

## **Problem**

Medical-dental integration has been a priority in public health since the release of the Surgeon General's Report, *Oral Health in America*, in 2000. Treating oral infections is often an interdisciplinary effort involving infectious disease specialists with expertise in antimicrobial stewardship, such as pharmacists and physicians.<sup>1</sup>

Antimicrobial stewardship is a broad area of public health that focuses on addressing agents, procedures, and practices that result in selective treatment against bacterial growth.<sup>2</sup> Antibiotic stewardship, a subset of antimicrobial stewardship, is more specifically a set of "coordinated interventions designed to improve and measure the appropriate use of [antibiotic] agents by promoting the selection of the optimal [antibiotic] drug regimen including dosing, duration of therapy, and route of administration."<sup>3</sup> Embracing sound stewardship practices can lead to safer and more optimal dental prescribing. Such practices include improved clinical outcomes, reduced adverse effects, and reduced costs attributable to the suboptimal use of antibiotics.<sup>3,4</sup>

In the United States between 2011-2015, dentists were responsible for 13 percent of outpatient antibiotic prescriptions, a significant contribution to overall antibiotic prescribing in medicine.<sup>5</sup> The prescribing habits by dentists in the U.S. preceding 2018 have not been well understood.<sup>6</sup> The Centers for Disease and Control and Prevention (CDC) estimates that at least 30 percent of antibiotic prescribing in primary care medical clinics are unnecessary.<sup>7</sup>

Although the lifesaving benefit of using antibiotics is well-documented, the use of antibiotics is not without risk. One common myth in stewardship is that the misuse of antibiotics is a threat only at the population level. However, antibiotics have the potential to cause a range of adverse reactions for individuals, from mild rashes to life-threatening opportunistic infections ("superinfections").<sup>4,8,9</sup>

An estimated one in every five emergency department (ED) visits is from antibiotic-related adverse events.<sup>9</sup> According to Geller et al, a study conducted over a four-year period found that each year nearly 150,000 emergency department visits by adults were correlated with antibiotic use.<sup>10</sup> Some short-term adverse effects include allergic reactions, gastric upset, Steven Johnson's Syndrome (SJS), Toxic Epidermal Necrolysis (TEN), central nervous system problems, and drug levels in the body that result in organ toxicity.<sup>11,1</sup> Of these emergency visits for adverse effects, more than three-fourths were allergic reactions.<sup>10,12</sup> Although these acute allergic reactions can typically be treated effectively, a small percentage can be life-threatening.<sup>13</sup> Reactions that are not true allergies may lead patients and healthcare providers to use drugs that are often not considered "first line" agents. This practice leads to the use of more broad spectrum antibiotics and in turn, potentially more harmful side effects or levels of resistance.<sup>13</sup> The medical community is recommending testing for antibiotic allergies to identify true allergies, and to allow patients who can tolerate first line agents to take them. In addition to the two allergy problems with antibiotics, as the aging population increases, all healthcare providers will encounter more patients with chronic conditions who are taking multiple medications. The combination of these factors facilitates a clinical scenario where adverse drug interactions and effects may be exacerbated.<sup>14</sup>

In 2015, the U.S. spent \$2 billion dollars treating 2.2 million patients at hospital emergency departments for dental-related conditions (ICD 10 Code Dental problem, not otherwise specified).<sup>15</sup> Among young and working age adults (15-64 years old), both male and female, dental diseases were among the top 20 reasons for emergency visits.<sup>15</sup> The most common reason was non-traumatic dental emergencies, typically arising from dental caries that progressed into the pulpal tissues resulting in pain.<sup>16,17</sup> Because physicians usually receive little instruction on oral health related issues, patients who seek care from physicians or EDs likely only receive antibiotics and pain medications instead of definitive care.<sup>18</sup> There is a gap in the training and education for health care providers on interdisciplinary antibiotic stewardship that includes clear recommendations for their appropriate use in dentistry.<sup>19,20</sup>

