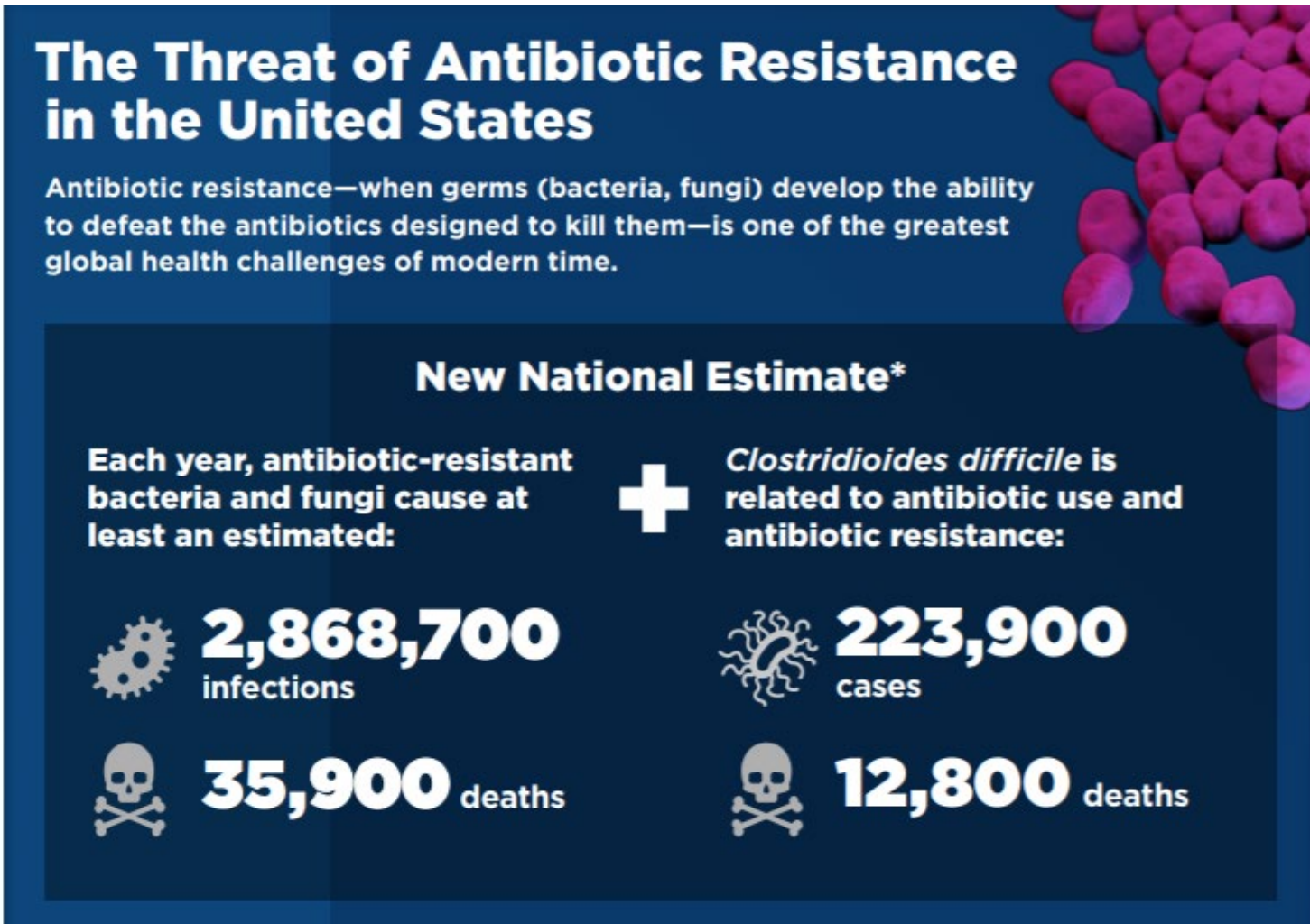
1. WHO – declared that AMR is one of the top 10 global public health threats facing humanity.
2. CDC – AMR is one of the greatest global health challenges to modern medicine.
3. Without urgent action, we are heading for a post-antibiotic era, in which common infections and minor injuries can once again kill.
4. It has been estimated that by 2050, 10 million worldwide deaths could result from antibiotic resistance, making it deadlier than cancer.



## ANTIMICROBIAL RESISTANCE

1. Happens when microorganisms like bacteria and fungi develop the ability to defeat the drugs designed to kill them.
2. Is a naturally occurring process. However, the presence of antibiotics and antifungals can accelerate the process by pressuring bacteria and fungi to adapt.
3. **Resistant infections can be difficult, and sometimes impossible, to treat.**

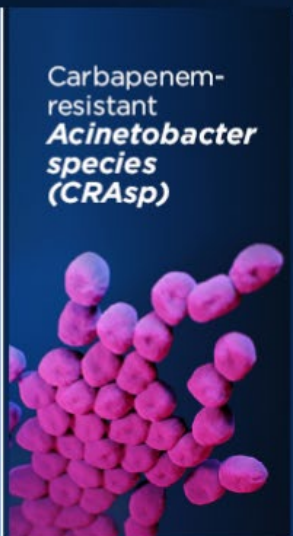
# CDC: Antibiotic Resistance Threats in the United States, 2019 (AR Threats Report)



6 of the 18 most alarming **antibiotic resistance threats** cost the U.S. more than **\$4.6 billion annually**



