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Prophylactic Antibiotic Prescribing in Dental Practice – Findings from a National Dental PBRN Questionnaire

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Abstract

Background

Little is known about antibiotic prescribing practices of dentists. The objective of this study was to gain a better understanding of dentists' beliefs and behaviors regarding the use of antibiotic prophylaxis (AP) prior to invasive dental procedures.

Methods

A multidisciplinary team developed and disseminated a questionnaire to 3,584 dentist members of the National Dental Practice-Based Research Network (network).

Results

Overall, 2,169 network dentists (61%) responded. Respondents saw patients at risk of infective endocarditis (IE) and prosthetic joint infection (PJI) at least once per week (35% and 65%, respectively). Although 78% of dentists agreed that the 2007 American Heart Association guidelines for the prevention of IE are well-defined and clear, only 49% agreed concerning PJI guidelines. Differences for the IE and PJI patient populations also existed for questions regarding dentists' understanding of the specific patient groups at risk, the recommended antibiotic regimens, and the need to consult with a patient's cardiologist or orthopedist.

Conclusions

The survey results indicate that decision-making regarding use of AP occurs frequently among dentists. Moreover, dentists reported uncertainty about appropriate use of AP as

defined by both IE and PJI guidelines, which may have resulted in a lack of concordance between dentists' beliefs and their practice behaviors.

Practical Implications:

Our results highlight the need to develop better educational programs that address antimicrobial stewardship in AP for patients at risk for IE and PJI, and target the dental profession.

Key Words (3-10 words): Endocarditis, surveys, antibiotic prophylaxis, antibiotics, practice guidelines, cardiovascular diseases, infection

Introduction

The use of antibiotics to prevent infection at an anatomical location distant to the site of an invasive procedure is referred to as secondary prophylaxis. Support for antibiotic prophylaxis (AP) is based on several factors, the most significant of which is a concern for preventing rare but devastating complications such as infective endocarditis (IE), with its high of morbidity and mortality rates.[1-4]

Many studies over the past 40 years have reported on the incidence, duration, nature, and magnitude of bacteremia from a variety of invasive dental procedures and from activities of daily living (e.g., toothbrushing).[5] These studies have contributed to an emphasis on dental procedures as a primary source of transient bacteremia and the potential for distant site infections, including infective endocarditis and prosthetic joint infections. There is, however, an increasing worldwide concern about the unnecessary and unsupported use of antibiotics for prophylactic as well as therapeutic purposes, given significant risks of adverse drug effects for individuals and society.[6-8] Although there have been no randomized trials, results of some large observational studies suggest a potential benefit from AP in certain “at-risk” cardiac patient populations, furthering confusion regarding the use of AP.[9-12]

Since the initial formal recommendations for AP by the American Heart Association (AHA) in 1955, there has been a major increase in the use of secondary AP for a wide variety of patient populations, most notably for a variety of cardiac conditions, as well as for prosthetic joints.[2,4,13] However, the nature of the patient populations, the number of patients at risk, and the frequency of AP use are unclear. Studies suggest that there are

wide variations in dentist and physician opinions regarding the use of AP for various patient populations, clinical settings and dental procedures, and on compliance with AP guidelines for both cardiac and prosthetic joint patients.[4,14-17] It is not clear what factors dental practitioners use when making decisions about secondary AP for these patient populations.

The primary objective of this study was to quantify the beliefs and behaviors related to dentists' use of secondary AP, with a focus on patients at risk for IE or PJI. Secondary objectives were to explore factors related to dentists' adherence to AP guidelines, the influence of these guidelines on AP prescribing practices, and their knowledge about risks for bloodstream infection and the utility of AP in preventing distant site infections.

Methods

A multidisciplinary study team of clinicians and research experts covering oral medicine, psychology, informatics, statistics, and survey methodology developed a questionnaire with 15 multi-response questions on AP prescribing practices. An extensive process was utilized for the development of this survey to ensure that the data derived from these dental practices would best reflect the beliefs and behaviors of dentists in the U.S. The complexity and length of the methodology was such that it necessitated a separate publication. [18] In brief, the development of the survey involved 3 stages:

Stage 1: The timeline was determined, supporting documentation was collected and a preliminary survey draft of 90 questions was established *Ad hoc* and refined by team

members. A think aloud test was then implemented with a group of eleven dental practitioners to identify and reduce cognitive demand and fatigue, thereby optimizing the response rate.