Long-term adverse effects of antibiotic use can include antimicrobial resistance and superinfections. By 2050, estimates are that antimicrobial resistance may cause 10 million deaths per year globally and result in a 100 trillion dollar burden to the world's economy.<sup>21</sup> Resistance is leading to longer hospital stays, higher medical costs and increased mortality. For example, in 2019, the CDC reported that more than 2.8 million antibiotic-resistant infections occur each year in the U.S., and have resulted in more than 35,000 deaths.<sup>22</sup> In addition, there were nearly 224,000 cases of *Clostridioides difficile* (*C. Diff*) that caused nearly 13,000 deaths in 2017.<sup>22</sup> *C. diff* is an opportunistic infection usually acquired from use of antibiotic medications. Treating *C. diff* infections (CDI) is serious and costly for the patient and the healthcare system.<sup>23</sup> In response to this growing problem, the CDC has classified antibiotic resistance, and *C. diff*, as an urgent public health threat.<sup>24</sup> Three of the four antibiotics most frequently associated with CDIs are also among the most commonly prescribed in dentistry; they include lincosamides (clindamycin), cephalosporins, fluoroquinolones and carbapenems. Dentists in the U.S. are the top prescribers of lincosamides.<sup>25</sup> This places dentists in a unique position to create better health outcomes by changing prescribing patterns.<sup>26</sup>

Inappropriate use of antibiotics includes unnecessary (given without indication) utilization, improper selection (the antibiotic is not suggested to be prescribed for a specific diagnosis), dosing error (dose is too high or too low), and/or an error in duration (either too short or too long a time span for the patient's condition). A 2019 study showed that in a sample of more than 91,000 dental patients who received antibiotic prophylaxis for a dental visit, 81% of the prescriptions were unnecessary.<sup>27</sup> Prescribing errors can occur at multiple points throughout a treatment plan.

## Methods

In 2019, the American Dental Association released an evidence-based clinical practice guideline on antibiotic use for tooth pain and swelling, a follow up to guidelines for antibiotic prophylaxis for dental patients.<sup>28,29,30</sup> The new instructions encourage dental and other healthcare providers to not prescribe antibiotics for most cases of tooth pain and/or swelling. These recommendations, expected to be published in 2020 in a professional journal for emergency department providers, will be the first set of multidisciplinary guidelines related to dental prescribing stewardship, and should shift the culture in dentistry and dental treatment from palliative care with antibiotics and opioids to a more definitive and conservative approach. The goal is to move away from a "just in case prescribing" approach to prescribing only when absolutely necessary.

Dentists and dental education programs are well-positioned to act as a primary resource and advocate for promoting the best evidence-based treatment approaches involving the use, prescribing, and stewardship of antibiotics for dental related problems.

Working with partners, state and territorial oral health programs (S/TOHP) play an important role in promoting and supporting interdisciplinary stewardship programs. Through facilitating the development of a task force and regular meetings between stakeholders, creation of educational resources, and sharing of existing stewardship tools, S/TOHP can provide a source of oral health-related antibiotic resources for dentists to increase patient education and in turn have better health outcomes.<sup>31,32</sup>

## **Stewardship Programs: Examples**

### **1) Training and Education**

All healthcare providers are encouraged to address chronic diseases, including complications from dental caries, in an interdisciplinary manner. Education can be one of the most convenient and inexpensive options to provide comprehensive antibiotic stewardship training to interdisciplinary groups. Illinois, Massachusetts, Michigan and Minnesota have launched their own state programs.<sup>33,34,35,36</sup> States can design their own online training, similar to the *Massachusetts Toolkit for Oral Health Clinicians*.<sup>34</sup> This activity allows for the opportunity to partner with local health departments, dental schools, dental societies and other organizations to create state specific online resources.

