

# Antibiotic prescribing by general dentists in the United States, 2013

Rebecca M. Roberts, MS; Monina Bartoces, PhD; Sydney E. Thompson, DNP, APRN; Lauri A. Hicks, DO

In dentistry, antibiotics are recommended for management of bacterial oral infections and for prophylaxis of infective endocarditis (IE) in patients with certain cardiac conditions and potentially in some patients who are immunocompromised. Increasing concerns about antibiotic resistance and antibiotic-associated adverse events make the identification of opportunities to improve antibiotic prescribing a public health priority. The

Centers for Disease Control and Prevention estimates that, in

the United States, antibiotic-resistant infections annually affect at least 2 million people and cause 23,000 deaths.<sup>1</sup> The primary driver of antibiotic resistance is the use of antibiotics, whether appropriate or inappropriate.<sup>2,3</sup> In addition, antibiotic use can lead to adverse drug events such as allergic reactions or *Clostridium difficile* infections, which are becoming increasingly common in the community setting and often are related directly to a recent antibiotic prescription or a visit to an outpatient health care facility.<sup>4-9</sup> Investigators in a 2013 study found that, among those with community-associated *C difficile* infections (that is, *C difficile* infections occurring in people with no overnight health care facility stay within the previous 12 weeks), 40.7% reported that they had visited a physician's or dentist's office in the preceding 12 weeks.<sup>9</sup>

Investigators in previously published studies have quantified the amount of antibiotic prescribing occurring in the outpatient setting in the United States and noted variability according to geographic region and provider specialty.<sup>10,11</sup> Although primary care providers such as family practitioners (24%, 64.1 million prescriptions), pediatricians (12%, 32.4 million prescriptions), and

## ABSTRACT

**Background.** Dentists prescribe approximately 10% of outpatient antibiotics, but little is known about dentists' antibiotic prescribing patterns. The authors conducted a study to characterize prescribing by dentists according to antibiotic agent and category, patient demographic characteristics, and geographic region in the United States.

**Methods.** The authors identified oral antibiotic prescriptions dispensed during 2013 in the Xponent (QuintilesIMS) database. The authors used the total number of prescriptions and county-level census population denominators to calculate prescribing rates. In addition, the authors analyzed prescribing according to individual agent, drug category, and patient demographic characteristics and the total number of prescriptions calculated for general dentists overall.

**Results.** Dentists prescribed 24.5 million courses of antibiotics in 2013, a prescribing rate of 77.5 prescriptions per 1,000 people. Penicillins were the most commonly prescribed antibiotic category. Dentists prescribed most antibiotics for adults older than 19 years. The Northeast census region had the highest prescribing rate per 1,000 people. The District of Columbia had the highest prescribing rate of 99.5 per 1,000 people, and Delaware had the lowest prescribing rate of 50.7 per 1,000 people.

**Conclusions.** Dentists prescribe large quantities of antibiotics in outpatient settings, and there is considerable geographic variability. Additional study is needed to better understand the reasons for this variability and identify areas of possible intervention and improvement.

**Practical Implications.** Continued efforts to combat antibiotic resistance will require all prescribers, including dentists, to examine prescribing behaviors for appropriateness and the effectiveness of guidelines to identify opportunities to optimize antibiotic use.

**Key Words.** Antibiotics; prophylaxis; dentistry; treatment.

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internists (12%, 32.1 million prescriptions) provided most antibiotic prescriptions in the outpatient setting, in 2011, general dentists prescribed 10% (24.5 million prescriptions) of all antibiotics in the community.<sup>11</sup> Despite the large contribution of dental prescribing to all antibiotic prescribing in the outpatient setting, not much is known about the details of antibiotic prescribing practices in dentistry. Changes in antibiotic prophylaxis recommendations and limited guidance from professional societies and other stakeholders regarding how to treat specific dental infections may be contributing to inappropriate antibiotic prescribing. To better understand how dentists are prescribing antibiotics in the United States, we conducted a study to characterize antibiotic prescribing by dentists according to antibiotic agent and category, patient demographic characteristics, and geographic region on the basis of 2013 data.