Stage 2: The survey was organized into themes and an informal review was carried out by the National Institute of Dental and Craniofacial Research. A final survey of 15 multi-answer questions was reviewed by the Central National Dental PBRN Central IRB, University of Alabama at Birmingham, and the IRB at Carolinas Medical Center-Atrium Health.

Stage 3: The final survey was configured using Research electronic data capture (REDCap) software. Email invitations, which included a link to the questionnaire, were distributed through REDCap to 3,584 actively practicing dentists, including generalists and specialists in endodontics, periodontics, prosthodontics, orthodontics, pediatric dentistry, dental public health, orthodontics, and oral/maxillofacial surgery. Individuals not completing the questionnaire within two weeks of a third e-mailed invitation were considered non-responders. All dentists were members of the National Dental Practice-Based Research Network ("network"), a consortium of dental practices and dental organizations focused on improving the scientific basis for clinical decision-making.[19,20] All activities for these investigations were approved by the Institutional Review Boards governing each of the six regions encompassing the network. Data were also collected about each practitioner using the network's Enrollment Questionnaire of reported information about themselves, their practice(s), and their patient population.[20] The typical enrollee completed the questionnaire online, although a paper option was also available.

Dental practitioners eligible for this study were all U.S. licensed, clinically active general and specialty dentists, and current members of the Network.

Dentists' prescribing practice behaviors were assessed with questions that covered: 1) How often they see specific patient populations; 2) Their sense of clarity of AP guidelines; 3) The extent to which they consult with the patient's physician, and who has the responsibility to make decisions concerning the need for AP; 4) Their adherence to AP guidelines; and 5) Their opinions on efficacy of AP, and its use for different patient populations and dental procedures.

Statistical Analyses

Power analysis was conducted based on an anticipated sample size of 2,400 completed questionnaires. This sample size would yield sufficient precision to estimate response percentages with a margin of error of 3.15% (+/- 0.34 (SD) on average per region, with 95% confidence level. Descriptive statistics are presented as counts and percentages for categorical variables, and as means and standard deviations for continuous measures. The analysis was conducted using SAS Enterprise Guide version 7.1 on platform of SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

Overall, 2,169 eligible dentists (61%) responded to the questionnaire, which included 1,706 (79%) general practitioners and 458 (21%) specialists. Five respondents did not provide practice types. The remaining demographics are in Table 1. The majority of

dentist respondents saw patients at risk for PJI once per week or more often (65%), and patients at risk of IE once per month or more often (73%), with 35% seeing them at least once per week (Figure1) (Supplemental Table 1). Seventy-eight percent of dentists either "strongly agree" or "somewhat agree" that the AHA IE prevention guidelines were well-defined and clear, but only 49% felt that way concerning patients at risk for PJI (Figure 2.a.). Similarly, 75% of dentists agreed that IE-risk patient groups were "well defined and clear" versus 47% for PJI-risk patients (Figure 2.b.). Seventy-two percent of respondents acknowledged that dental procedures of concern were well-defined and clear for patients at risk for IE versus 55% for PJI (Figure 2.c.). Differences in clarity also exist for questions regarding appropriate antibiotic regimens (IE - 88% versus PJI - 74%) (Figure 2.d.). Similarly, substantial percentages of respondents felt a need to consult with a patient's cardiologist or orthopedist (48% versus 59%, respectively) about the need for AP and many preferred that a patient's physician make the decision regarding the need for AP (63% and 71%, respectively) (Fig's 3.a and b.). When asked about the antibiotic they preferred, dentists rarely prescribed an alternative to those recommended by the AHA or American Dental Association (ADA) (Figure 4). When asked what they would do if a patient's doctor advised AP that was not consistent with standard guidelines, the most common response was to ask the physician/surgeon to provide the prescription to the patient (45%), although other common responses included following the physician/surgeon's instructions (25%) or calling the physician/surgeon to discuss the issue (21%) (Figure 5). Dentists were asked about the AHA-recommended dose and timing for AP and how often they gave prophylaxis for more than the one recommended dose. The majority (86%) replied "never" or "rarely" (Figure 6).