Using online continuing education and training opportunities presents several benefits. They provide optimal flexibility so professionals can access the materials at their own convenience. In addition, online education programs can be timely, efficient, pragmatic, high quality, aligned to the needs of the professional, sustainable and cost-effective. However, online continuing education has its challenges including learner engagement, level of audience interaction including Q&A sessions, keeping content accurate and up to date, and infusing active learning into online education.

A second education option is to promote and encourage the use of existing stewardship modules.

- The *CDC Training on Antibiotic Stewardship* (released in 2018) offers participants up to eight hours of free continuing education. Content is divided into four sections: 1) antibiotic resistance and threats; 2) epidemiology of outpatient antibiotic use in the U.S. and opportunities for improvement; 3) antibiotic stewardship considerations for the management of common outpatient conditions and antibiotic stewardship in dentistry; and 4) antibiotic stewardship in emergency departments, hospitals and nursing homes.<sup>37</sup>
- The American Society of Health-System Pharmacists offers a course titled *An Interdisciplinary Approach to Antimicrobial Stewardship: Implementing Team-Based Strategies That Impact Patient Outcomes*. This course includes a continuing education discussion guide designed to provide the antimicrobial stewardship team with timely, relevant and useful information on issues in the implementation and management of antimicrobial stewardship programs.<sup>38</sup>

An example of a successful online educational intervention is the “Monday Minutes” series at the University of Illinois at Chicago College of Dentistry (UIC). For 12 weeks, emails sent to staff providing one-minute updates on clinical guidelines, safety measures and general reminders focused on antibiotic stewardship in oral health. Evaluation data suggested there was a substantial decrease in antibiotic prescribing; dental providers also expressed anecdotally that they had become more conscious of appropriate antibiotic prescribing since the implementation of the education intervention.<sup>39</sup> This is a good example of an intervention that can be applied at a university level, tailored towards dental students during their formative training. A program such as this one could also be applied at the local level for a hospital system or at the state level for statewide interdisciplinary education and training.

Many healthcare professionals find that face-to-face interactions are the most effective means of learning. Active learning tends to make interaction, active participation, and immediate feedback easier, which has

been shown to make acquisition of knowledge more effective.<sup>40</sup> Technical issues at inopportune times that might compromise completing online continuing education courses in a timely manner are not a worry for in-person trainings. Dental and other healthcare education program directors can decide what would be most effective for the clinicians they represent and whether the antibiotic stewardship training materials should be provided online or in-person.

## 2) Toolkits

Dentists, along with other healthcare providers, must give serious consideration to the risks and benefits of antibiotics before prescribing an antibiotic.<sup>9,41,42</sup> Implementation of antibiotic stewardship programs can be initiated by developing a state stewardship toolkit that can provide the necessary tools needed to improve prescribing. In Illinois, a toolkit provides dentists with the resources to support appropriate antibiotic prescribing as part of the Illinois “Precious Drugs & Scary Bugs” Campaign, and the associated *Antibiotic Stewardship Toolkit for Dental Providers*.<sup>33</sup> The campaign promotes judicious use of antibiotics in the outpatient setting. The toolkit provides a step-by-step process for dentists to establish effective and appropriate stewardship practices. The steps are to:

1. Demonstrate commitment to optimizing antibiotic prescribing and patient safety;
2. Use evidence-based diagnostic criteria and treatment recommendations to improve antibiotic prescribing;
3. Implement at least one [new] system to track and report antibiotic prescribing;
4. Complete a survey for self-evaluation of personal prescribing practices; and
5. Educate patients on appropriate antibiotic use and potential harms of antibiotic use.

Other antibiotic stewardship resources for dentists available in the U.S. are the Massachusetts Antibiotic Stewardship: Clinical Practice website; the Michigan Antibiotic Resistance Reduction Coalition: Resources for dentists; the Minnesota Antimicrobial Stewardship Program Toolkit website; and the CDC’s *Core Elements of Outpatient Antibiotic Stewardship*.<sup>1,43,36</sup>

The United Kingdom uses an antimicrobial stewardship dental toolkit.<sup>39</sup> The toolkit offers a comprehensive guide to completing a clinical audit on antibiotic prescribing and/or the management of dental infections. The UK toolkit and the CDC toolkit provide waiting room posters and an information brochure to share with patients. The aim of the poster and brochure is to educate patients on the problems associated with antimicrobial resistance and the indications for antibiotics in the management of dental infections.