Vancomycin-resistant  
***Enterococcus***  
**(VRE)**



Carbapenem-resistant  
***Acinetobacter***  
**species**  
**(CRAsp)**



Methicillin-resistant  
***Staphylococcus***  
***aureus*** (**MRSA**)



Carbapenem-resistant  
**Enterobacterales**  
**(CRE)**



Extended-spectrum  
cephalosporin resistance  
in Enterobacterales  
suggestive of extended-  
spectrum  $\beta$ -lactamase  
**(ESBL)** production



Multidrug-resistant (MDR)  
***Pseudomonas***  
***aeruginosa***

[www.cdc.gov/DrugResistance](http://www.cdc.gov/DrugResistance)



U.S. Department of  
Health and Human Services  
Centers for Disease  
Control and Prevention

# ANTIMICROBIAL RESISTANCE THREATS

## in the United States, 2021-2022

20%

- The new data show that 6 bacterial antimicrobial-resistant hospital-onset infections increased by a combined 20% during the COVID-19 pandemic compared to the pre-pandemic period, peaking in 2021, and remaining above pre-pandemic levels in 2022.

5x

- In addition, the number of reported clinical cases of *C. auris* increased **nearly five-fold** from 2019 to 2022.
  - *C. auris* is a type of yeast that can spread in healthcare facilities, is often resistant to antifungal medications, and can cause severe illness.

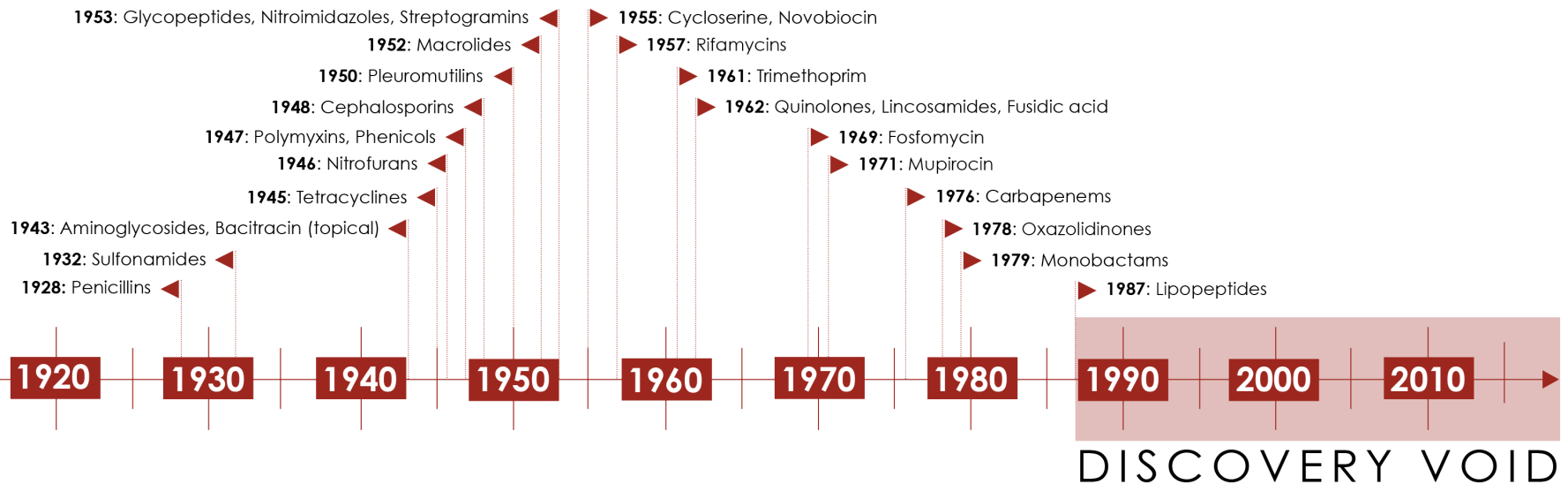
# HOW DID WE GET HERE?



- Lack of clean water and sanitation, and inadequate infection prevention and control promote the spread of microbes, some of which can be resistant to antimicrobial treatment.
- The main drivers in the development of drug-resistant pathogens are **misuse and overuse of antimicrobials**.
  - Any antibiotic use—in people, animals, or crops—can lead to resistance.