Another series of questions addressed other patient populations who might be at risk for distant site infection. When asked the extent to which AP prevents infection, more dentists somewhat or strongly agreed that AP prevented infection in those with a prosthetic heart valve (recommended for AP by the AHA) (80%) as compared to patients with a prosthetic joint (43%). Far fewer dentists somewhat or strongly agreed that AP prevented infection in those with a heart murmur (not recommended for AP by the AHA) (17%). However, when asked about patients with a coronary artery bypass graft (not recommended for AP by the AHA), 42% of dentists somewhat or strongly agreed that AP prevented infection, close to the response concerning patients with a prosthetic joint (Figure 7). When asked if they ever prescribe AP before invasive dental procedures for other patient populations, a majority of dentists said they would defer to the patient's physician about the need for AP in patients immunosuppressed due to corticosteroids (59%), cancer chemotherapy drugs (65%), organ transplant immunosuppression (66%) or disease (e.g. HIV/AIDS) (61%). Far fewer (34%) felt the need to defer to a patient's physician about need for AP in insulin dependent diabetics and most (50%) would not give AP, although 15% would (Figure 8). Finally, with regard to risk for developing IE, only 19% of dentists strongly or somewhat agreed that local anesthetic injection posed a risk, while 31% strongly or somewhat agreed that home care posed a risk. More dentists strongly or somewhat agreed that extractions (77%), scaling (68%), and to a lesser extent, restorations that involve the gingival margin (46%) pose a risk (Figure 9).

Discussion

The results of this survey are important and demonstrate a paradox in practice. They

indicate that despite the commonality of AP use in a dental practice, the understanding of recommended guidelines for its use in both IE and PJI at-risk patient groups is not optimal. Educational efforts are therefore warranted since the indications for AP use are a frequent clinical issue encountered by dentists.

The high frequency of patients at risk for IE and PJI seen in network practices was striking and likely contributed to our high response rate of 61%, and this suggests a strong interest in AP. A survey of 530 French dentists found that 94% treat patients at risk of IE at least once a month.[21] The response rate to our questionnaire far exceeds those for practitioner surveys, in general,[22] and may also reflect network practitioners' desire to contribute to the scientific base for clinical practice.

Consistent differences between dentists' beliefs and behaviors regarding AP use in patients at risk of IE versus PJI may reflect, in part, the history of professional guidelines addressing these two patient populations. Current AHA guidelines restrict AP to patients at highest-risk from (not for) IE and it is not intended for those at moderate-risk,[13] who represent nearly 90% of patients previously recommended for AP. This moderate risk group deletion in 2007 therefore resulted in a 90% reduction in the number of patients recommended for AP.[2,23] The use of AP for patients with prosthetic joints, however, is a longstanding and controversial issue. The role of oral bacterial species in IE is well established and it may have prompted orthopedic surgeons to support AP to prevent the devastating consequences of late-PJI.[24] However, despite their role in IE, oral bacterial species are a rare cause of PJI.

There is ongoing controversy regarding which, if any, patients with prosthetic joints are

sufficiently at risk to warrant regular exposure to antibiotics for invasive dental procedures.[2,25] The longstanding practice of using AP before a dental procedure for all patients with a prosthetic joint changed in 1997 when a Joint Committee representing the ADA and the American Association of Orthopaedic Surgeons (AAOS) recommended that AP only be used for two years following placement of a prosthetic joint, and beyond two years for only a select group of medically complex patients.[26,27] This well-accepted standard, however, was reversed in 2009 when a "Patient Safety Committee Opinion Statement" from the AAOS unilaterally recommended AP "for all total joint replacement patients prior to any procedure that may cause bacteremia".[28] Since then, there have been three formal attempts to resolve this controversy[25,29,30] but the outcome has been ongoing confusion.[31,32] This likely explains why, in our study, only 16% of dentists strongly agreed with the statement that guidelines concerning the use of AP are well defined and clear for patients with prosthetic joints.

The long history of the AHA guidelines, along with consistent involvement of the dental profession in producing them, probably explains why more dentists somewhat or strongly agree that the AHA guidelines and the patient populations at risk of IE are "well defined and clear" for IE than for PJI (Fig. 2.b.). However, even for AHA guidelines, only 33% of dentists strongly agreed that they were well defined and clear and only 30% felt that the patient groups recommended for AP in the AHA guidelines were well defined and clear. This may explain recent findings that suggest many U.S. dentists are continuing to prescribe AP for patients in the AHA moderate-risk group.[12,23] These observations are not unique to the U.S.. A French survey found that 88% of dentists still prescribe AP to patients at moderate risk of IE despite French guidance recommending that they not do

so.[21]

Efforts to reduce AP in those at moderate-risk of IE may inadvertently have also resulted in a significant fall in AP prescribing for those at high-risk since the 2007 AHA guidelines.[23] This may reflect difficulties dentists experience in distinguishing between the different cardiac conditions that constitute high- and moderate-risk. It may also reflect pressures of the antibiotic stewardship message to reduce antibiotic prescribing wherever possible.