Offering educational tools in exam rooms on the potential harm of antibiotics and their appropriate use may discourage patients from requesting antibiotics and decrease inappropriate use in dental clinics.<sup>39</sup> Patient education resources can be included in toolkits for dentists and organizations to use to improve communication between healthcare providers and patients.

A major benefit of toolkits is that they can be shared among professionals, and often provide user-friendly step-by-step guides to facilitate designing or updating a program or guidelines. Dentists and dental education programs should act as a primary resource and advocate for promoting the best evidence-based treatment approaches involving the use, prescribing, and stewardship of antibiotics for dental related problems. State and national toolkits highlight evidence-based resources, pre-existing tools, and relevant studies that S/TOHP dental directors, their partners and dentists might find useful for their own initiatives.

### 3) Monitoring and Feedback

All healthcare providers (e.g., dentists, pharmacists, and primary care providers) should work together to create interprofessional stewardship systems to select the best antibiotic for the diagnosis, dosage, duration, and time interval for treatment. Many materials exist that dental program directors, dentists and dental team members can use to assess, monitor and provide feedback for antibiotic stewardship programs. At the state level, promising research demonstrates that change can be created by empowering leadership on antimicrobial stewardship, and providing a comparison of prescribing habits of dental providers with their peers.<sup>44</sup> When nudged by peers, colleagues, or leaders in their fields, members of a team may feel more obligated to change their antibiotic prescribing behaviors.

An example of a monitoring and feedback program was documented in Wales. Initially, monitoring antibiotic prescribing patterns was difficult as dentists utilized generic prescription pads on which the prescribed antibiotics lacked individualized information.<sup>45</sup> Consequently, individualized feedback could not be provided to the dentists. Evidence from a study conducted by the National Health Service in Scotland indicated that providing general dentists with personalized feedback on their antibiotic prescribing could result in a six percent reduction in dispensed prescriptions.<sup>46</sup> A sustainable system of monitoring antibiotic prescribing patterns in primary dental care was needed and was achieved by: (1) identifying indicators that could be used to provide feedback to general dentists on their use of systemic antibiotics and (2) assessing whether it was possible to aggregate performer-level data to produce prescribing profiles. These actions led to a decrease in antibiotic prescribing among dentists. The Scottish study noted that work still remains to improve the dental prescribing database and to better understand the complex factors that influence antibiotic prescribing behaviors.<sup>45</sup>

A useful resource for monitoring and feedback can be found in the CDC's *Core Elements of Outpatient Antibiotic Stewardship*.<sup>1</sup> This document was used in the UIC program and includes checklists for both the clinician and the healthcare facility. The checklists can be adapted for different healthcare entities and used as baseline assessments of policies and practices currently in place. In addition, a checklist can help clinicians and staff review progress in expanding stewardship activities on a designated regular basis.<sup>31</sup> The routine use of such checklists is crucial for monitoring the impact of antibiotic stewardship activities.

A drawback to implementing an already existing monitoring and feedback system is adaptability. Private practices or local health departments may dedicate a single team member for monitoring. However, hospital systems and other larger organizations such as the Veterans Health Administration, Armed Forces, Kaiser Permanente, or Partners Healthcare could have an entire department dedicated to stewardship. Implementing a monitoring and feedback system may be costly. However, coordination of a team that has the combined expertise in clinical practice, communication, and data analytics is essential to drive future considerations for improvement. Guidance for expansion efforts can also be further facilitated with each state's county-level data that monitors the frequency of prescribing by health care provider type, including dentists. A sample chart audit can be found in the Massachusetts State Toolkit.<sup>34</sup>

By promoting toolkits that include evidence-based protocols and guidelines for the use of antibiotics in dentistry, a S/TOHP can encourage dental and other healthcare providers to use reliable and up-to-date information on evidence-based practices. These resources will encourage interdisciplinary collaboration, for example by improving referral systems and treatment guides for dental emergencies.