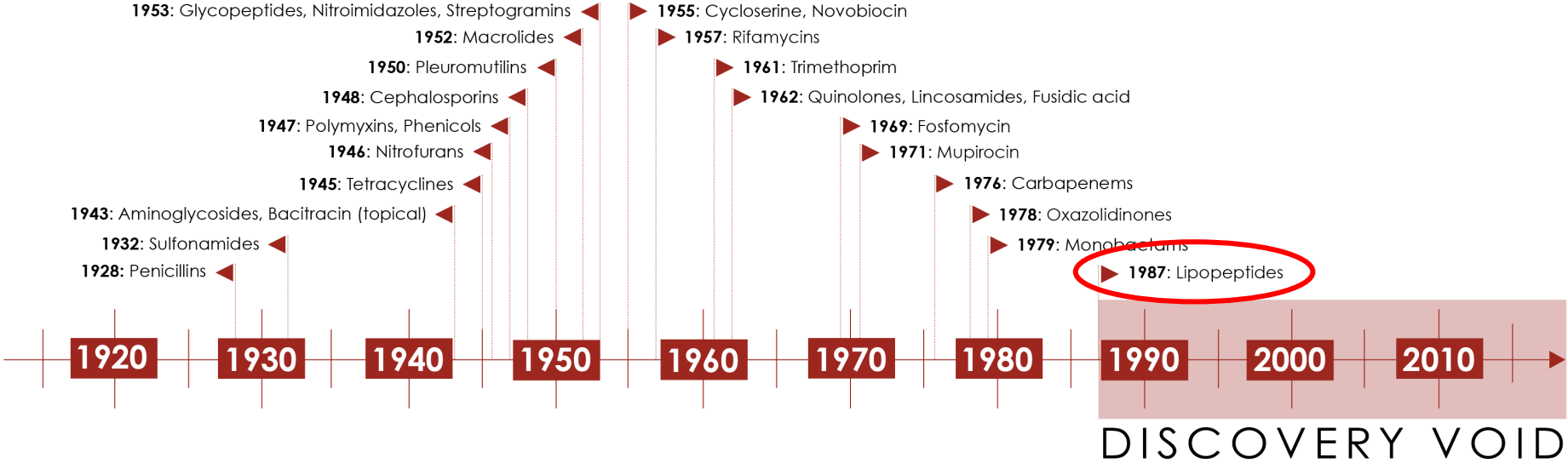
# THE CLINICAL PIPELINE OF NEW ANTIBIOTICS IS DRY



© ReAct Group 2015

Timeline of Antibiotic Discovery

# THE CLINICAL PIPELINE OF NEW ANTIBIOTICS IS DRY



© ReAct Group 2015

Timeline of Antibiotic Discovery

# ANTIBIOTIC DEVELOPMENT IS NOT ENOUGH

- The problem of antibiotic resistance cannot be “solved” by the discovery of one or a few new antibiotics.
- Even if new medicines are developed, without behavior change, antibiotic resistance will remain a major threat.



# ANTIBIOTIC USE IN THE PEDIATRIC POPULATION



UNIQUE CHALLENGES

# ADVERSE EVENTS

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- Antibiotics are the most frequent cause of adverse drug events leading to emergency department visits in children.
- Antibiotics continue to be the most commonly prescribed drugs in children.



Health

# Antibiotic Exposure in Children Under Age 2 Associated With Chronic Conditions

Antibiotic exposures, especially when frequent and occurring early in life, has the potential to promote intestinal dysbiosis and possibly affect the development of conditions such as juvenile idiopathic arthritis, inflammatory bowel disease, asthma, and diabetes (American Academy of Pediatrics).



# Association of Infant Antibiotic Exposure With Childhood Health Outcomes

Zaira Aversa, MD, PhD; Elizabeth J. Atkinson, MS; Marissa J. Schafer, PhD;  
Regan N. Theiler, MD, PhD; Walter A. Rocca, MD; Martin J. Blaser, MD;  
and Nathan K. LeBrasseur, PhD

This population-based cohort study included 14,572 children born in Olmsted County, Minnesota, between January 1, 2003, and December 31, 2011 of whom 70% (10,220) received at least 1 antibiotic prescription during the first 2 years of life.

- Childhood-onset asthma
- Respiratory allergies
- Eczema
- Celiac disease
- Obesity
- ADHD



# USE OF ANTIBIOTICS IN OUTPATIENT SETTINGS & DENTISTRY



# OUTPATIENT ANTIBIOTIC PRESCRIBING IN THE US

- An estimated 80-90% of human antibiotic use occurs in outpatient settings.
- In 2022, the CDC found that healthcare providers prescribed 236.4 million antibiotic prescriptions dispensed from U.S. community pharmacies, roughly 7 prescriptions for every 10 people in the outpatient setting.
- At least 28% of antibiotics prescriptions are unnecessary in U.S doctor's offices and emergency departments.
  - This includes unnecessary antibiotic use plus inappropriate antibiotic selection, dosing, and duration.
- A 2019 study assessing the appropriateness of antibiotic prescriptions for infection prophylaxis before dental procedures estimates that **nearly 81% of the antibiotics prescribed before dental procedures are unnecessary** (Suda et al.).

Suda et al. (2019). Assessment of the Appropriateness of Antibiotic Prescriptions for Infection Prophylaxis Before Dental Procedures, 2011 to 2015

CDC (2023). Antibiotic Prescribing and Use in Doctor's Offices

# ORAL ANTIBIOTIC PRESCRIPTIONS BY PROVIDER SPECIALTY — UNITED STATES, 2022

PROVIDER SPECIALTY	NUMBER OF ANTIBIOTIC PRESCRIPTIONS (MILLIONS)	ANTIBIOTIC PRESCRIPTIONS PER PROVIDER, RATE
Physician Assistants & Nurse Practitioners	84.4	165
Primary Care Physicians	70.0	179
Dentistry	25.2	127
Surgical Specialties	16.4	115
Emergency Medicine	12.0	182
Dermatology	5.4	299
Obstetrics/Gynecology	4.5	81
Other	18.5	27
All Providers	236.4	114

## KEY TAKEAWAY FROM CDC DATA

**The most important  
modifiable risk factor for  
antibiotic resistance is  
inappropriate prescribing of  
antibiotics.  
- CDC**



# ANTIBIOTIC STEWARDSHIP – DEFINED

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The effort:

- To measure antibiotic prescribing
- To improve antibiotic prescribing by clinicians and use by patients so that antibiotics are only prescribed and used when needed.
- To minimize misdiagnoses or delayed diagnoses leading to underuse of antibiotics.
- To ensure that the right drug, dose, and duration are selected when an antibiotic is needed.