When asked about dental procedures that put some patients at risk for IE, opinions covered the spectrum from strongly disagree to strongly agree (Fig. 9). The level of confusion appears to be high, exceeding 90% in one survey[17]. Of interest, the dental procedures that may put patients at risk are stated in the AHA guidelines with a simple sentence that was intended to result in a common understanding of risk for the many dental procedures with widely varying invasiveness (Figure 9).

Our results also show that a majority of dentists somewhat or strongly agree that a patient's cardiologist, orthopedist or physician should decide if a patient needs AP. This likely reflects concerns about the lack of clarity of the IE and PJI guidelines, and the feeling that cardiologists and orthopedic surgeons are better able to make this decision. It may also reflect medico-legal concerns about who should take responsibility for these decisions. In the past, the AHA produced a wallet card for cardiologists to give to patients to indicate if AP is recommended.

It also appears that 15-22% of dentists use AP for patients who may be immunosuppressed from drugs or disease, and for those who have insulin-dependent

diabetes. There are no published guidelines on AP for these patient populations and no scientific studies to suggest a risk

These data have certain limitations, and conclusions should take into account that this study measured beliefs about treatment recommendations in hypothetical clinical scenarios, which may not reflect clinical treatment behavior. Additionally, although the response rate was very good, it is possible that non-respondents would have reported different beliefs and behavior. Although network practitioners have much in common with dentists at large,[33] they are not recruited randomly and their responses may not be representative of all dentists in the U.S.. However, a case can be made that Network dentists are representative of U.S. dentists. This conclusion is warranted because: (1) substantial percentages of network general dentists were represented in the different response categories of the Enrollment Questionnaire; (2) findings from several network studies document that network dentists report patterns of diagnosis and treatment that are similar to patterns determined from non-network dentists;[34,35] and (3) the ADA Survey of Dental Practice demonstrated the similarity of network and non-network dentists.[36]

These results reinforce the need for continuing education and antibiotic stewardship programs specifically designed for the dental practice setting. Dentists are high prescribers of antibiotics, in general[37-41] and they prescribe more than 2.9 million prescriptions per year.[16] Because of increasing concerns about antibiotic resistance, they can be a significant part of the solution.[16,42-45] Similar to the actions taken in response to an increased awareness of dentists' roles in opioid prescriptions (e.g., mandatory prescription drug monitoring programs and mandatory continuing education)[46], it is

possible that similar actions will be seen as partial solutions to foster improved antibiotic stewardship.

The volume of information, figures and tables derived from this survey of over 2,000 dentists was such that it could not be covered in one manuscript. For this reason, the data for specialists and generalist dentists were pooled together and a separate publication is planned that will allow for a discussion of the survey data broken down by dental specialty and other demographics.

Conclusions:

Our study clearly suggests the need to explore in more detail the opinions of dentists concerning their prescribing of AP to all patient populations, not just those at risk for IE and PJI, and what they do in practice for all patients who may benefit from primary as well as secondary prophylaxis. Data that supports better targeting of antibiotics to patients and situations where they are justified, and a reduction in antibiotic prescribing overall, is in the interests of all patients and society in general.

