

Drug cost implications for antibiotic prophylaxis for dental procedures

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Objective. To determine the potential economic impact from the practice of antibiotic prophylaxis for dental procedures.

Study Design. We estimated the prevalence of patients in the United States with 15 medical conditions and devices. We multiplied the prevalence for each patient population by the percentage of specialists recommending prophylaxis, then by the estimated number of dental office visits per year, and then by an average pharmacy cost to arrive at a total estimated range of annual cost for this practice.

Results. The 15 medical conditions and devices included in the present study involve upward of 20 million people and an estimated annual cost between \$19,880,279 and \$143,685,823. The actual cost may be far greater because of an underestimation of these prevalence figures and the use of antibiotic prophylaxis for additional patient populations.

Conclusions. Our data suggest a significant cost for antibiotic prophylaxis in the dental practice setting and the need for evidence-based recommendations concerning this practice. (*Oral Surg Oral Med Oral Pathol Oral Radiol* 2013;115:345-353)

The practice of antibiotic prophylaxis (AP) prior to dental procedures has a long history but it is increasingly controversial.¹ Some purported indications for this practice stem from the incidence, severity, and outcomes of infection in some patient populations. For example, the number of hospitalizations with cardiovascular implantable electronic device (CIED) infections increased 3.1-fold from 1996 to 2003, with a correspondingly high mortality rate.^{2,3} Since the original American Heart Association (AHA) recommendations for AP in 1955, there has been a proliferation of non-evidence-based use of AP for upward of 25 different noncardiac patient populations thought to be at risk for distant site infection from dental procedures, despite a lack of evidence for efficacy.^{1,4,5} A recent paper by Thornhill et al. is the strongest evidence we currently have concerning the efficacy of AP for dental procedures.⁶

The two primary concerns with the widespread use of antibiotics for this purpose are life-threatening anaphylactic-type reactions and an increase in the prevalence of drug-resistant bacterial infections.⁷⁻¹⁷ A third

concern involves the cost to the health-care system. Although there have been attempts to determine the cost-effectiveness of antibiotic prophylaxis,^{8,10} we could find no estimates of the cost of antibiotics used for this purpose in dental practice for any of these patient populations.^{18,19} The purpose of this analysis was to determine the potential annual economic impact in the United States from the use of AP for 15 different patient populations.

MATERIAL AND METHODS

The following steps were used to arrive at an estimated annual cost for antibiotics used for AP in dental practice: (1) identify the primary patient populations with medical conditions and devices that are reported to be at risk for infection from dental procedures; (2) determine the prevalence for each patient population; (3) determine the range of support for the use of AP for each of these patient populations; (4) determine the frequency of exposure to a bacteremia in the dental office setting; and (5) estimate the average cost for a dose of amoxicillin recommended by the AHA, as well as that for the AHA's alternative antibiotic recommen-

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Statement of Clinical Relevance

There is little scientific basis for antibiotic prophylaxis prior to dental procedures. We calculate that the annual cost for antibiotic drugs could exceed \$145,578,685, and the actual cost may be far greater. There is a need for evidence-based recommendations concerning this practice.

dations. The range of total estimated antibiotic cost for each group considered the total number of exposures per year.

1. Patients at risk for distant site infection

Although over 25 patient populations have been reported to be at some risk for distant site infection from invasive dental procedures, we selected 15 patient groups commonly seen in dental practice (Table I).¹ We categorized them as either procedure based (prosthetic heart valves, CIED, heart transplants, prosthetic joints [hips and knees only], dialysis shunts, ventriculoperitoneal and ventriculocardiac shunts, vascular grafts, and breast implants) or as non procedure based (native heart valve disease, previous endocarditis, congenital heart disease, neutropenia secondary to cancer chemotherapy, systemic lupus erythematosus, and type 1 diabetes).^{1,5}

2. Prevalence for each patient population

We conducted a thorough literature search on the prevalence of these 15 populations for all age groups. For conditions and devices without published prevalence figures (CIEDs, prosthetic joints, and vascular grafts) we calculated an approximate number based on the number of procedures performed per year (Table I). In brief, prevalence was calculated for these 4 groups by multiplying the number of procedures performed per year by the survival rate reported in the literature or in data reports. To determine prevalence of immunosuppression caused by cancer chemotherapy (group 12), we recorded the number of patients projected to be diagnosed in the United States in 2012 with cancers treated with highly myelosuppressive doses of chemotherapy (Table II).²⁰

3. Range of support for the use of antibiotic prophylaxis

We used published data from a survey of 477 infectious disease consultants that gave a wide range of support for AP for dental procedures (Table I).⁵ We used these data to define the upper end of the range for CIEDs (groups 3 and 4) and the lower figure for the range of support for the use of antibiotics for groups 8 to 14. We also conducted an extensive search of the literature for references to this practice.¹ In an effort to define the range of percentages for groups 2, 5, 7, and 8, we assigned a high end percentage to reflect the literature, organizational guidelines,²¹ or a common practice standard in some communities. Likewise, the low end of the range for groups 1, 3, and 4 was taken from published guidelines.^{13,22} The lower percentage for group 6 represents the 10% estimated percentage of people with congenital cardiac problems who are indicated for AP

by the AHA guidelines.²³ The upper figure of 100% for groups 1, 6, 7, and 9-15 was selected as a clinical practice standard for at least some dentists and physicians. Although a recent statement from the AHA does not recommend AP for patients with CIEDs, we used the figure from the infectious disease consultants as a baseline level of support and assume that some dentists may continue to cover these patients.²²

4. Frequency of bacteremia—dental visits per year

Data from 2007^{24,25} suggest that 56% to 71% of Americans between 18 and 64 years of age and 52% to 64% of Americans over 65 years of age had dental visits in the past year. Other data on adults suggest a range from 1.0 to 2.9 visits per year.^{12,26,27} We chose to use 2 visits, which is in keeping with a longstanding recommendation from the ADA. However, there are no published data on the average number of dental visits per year for any of these 15 patient groups.^{28,29} Because cancer patients are immunosuppressed for relatively brief periods, we estimated the number of dental visits for this group to be once per year. Finally, the potential for bacteremia from each of the many dental procedures is unclear. Our analysis of data on claims paid by a large health-care carrier (Dental Research and Data Institute operated by Delta Dental of Michigan, Ohio, and Indiana) reveals that over 85% of 23 million dental office visits in 2008 likely result in a bacteremia according to the definition for invasive dental procedures in the 2007 AHA guidelines. This strongly suggests that dentists will default to covering patients with antibiotics for virtually all office visits and procedures if antibiotic prophylaxis is deemed warranted.

5. Estimated antibiotic exposure

The estimated antibiotic exposure was determined by multiplying the number of individuals in each of the 15 groups (step 2, prevalence) by the percentage figures for clinicians recommending prophylaxis (step 3) and multiplying the resultant numbers by the number of dental visits per year (step 4) (Table I).

6. Estimated cost for antibiotics

Current AHA recommendations for the prevention of infective endocarditis suggest 2 g of oral amoxicillin as the appropriate first-line therapy for adults³⁰ or clindamycin (600 mg) for those patients allergic to penicillin-type drugs. In August 2010, we contacted five different national or regional retail pharmacy chains across the United States and three different national pharmacy benefit management organizations, and we reviewed <http://Drugstore.com>. We asked each company what they charge the consumer for the drugs and doses listed

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