# THE ANTIMICROBIAL RESISTANCE (AMR) CHALLENGE

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- The AMR Challenge was a yearlong effort by the U.S. government to accelerate the fight against AMR.
- The challenge ran from September 2018 to September 2019 (UN General Assembly side events).
- The Challenge resulted in more than 350 organizations across the globe committing to slow AMR.



U.S. Secretary of Health and Human Services Alex Azar speaking at the 2018 AMR Challenge.

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## The ADA pledged commitment to:

1. Creating and disseminating guidance to help clinicians appropriately prescribe antibiotics for dental pain and swelling.
2. Publishing a survey of current antibiotic prescribing practices among dentists to demonstrate the need for such guidance.

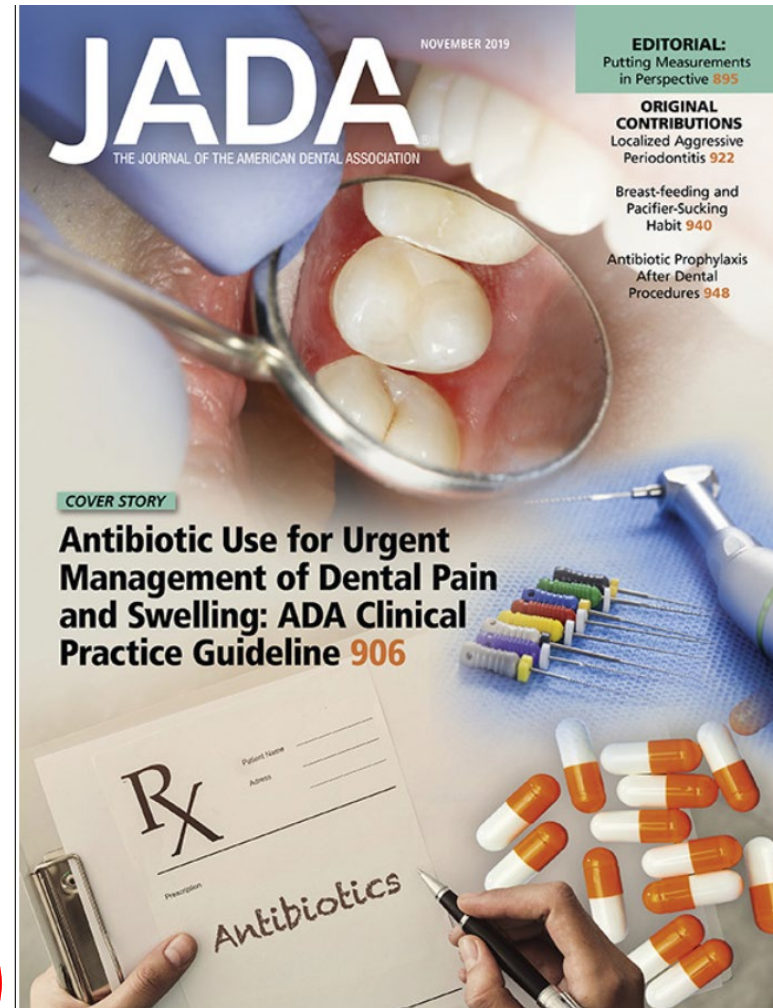


U.S. Secretary of Health and Human Services Alex Azar speaking at the 2018 AMR Challenge.

# ADA CLINICAL PRACTICE GUIDELINES

In 2018, the American Dental Association (ADA) Council on Scientific Affairs convened a multidisciplinary panel of subject matter experts from general and public health dentistry, endodontics, oral and maxillofacial surgery, oral medicine, infectious diseases, emergency medicine, pharmacology, and epidemiology.

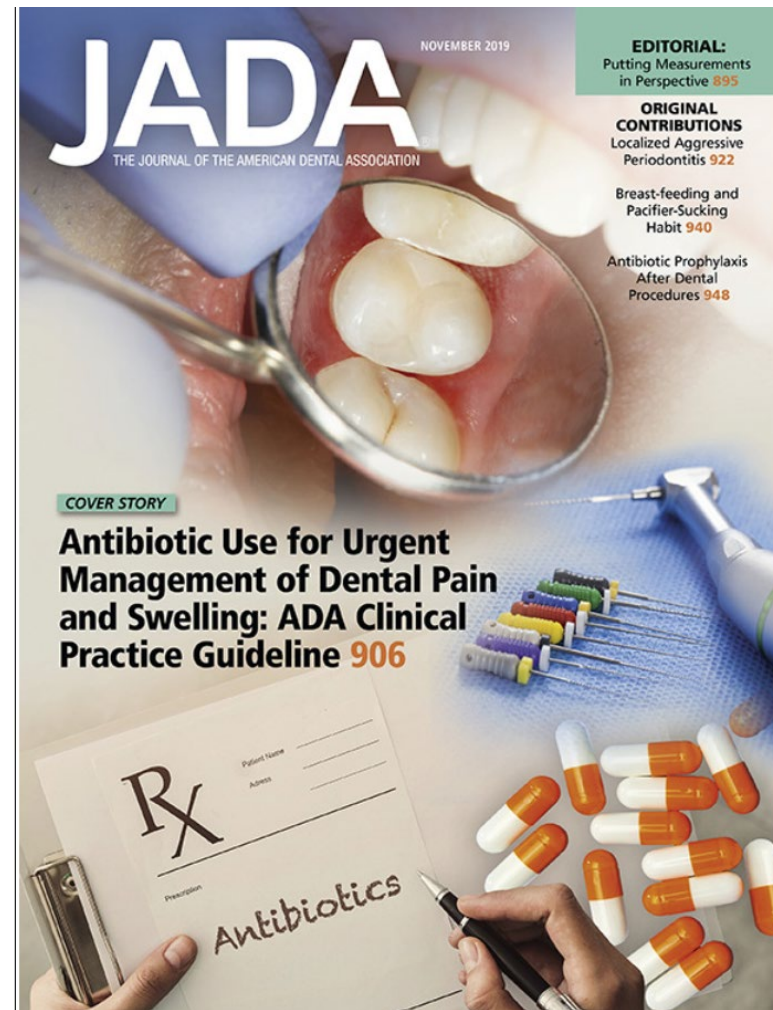
The scope of this guideline focuses on immunocompetent adult patients (18 years or older) with the target conditions and without additional comorbidities.