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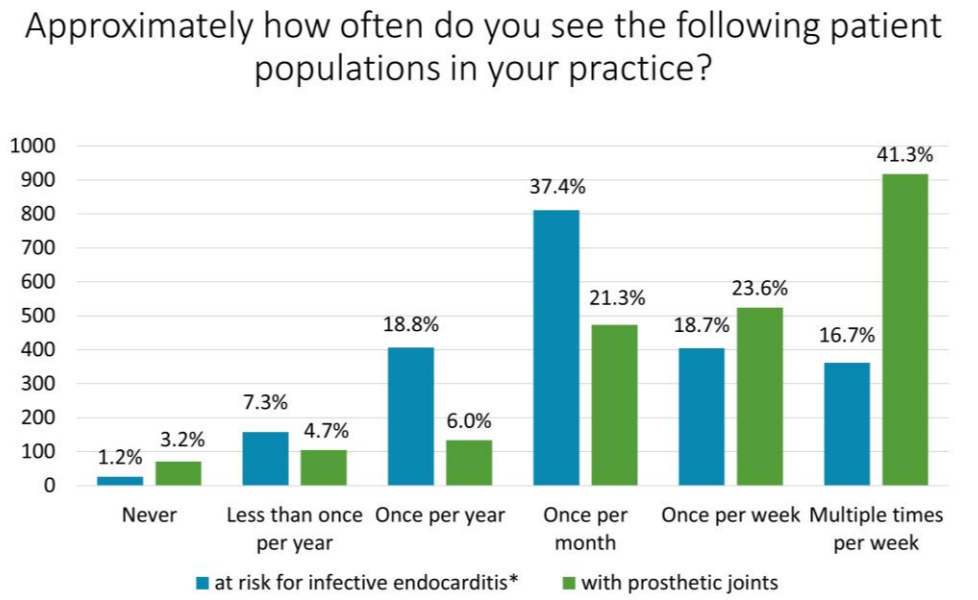
Table 1. Demographic characteristics of all practitioners who completed the AP questionnaire, based on responses from the network enrollment questionnaire*

	N	%
Total	2169	100.0
Age groups		
25-35	94	4.3
35-45	501	23.1
45-55	444	20.5
55-65	686	31.6
65+	421	19.4
Missing	23	1.1
Network Region		
Western Region	313	14.4
Midwest Region	247	11.4
Southwest Region	437	20.1
South Central Region	418	19.3
South Atlantic Region	293	13.5
Northeast Region	459	21.2
Missing	2	0.1

Gender		
Male	1507	69.5
Female	649	29.9
Missing	13	0.6
Race		
White or Caucasian	1751	80.7
Black or African American	87	4.0
American Indian or Alaska Native	5	0.2
Asian	216	10.0
Native Hawaiian or other Pacific Islander	4	0.2
Other + missing	106	4.9
Hispanic or Latino origin		
Yes	115	5.3
No	2021	93.2
Missing	33	1.5
Primary practice location		
Inner city of urban area	272	12.5
Urban	612	28.2
Suburban	968	44.6
Rural	298	13.7

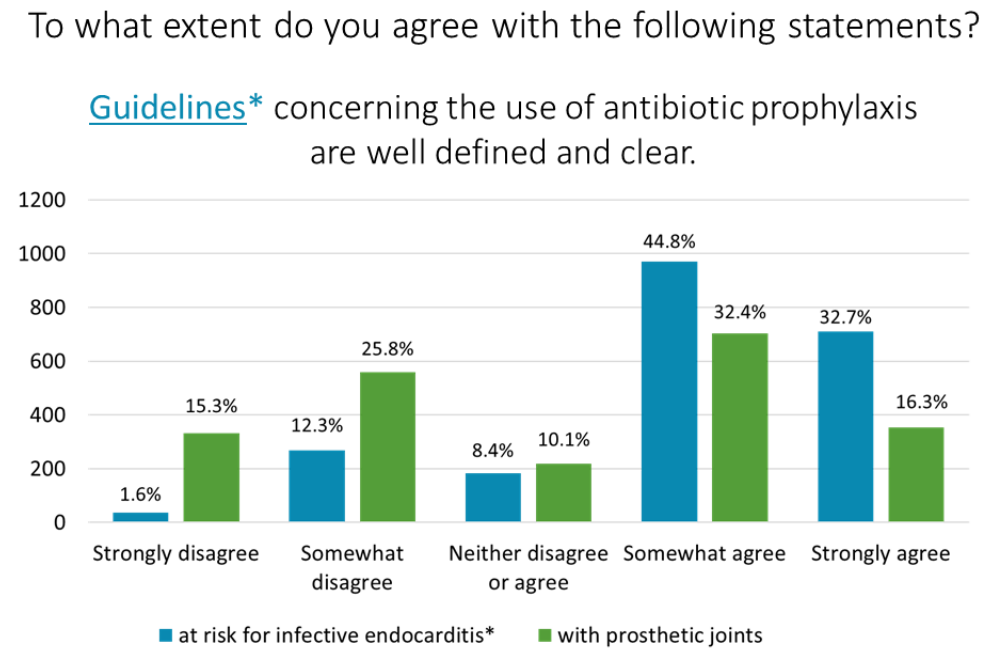
Missing	19	0.9
Practice time type		
Full-time	1798	82.9
Part-time	344	15.9
Missing	27	1.2
Practice type		
General practitioner	1706	78.7
Specialist	458	21.1
Missing	5	0.2
The number of practice locations		
One location	1701	78.4
Two locations	347	16.0
Three locations	67	3.1
More than 3 locations	52	2.4
Missing	2	0.1

Figure 1



*as per the 2007 American Heart Association Guidelines

Figure 2.a.