## METHODS

We identified oral antibiotic prescriptions dispensed during 2013 from the Xponent (QuintilesIMS) database. The Xponent database captures more than 75% of all outpatient prescriptions in the United States, reconciles them to wholesaler deliveries, and projects to 100% coverage of all prescription activity by using a patented projection methodology that is based on a sample of patient deidentified prescription transactions collected from pharmacies that report their entire pharmacy business to QuintilesIMS each week. These data represent all outpatient antibiotic prescriptions, across all payers, including community pharmacies and nongovernmental mail service pharmacies, with the exception of federal pharmacies and facilities. QuintilesIMS describes its projection methodology as standardizing these data into estimated prescription counts and using geospatial methodology to align the estimated prescriptions for the nonsample pharmacies to prescribers with observed prescribing behaviors for the same product in nearby sample pharmacies. QuintilesIMS statistical and analytic teams routinely validate the methodology at various levels of granularity.

We summarized prescription counts according to drug category, patient's age, and patient's sex. We aggregated antibiotics into categories according to the Uniform System of Classification, a therapeutic classification system created by QuintilesIMS, as follows: tetracyclines, cephalosporins, lincosamides (for example, clindamycin), macrolides, narrow-spectrum penicillins (for example, penicillin, amoxicillin), quinolones, sulfa-containing antibiotics,  $\beta$ -lactams with increased activity (for example, amoxicillin clavulanate), urinary anti-infective agents (for example, nitrofurantoin), and others. The [Appendix](#) (available online at the end of this article) lists all antibiotics and the respective Uniform System of Classification category prescribed by dentists in 2013.

We based provider specialties on data collected by QuintilesIMS from multiple sources, including the US Drug Enforcement Administration and state licensing authorities. This analysis includes only practitioners identified in the Xponent data as practicing general dentistry. Specialists, such as endodontists, periodontists, and oral surgeons, were aggregated into broader specialty categories in the data we received, and, therefore, we did not include them in this analysis. To estimate provider denominators and providers per capita, we used the Xponent prescription database to extract the total number of prescribers in each provider specialty.

We used the total number of prescriptions, corresponding to the county-level location of the prescribing provider, and census denominators to calculate per-capita (1,000 people) prescribing rates according to state and US census region.<sup>12</sup> In addition, we analyzed prescribing according to individual agent and drug category, as well as according to patient demographic characteristics. Indications and diagnoses were not available because these data captured dispensed prescriptions that did not include this information. We calculated the total number of prescriptions for general dentists overall. We computed all statistics by using SAS Version 9.3 (SAS Institute). The Human Subjects Advisor at the National Center for Emerging and Zoonotic Infectious Diseases determined this project was consistent with nonresearch program evaluation and monitoring, so institutional review board review was not required.

## RESULTS

Dentists prescribed 24.5 million courses of outpatient antibiotics in 2013, a prescribing rate of 77.5 prescriptions per 1,000 people ([Table](#)). Dentists prescribed more antibiotics for female patients than they did for male patients in 2013 (female patients, 13.7 million; 85.2 per 1,000 female patients; male patients, 10.7 million; 68.9 per 1,000 male patients). Most antibiotics dentists prescribed were for adults older than 19 years; fewer than 10% of all antibiotics dentists prescribed were for children aged 19 years or younger. Of the antibiotics prescribed for adults, most were for those aged 40 to 64 years (10.8 million prescriptions, 103.6 prescriptions per 1,000 people). For children, the prescribing rate per 1,000 people was 26.1 and 26.5 for ages 3 to 9 years and 10 to 19 years, respectively. The prescribing rate for children 2 years or younger was only 2.8 prescriptions per 1,000 people.

The geographic region with the most antibiotic prescriptions was the South census region (9.0 million, 36.6% of the total), but the Northeast census region had the highest prescribing rate per 1,000 people compared

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**ABBREVIATION KEY.** ADA: American Dental Association. AHA: American Heart Association. IE: Infective endocarditis.

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