# ADA CLINICAL PRACTICE GUIDELINES

## Key Points

1. 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.
2. If a patient's condition progresses to systemic involvement, showing signs of fever or malaise, then dentists should prescribe antibiotics.





# Use of Antibiotic Therapy for Pediatric Dental Patients

Adopted in 2001.  
Latest revision 2022.

## Key Points

1. Antibiotic therapy usually **is not indicated nor effective if the dental infection is contained within the pulpal tissue or the immediate surrounding tissue.**
2. For a child presenting with acute symptoms of pulpitis, treatment with pulpotomy, pulpectomy or extraction should be rendered.



# OUR CHALLENGE

THE PRESCRIPTION OF ANTIBIOTICS IS AN IMPORTANT ADJUNCT IN THE MANAGEMENT OF OROFACIAL INFECTIONS.

HOW DO WE ENSURE JUDICIOUS USE OF ANTIBIOTICS IN OUR PRACTICE?

# GUIDING PRINCIPLES FOR JUDICIOUS ANTIBIOTIC USE

---

1. Use therapeutic antibiotics only when clinically indicated.
2. Surgery to remove the cause of infection and establish drainage is primary. Antibiotics are adjunctive treatment.
3. Use specific antibiotic therapy as soon as possible, based on culture and sensitivity testing.
4. Use evidence-based medicine and guidelines when available.
5. Use the narrowest spectrum empiric antibiotic effective against the most likely pathogens.
6. Minimize the duration of antibiotic therapy, as appropriate, to the presenting type of infection.

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# INDICATIONS FOR ANTIBIOTIC THERAPY

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Antibiotics are indicated in combination with surgery both therapeutically and prophylactically in the following situations:

1. Acute cellulitis of dental origin
2. Acute pericoronitis with elevated temperature and trismus
3. Deep fascial space infections
4. Open (compound) fractures of the mandible and maxilla, or other facial bones
5. Extensive, deep, orofacial lacerations.
6. Dental infection or oral-maxillofacial surgery in the compromised host (ex. those with poorly controlled diabetes, those who are immunosuppressed, those receiving renal dialysis)
7. Prophylaxis for dental surgery for some patients with valvular cardiac disease or a prosthetic valve

# Use of Antibiotic Therapy for Pediatric Dental Patients

## Other Indications for Adjunctive Antibiotic Therapy

### Avulsion

Permanent incisors with an open or closed apex

### Pediatric periodontal diseases associated with systemic conditions

### Salivary gland infections of bacterial nature

### Acute apical abscess with systemic involvement

Fever, Malaise, Fatigue, Weakness, Tachypnea, Tachycardia, Dysphagia, Lymphadenopathy, Trismus

# GUIDING PRINCIPLES FOR JUDICIOUS ANTIBIOTIC USE

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# MANAGEMENT OF INFECTIOUS DISEASE

Two cardinal strategies → source control and antibacterial chemotherapy.

1. Source control is the physical removal of infected material, including pus, necrotic tissue, bacterial colonies and vegetations, and foreign bodies.
  - Any infection of dental origin requires definitive treatment of the affected tooth *if the source of the infection is to be eliminated*.
  - **The scalpel, extraction forceps, and the endodontic reamer remain the keystones of therapy for odontogenic infections.**
2. An important consideration in starting antimicrobial therapy is to assess if the infection is localized and if the patient has an adequate immune response to control the bacteria if supported surgically.



# TIMING TO SURGICAL INTERVENTION

- It is recommended to extract infected teeth as soon as safely possible, given a patient's overall medical condition.
- The longer a necrotic tooth remains, the more likely it is to cause a fascial space infection, with greater morbidity and possible mortality.

Johri & Piecuch (2011).



# GUIDING PRINCIPLES FOR JUDICIOUS ANTIBIOTIC USE

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## SPECIFIC VS. EMPIRIC

- Specific antibiotic therapy is guided by the results of culture and sensitivity testing on specimens taken from an individual patient. **IDEAL**
- **Empiric antibiotic therapy** is an educated choice of antibiotic based on knowledge of the most likely pathogens for a given clinical presentation. **PRACTICAL**
- Most head and neck infections are caused by the abscess-forming combination of gram-positive cocci and anaerobes.
- The oral flora involved in abscesses of odontogenic origin in pediatric patients is similar to that in adults.