*as per the 2007 American Heart Association Guidelines

Figure 2.b.

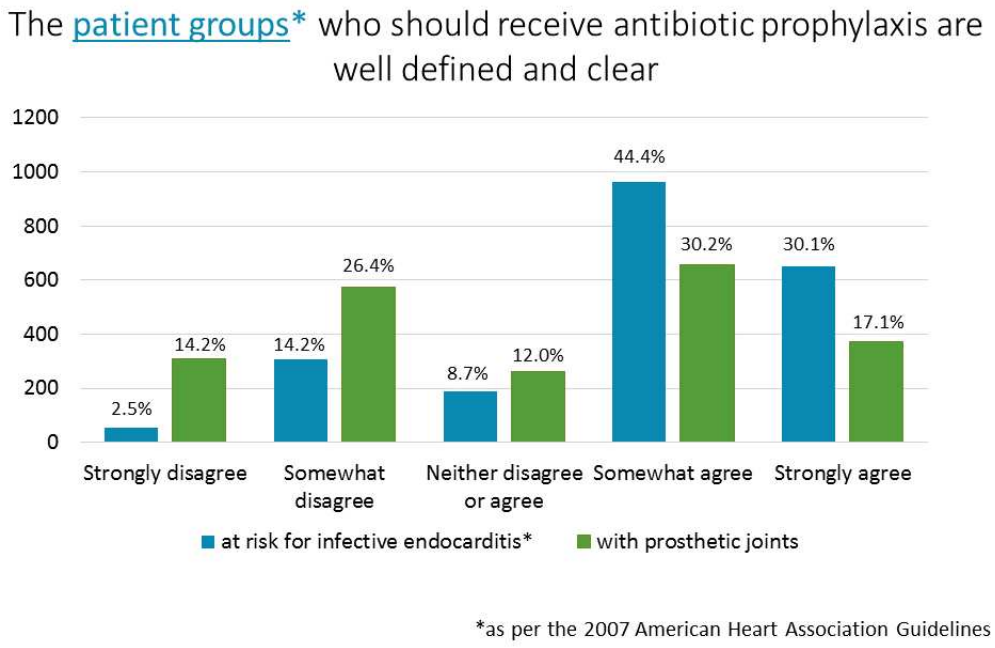


Figure 2.c.

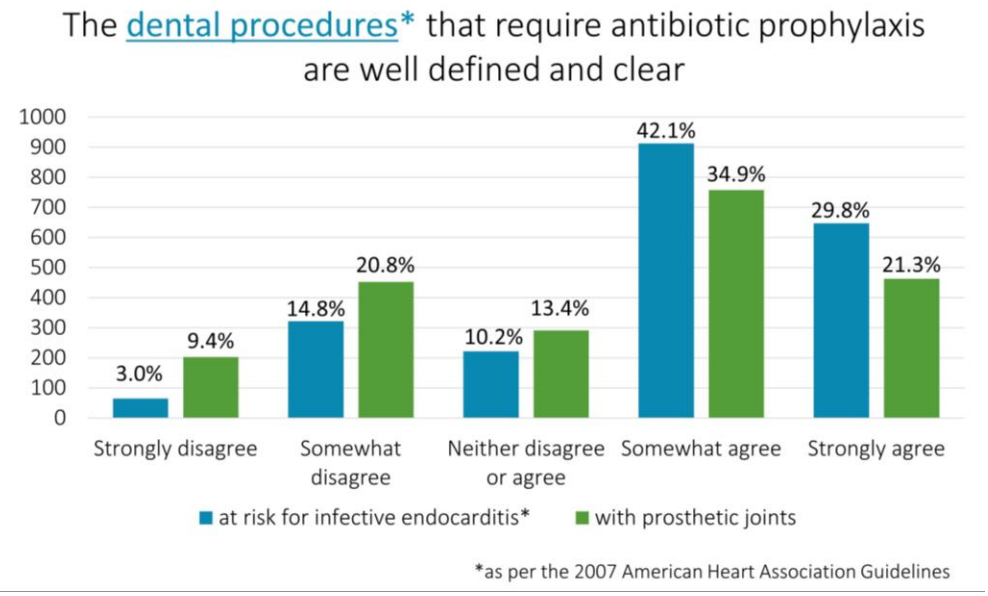


Figure 2.d.

