

An evaluation of dental antibiotic prescribing practices in the United States

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Antibiotics are the most commonly used medications for the treatment and prevention of bacterial infections, and they account for \$10.7 billion in health care expenditures in the United States.^{1,2} However, antibiotic misuse is widespread in outpatient and inpatient clinical settings. For example, the Centers for Disease Control and Prevention (CDC) conservatively estimated that 47 million prescriptions for antibiotics (30% of all outpatient antibiotic prescriptions) are un-

necessary.³ Excessive antibiotic use contributes to the development of antibiotic-resistant bacteria, such as *Clostridium difficile* and carbapenem-resistant Enterobacteriaceae, which are recognized as urgent threats to the US health care system. Serious antibiotic-resistant bacteria are estimated to cause 23,000 deaths and 2 million illnesses in the United States annually.¹

A number of organizations have initiated strategies to improve antibiotic use, including the CDC, which has set a national goal to reduce the number of inappropriate antibiotic prescriptions by one-half by the year 2020.⁴ In 2003, the CDC launched the *Get Smart About Antibiotics* campaign, aimed at educating health care providers and consumers about appropriate antibiotic prescribing and use.⁵ More recently, the CDC released guidance to

ABSTRACT

Background. Antibiotic prescribing practices among general dentists and dental specialists in the United States remains poorly understood. The purpose of this study was to compare prescribing practices across dental specialties, evaluate the duration of antibiotics dentists prescribed, and determine variation in antibiotic selection among dentists.

Methods. The authors performed a retrospective cross-sectional analysis of dental care provider specialties linked to deidentified antibiotic claims data from a large pharmacy benefits manager during the 2015 calendar year.

Results. As a group, general dentists and dental specialists were responsible for more than 2.9 million antibiotic prescriptions, higher than levels for several other medical and allied health care provider specialties. Antibiotic treatment duration generally was prolonged and commonly included broad-spectrum agents, such as amoxicillin clavulanate and clindamycin. Although amoxicillin was the most commonly prescribed antibiotic among all dental specialties, there was substantial variation among other antibiotics each specialty selected. The most common antibiotic treatment durations were 7 and 10 days.

Conclusions. This study's results demonstrate that dentists frequently prescribe antibiotics for prolonged periods and often use broad-spectrum antibiotics. Further studies are necessary to evaluate the appropriateness of these antibiotic prescribing patterns.

Practical Implications. The clinically significant variation in antibiotic selection and treatment duration identified among all dental specialties in this study population implies that further research and guidance into the treatment of dental infections is necessary to improve and standardize antibiotic prescribing practices.

Key Words. Antibiotics; prophylaxis; dentistry; treatment.

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hospitals,⁶ nursing homes,⁷ and outpatient clinics⁸ about how to improve antibiotic prescribing practices. As of January 1, 2017, The Joint Commission (a national hospital accreditation agency in the United States) requires that all acute care hospitals have an antimicrobial stewardship program to improve antibiotic prescribing practices.⁹ Moreover, the Centers for Medicare & Medicaid Services has proposed formal antibiotic stewardship programs in all acute care hospitals as a condition of participation.¹⁰ Many of these initiatives are aimed at physicians, but antibiotic prescribing practices by other health care providers, including dentists, are likely to be evaluated closely in the future.

Published data about the antibiotic prescribing practices of dentists are lacking. Study results suggest that inappropriate antibiotic prescribing by dentists may be common. For example, results of a self-reported survey of dentists showed that 70% of dentists reported inappropriate prescription of prophylactic antibiotics before a dental procedure.¹¹ Moreover, dentists' adherence to the antibiotic prescribing guidelines likely remain suboptimal. In a case-based survey, adherence to prescribing guidelines among pediatric dentists in North Carolina varied by 10% to 42%.¹² In a UK study of antibiotic prescribing among general dental practices, only 19% of antibiotics were prescribed in situations in which their use was indicated by clinical guidelines. A similar study in the oral surgery acute dental clinic of a major London, UK, hospital reported only 30% of antibiotic prescriptions complied with clinical guidelines.¹³

To our knowledge, there has been only 1 nationwide epidemiologic investigation of antibiotic prescribing practices by dentists in the United States.¹⁴ Roberts and colleagues¹⁴ reported data on the number and type of antibiotics prescribed by general dentists. However, there are few data on the antibiotic prescribing practices among dental specialists for prophylaxis versus treatment purposes and the length of antibiotic treatment courses prescribed by dentists. In this study, we evaluated the antibiotic prescribing practices of dentists in the United States by analyzing dental antibiotic prescription claims data for a large nationally representative sample of people who were commercially insured.

METHODS

Express Scripts Holding Company (ESHC) is the largest independent prescription benefits manager in the United States, with detailed prescription data for more than 80 million Americans. We obtained data on outpatient antibiotic prescriptions from dentists from January 1, 2015, through December 31, 2015, from the ESHC database. Data included prescribing dental care provider specialty and location, as well as the prescribed antibiotic's name, dose, and days' supply (treatment duration). We excluded members with missing claims information, including provider information. We excluded topical

antibiotics, systemic or topical antifungals, antiparasitics, and antivirals. We combined antibiotics with the same active ingredient but a different formulation (for example, extended-release tablets). We included antimicrobials with antibacterial properties (for example, methenamine).

We ranked provider specialties according to percentage of total antibiotic prescriptions and displayed the top 10 (Table 1). For this initial analysis, we grouped general dentists and all dental specialists together. We also obtained the number of prescribers, prescriptions, patients, and eligible beneficiaries in the database. We defined the number of eligible beneficiaries as the total number of people within the ESHC database at the midpoint of the 2015 calendar year. In other words, this value represented the number of people eligible for prescription benefit coverage through ESHC. This number did not reflect the number of people who received dental care or filled any antibiotic prescriptions. We calculated the percentage of total prescribers by dividing the number of providers within each specialty by the total number of prescribers. We calculated the percentage of antibiotic prescriptions by using a similar method. We calculated the number of antibiotic prescriptions per prescriber to evaluate for high-volume antibiotic prescribing groups with fewer providers and low-volume antibiotic prescribing groups with several providers.

We reviewed the most common antibiotics prescribed by all dental care providers and stratified the results according to dental specialty. From the available data, we analyzed the number of dental specialty prescribers, number of prescriptions, number of patients, rate of prescriptions per provider, and rate ratio of antibiotic prescriptions compared with those of general dentists. We explored antibiotic selection by listing the top 10 most commonly prescribed antibiotics for each dental specialty. We conducted pairwise χ^2 tests to compare prescribing rates according to specialty with those of general dentists.

We presented antibiotic treatment duration (number of days) in histograms. To distinguish antibiotic prescriptions provided for prophylaxis purposes from those provided for treatment purposes, we defined antibiotic prophylaxis prescriptions as those written for a supply of antibiotics for 1 or fewer days, and we defined treatment prescriptions as those written for a supply of antibiotics for more than 1 day. We used US maps to evaluate variations in state-level antibiotic prescribing practices for overall antibiotic use, antibiotic use for prophylaxis, and antibiotic use for treatment purposes. We calculated antibiotic prescriptions by antibiotic prescription count

ABBREVIATION KEY. CDC: Centers for Disease Control and Prevention. ESHC: Express Scripts Holding Company.

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