# ANTIBIOTIC SELECTION

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Should be based on:

1. Properties of the agent (e.g., spectrum of coverage, safety)
2. Previous antibiotic use
3. Patient considerations (e.g., medical history, drug allergies, current medication use, ease of use)

# ANTIBIOTIC SELECTION

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- **Amoxicillin**
  - Considered the first drug of choice for dental infections in non-allergic children.
  - Effective against oral flora, is well absorbed from the GI tract, provides high, sustained serum concentrations, and has a low incidence of adverse effects.
- **Clindamycin**
  - Clindamycin has been associated with significant adverse drug reactions related to community-acquired *C. difficile* infections.
  - The American Heart Association no longer recommends clindamycin for prophylaxis against infective endocarditis due to frequent and severe reactions.
- **Azithromycin**
  - Considered one of the safest antibiotics for patients allergic to penicillins.
  - Can prolong the QT interval and cause arrhythmias (risks of cardiac complications in patients with pre-existing cardiovascular risk factors).
- **Doxycycline**
  - Recommended as an alternative to penicillin, cephalosporin, and macrolide allergy.
  - Short-term use (less than 21 days) of doxycycline had not been associated with tooth discoloration in children under eight years of age.

# GUIDING PRINCIPLES FOR JUDICIOUS ANTIBIOTIC USE

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## USE EVIDENCE-BASED MEDICINE AND GUIDELINES WHEN AVAILABLE

- Conducting clinical trials is more difficult in the pediatric population, therefore there is a dearth of publications on this particular population.
- In general, the guidelines offered by professional societies are usually the consensus of a panel of experts, who must make a recommendation often in the absence of convincing and valid scientifically established data.
- According to the various surveys done on the dental students, dentists and pediatric dentists on the antibiotic prescribing practices, overall, adherence to the professional clinical guidelines was low (Goel et al., 2020).

# GUIDING PRINCIPLES FOR JUDICIOUS ANTIBIOTIC USE

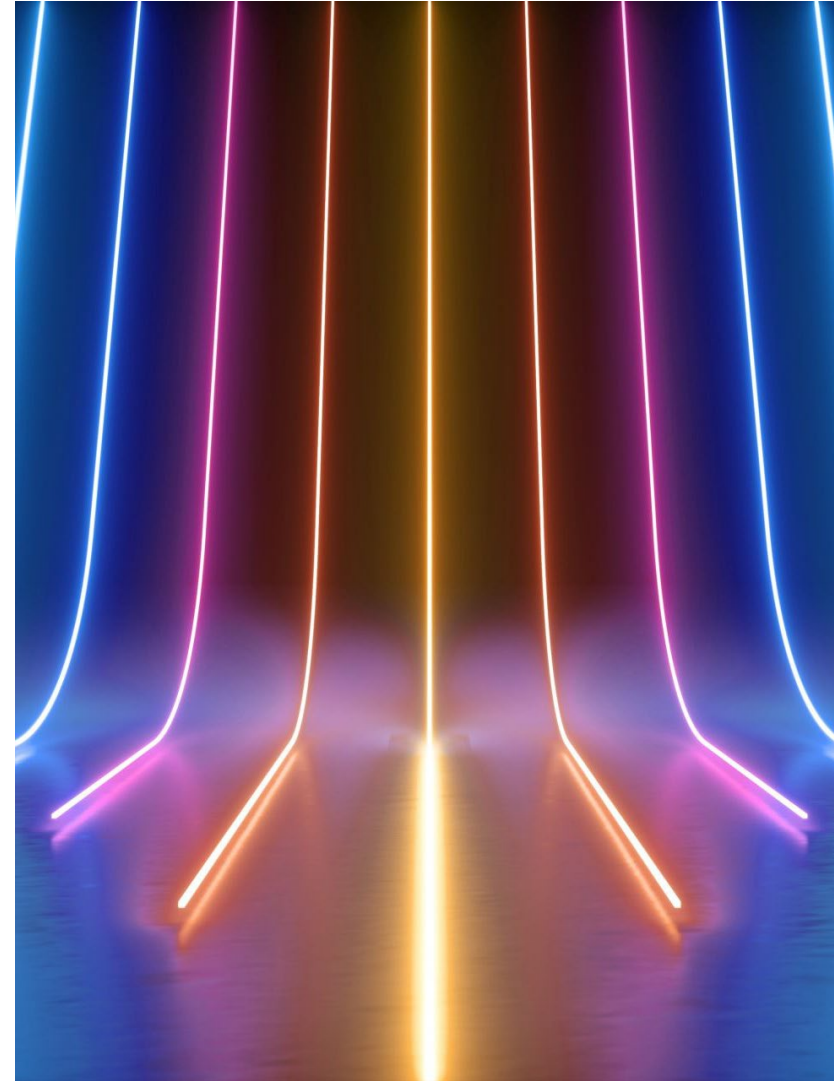
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# NARROWEST SPECTRUM

- The use of broad-spectrum antibiotics often increases:
  - pharmacologic toxicity
  - environmental selection pressure for antibiotic resistant bacterial strains
  - and usually is more expensive
- Initial use of first-line antibiotics, instead of second-line ones, reduces antibiotic resistance, pharmacologic toxicity in general, and cost.



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# ANTIBIOTIC TIME-OUTS

- Antibiotics are often started empirically.
- Formal reassessment of the continuing need and choice of antibiotics when the clinical picture is clearer and more diagnostic information is available.
- Usually 36-72 hours into the regimen.