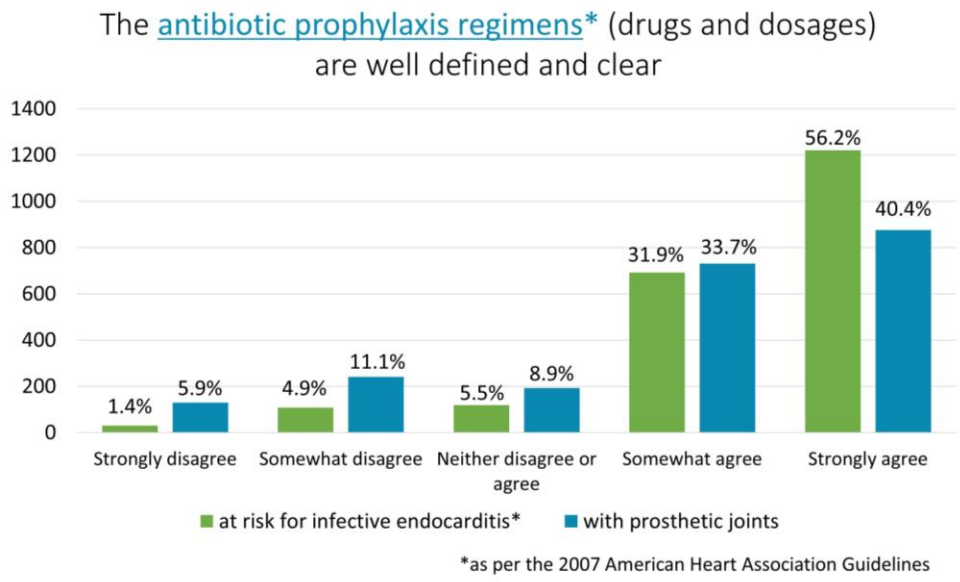


Figure 3.a.

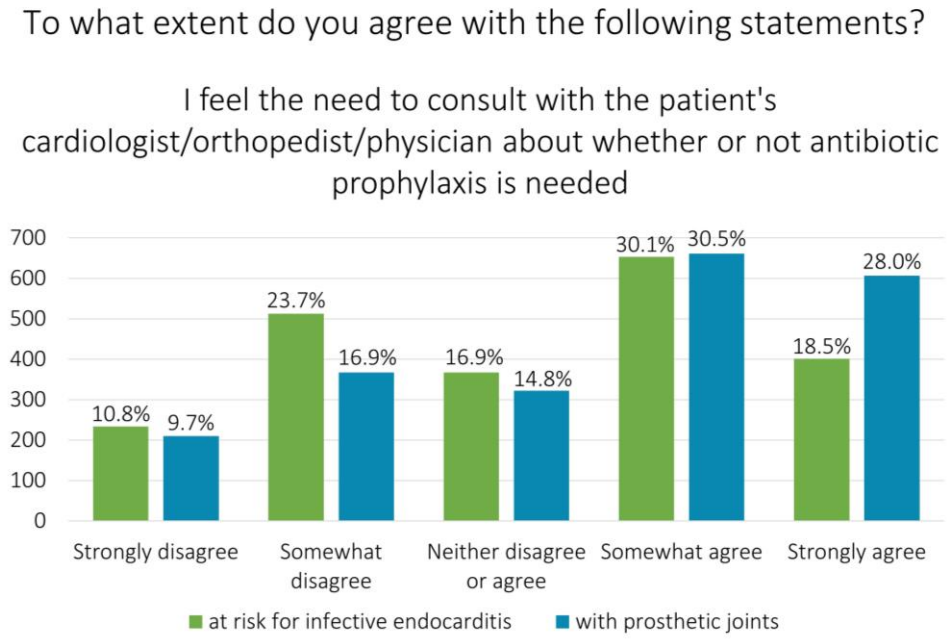


Figure 3.b.