## Concluding Statement

ASTDD supports adopting antibiotic stewardship strategies in oral health care at the state and territorial levels through encouraging healthcare provider and public education, resource development, and prescription monitoring. State and territorial oral health programs (S/TOHPs) can encourage healthcare providers to better understand their own prescribing trends through regular self-monitoring and evaluation of their prescribing practices and processes. In turn, this can lead to safer treatment planning and lower the risk of antibiotic resistance.<sup>47</sup> S/TOHPs can play a critical role in interdisciplinary collaborations to develop and implement effective ways to engage healthcare providers to create change and protect the public.

## Links for Antibiotic Stewardship Resources

<b>CDC Training on Antibiotic Stewardship</b> <a href="https://www.cdc.gov/antibiotic-use/community/for-hcp/continuing-education.html">https://www.cdc.gov/antibiotic-use/community/for-hcp/continuing-education.html</a>
<b>CDC Core Elements of Outpatient Antibiotic Stewardship</b> <a href="https://www.cdc.gov/antibiotic-use/community/pdfs/16_268900-A_CoreElementsOutpatient_508.pdf">https://www.cdc.gov/antibiotic-use/community/pdfs/16_268900-A_CoreElementsOutpatient_508.pdf</a>
<b>CDC Clinician Checklist for Outpatient Antibiotic Stewardship</b> <a href="https://www.cdc.gov/antibiotic-use/community/pdfs/16_268900-A_CoreElementsOutpatient_check_1_508.pdf">https://www.cdc.gov/antibiotic-use/community/pdfs/16_268900-A_CoreElementsOutpatient_check_1_508.pdf</a>
<b>CDC Facility Checklist for Outpatient Antibiotic Stewardship</b> <a href="https://www.cdc.gov/antibiotic-use/community/pdfs/16_268900-A_CoreElementsOutpatient_check_2_508.pdf">https://www.cdc.gov/antibiotic-use/community/pdfs/16_268900-A_CoreElementsOutpatient_check_2_508.pdf</a>
<b>Antibiotic Stewardship Toolkit for Dental Providers (Illinois Department of Public Health)</b> <a href="http://www.dph.illinois.gov/sites/default/files/publications/opps-antibiotic-stewardship-toolkit-dentists-final-121217.pdf">http://www.dph.illinois.gov/sites/default/files/publications/opps-antibiotic-stewardship-toolkit-dentists-final-121217.pdf</a>
<b>Antibiotic Stewardship Toolkit for Oral Health Clinicians (Massachusetts Department of Public Health)</b> <a href="https://mdphgis.maps.arcgis.com/sharing/rest/content/items/ff05024659db4d2e8d0bc317f0fa6f23/data">https://mdphgis.maps.arcgis.com/sharing/rest/content/items/ff05024659db4d2e8d0bc317f0fa6f23/data</a>
<b>Minnesota Antimicrobial Stewardship Program Toolkit for Outpatient Clinics (Minnesota Department of Health)</b> <a href="https://www.health.state.mn.us/diseases/antibioticresistance/hcp/asp/out/index.html">https://www.health.state.mn.us/diseases/antibioticresistance/hcp/asp/out/index.html</a>
<b>Michigan Antibiotic Resistance Reduction Coalition (MARR)</b> <a href="http://www.mi-marr.org/dental-provider.php">http://www.mi-marr.org/dental-provider.php</a>

The ASTDD Dental Public Health Policy Committee is pleased to acknowledge Kobie Gordon DDS, Erinne Kennedy DMD, MPH, MMSc, and Cara Ortega DDS, MPH for their efforts in drafting this paper.

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