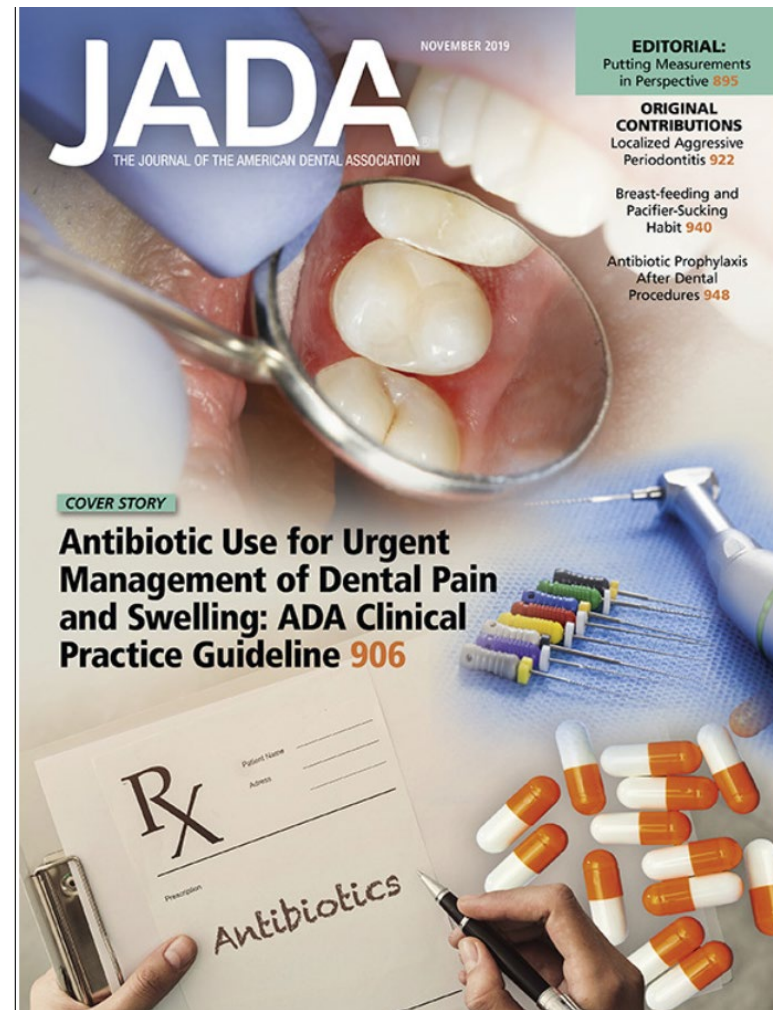
CDC (2019). Core Elements of Hospital Antibiotic Stewardship Programs.



# ADA CLINICAL PRACTICE GUIDELINES

## Antibiotic Time-Out Recommendations:

1. Clinicians should reevaluate within 3 d (for example, in-person visit or phone call).
2. Dentists should instruct patients to discontinue antibiotics 24 h after their symptoms resolve, irrespective of reevaluation after 3 d.



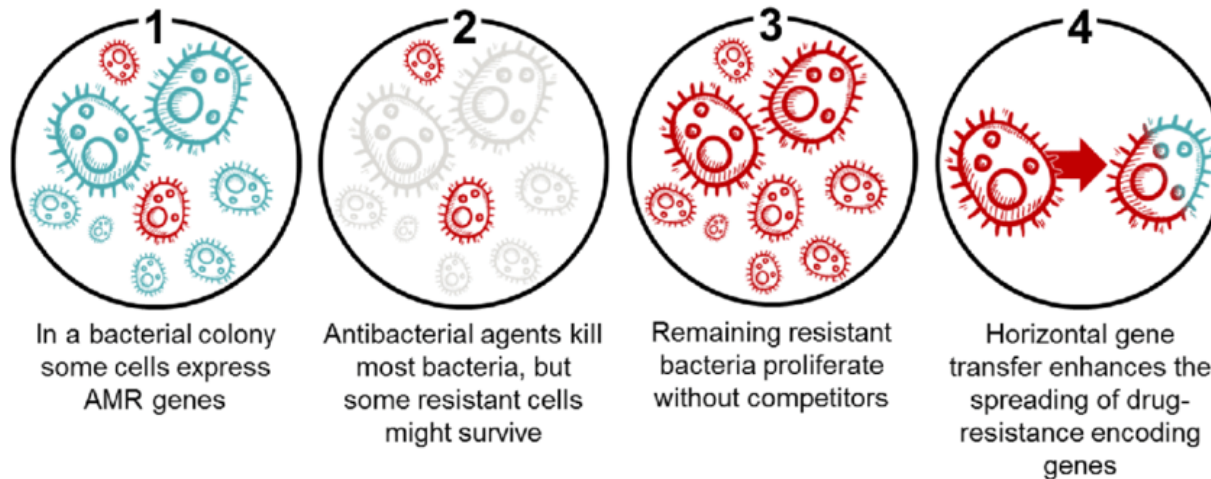
# Use of Antibiotic Therapy for Pediatric Dental Patients

## Antibiotic Time-Out Recommendations:

The clinician should consider altering or discontinuing antibiotics following determination of either ineffectiveness or cure prior to completion of a full course of therapy.

# DOES SHORT COURSES OF ANTIBIOTIC THERAPY INVITE THE SURVIVAL OF ANTIBIOTIC-RESISTANT STRAINS OF BACTERIA?

- Conventional wisdom held that treating the infection beyond symptom resolution would completely eradicate the bacteria causing the infection and thereby help prevent the emergence of antibiotic resistance.
- But what's become clear is that prolonged antibiotics are in fact increasing selection pressure for resistant bacteria, and resulting in more adverse side effects.



# IS SHORTER COURSES OF ANTIBIOTIC THERAPY EFFECTIVE?

- In odontogenic infections, two randomized clinical trials comparing 3- to 4-day antibiotic courses with 7- to 10-day courses found **no difference in clinical effectiveness** between the groups, as long as the appropriate dental or surgical treatment was performed, such as incision and drainage, extraction or endodontic treatment.

James R. Hupp and Elie M. Ferneini

HEAD, NECK, *and* OROFACIAL  
**INFECTIONS**  
An Interdisciplinary Approach

## Diseases for Which Short-course Antibiotic Therapy Has Been Found to Be Equally Effective to Longer Traditional Courses of Therapy

<b>Diagnosis</b>	<b>Short (d)</b>	<b>Long (d)</b>	<b>Result</b>
Community-acquired pneumonia	3 or 5	7, 8, or 10	Equal
Hospital-acquired/ventilator-associated pneumonia	7–8	14–15	Equal
Complicated urinary tract infections/pyelonephritis	5 or 7	10 or 14	Equal
Complicated/postoperative intraabdominal infections	4 or 8	10 or 15	Equal
Gram-negative bacteremia	7	14	Equal
Acute exacerbation of chronic bronchitis/chronic obstructive pulmonary disease (meta-analysis of 21 trials)	≤5	≥7	Equal
Acute bacterial skin and skin structure infections (cellulitis/major abscess)	5–6	10	Equal
Chronic osteomyelitis	42	84	Equal
Empiric neutropenic fever	Afebrile and stable × 72 h	Afebrile and stable × 72 h	Equal



# BENEFITS OF SHORTER THERAPY

Shorter treatments make more sense because they:

- are more likely to be completed properly
- have fewer side effects
- are likely to be cheaper
- reduce the exposure of bacteria to antibiotics, thereby reducing the speed by which the pathogen develops resistance.

**Short courses are preferred to long courses particularly when treating children, since children's compliance with conventional courses is poor.**



# OUR DUTY

AS HEALTHCARE PROFESSIONALS, WE ARE FRONTLINE STEWARDS CHALLENGED WITH BALANCING APPROPRIATE ANTIBIOTIC PRESCRIBING WITH WITHHOLDING OF UNNECESSARY USAGE.

# References

1. American Association of Endodontists (2017). AAE Guidance on the Use of Systemic Antibiotics in Endodontics. Accessed from <[www.aae.org](http://www.aae.org)>
2. AAPD Reference Manual (2018-19): Management Considerations for Pediatric Oral Surgery and Oral Pathology. *Pediatric Dentistry*, 40(6), 373-382.
3. AAPD Reference Manual (2022-23): Use of Antibiotic Therapy for Pediatric Dental Patients. *Pediatric Dentistry*, 40(6), 383-385.
4. American Dental Association (2019): Evidence-based clinical practice guideline on antibiotic use for the urgent management of pulpal- and periapical-related dental pain and intraoral swelling
5. CDC (2017). Antibiotic Prescribing and Use in Doctor's Offices. Accessed from <[www.cdc.gov](http://www.cdc.gov)>
6. CDC (2019). Antibiotic Resistance Threats in the United States. Accessed from [www.cdc.gov](http://www.cdc.gov)
7. CDC (2024). Outpatient Antibiotic Prescribing in the United States. Accessed from <[www.cdc.gov](http://www.cdc.gov)>
8. Goel D, Goel GK, Chaudhary S, Jain D. Antibiotic prescriptions in pediatric dentistry: A review. *J Family Med Prim Care*. 2020 Feb 28;9(2):473-480. doi: 10.4103/jfmpc.jfmpc\_1097\_19.
9. Hupp, J. R., & Ferneini, E. M. (2016). *Head, Neck, and Orofacial Infections: A Multidisciplinary Approach*. St. Louis.
10. Johri A, Piecuch JF. Should teeth be extracted immediately in the presence of acute infection? *Oral Maxillofac Surg Clin North Am*. 2011 Nov;23(4):507-11, v. doi: 10.1016/j.coms.2011.07.003.
11. Lin, Y. J., & Lu, P. (2006). Retrospective Study of Pediatric Facial Cellulitis of Odontogenic Origin. *The Pediatric Infectious Disease Journal*, 25(4), 339-342.
12. Stefanopoulos, P. K., & Kolokotronis, A. E. (2004). The clinical significance of anaerobic bacteria in acute orofacial odontogenic infections. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, 98(4), 398-408.
13. Suda KJ, Calip GS, Zhou J, et al. Assessment of the Appropriateness of Antibiotic Prescriptions for Infection Prophylaxis Before Dental Procedures, 2011 to 2015. *JAMA Netw Open*. 2019;2(5):e193909.
14. Vasudavan, S., Grunes, B., McGeachie, J., & Sonis, A. L. (2019). Antibiotic Prescribing Patterns Among Dental Professionals In Massachusetts. *Pediatric Dentistry*, 41(1), 25–30.