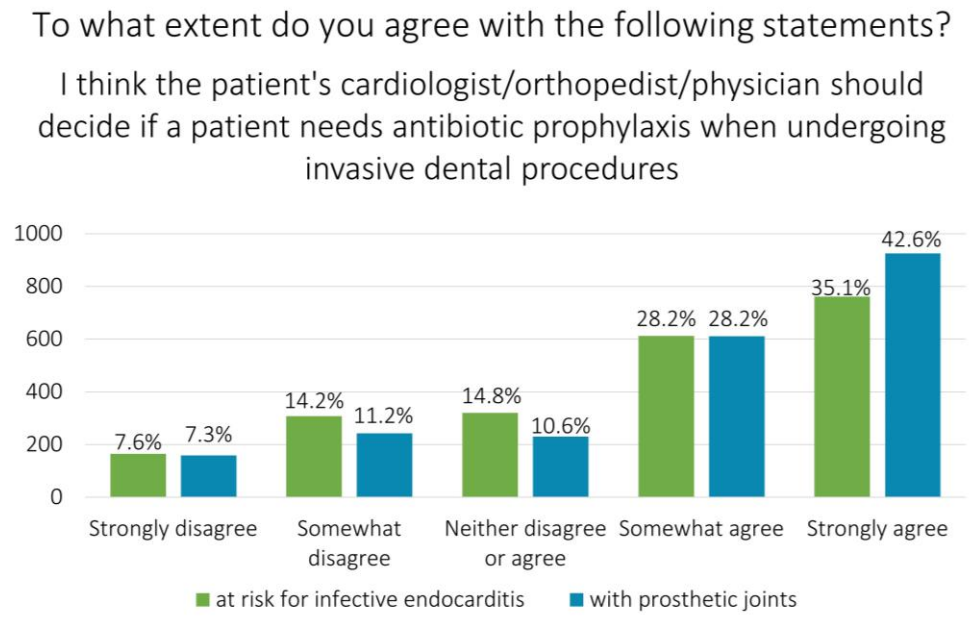


Figure 4

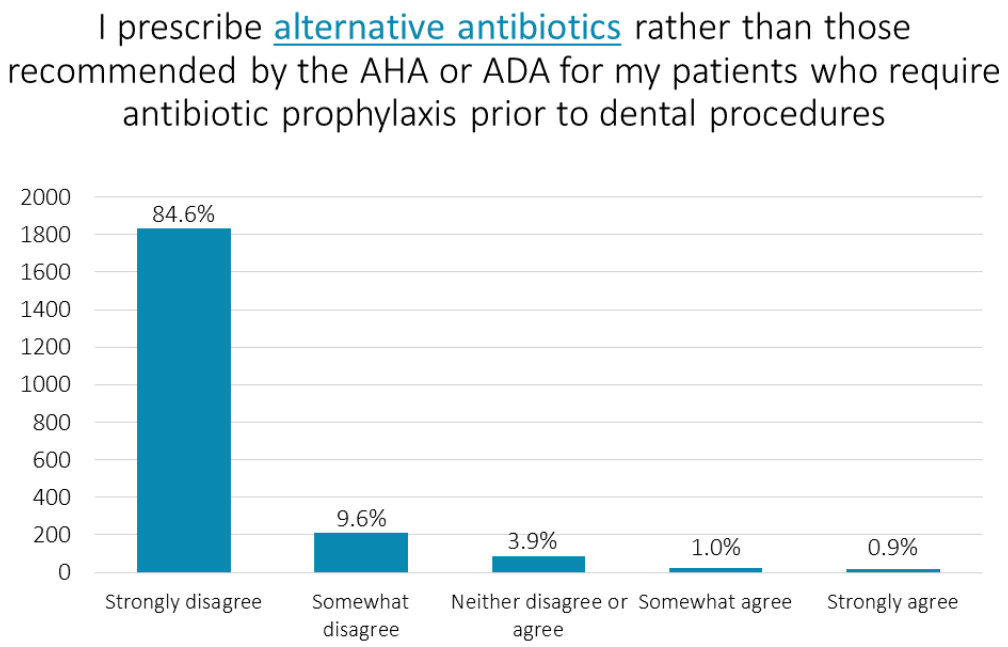


Figure 5

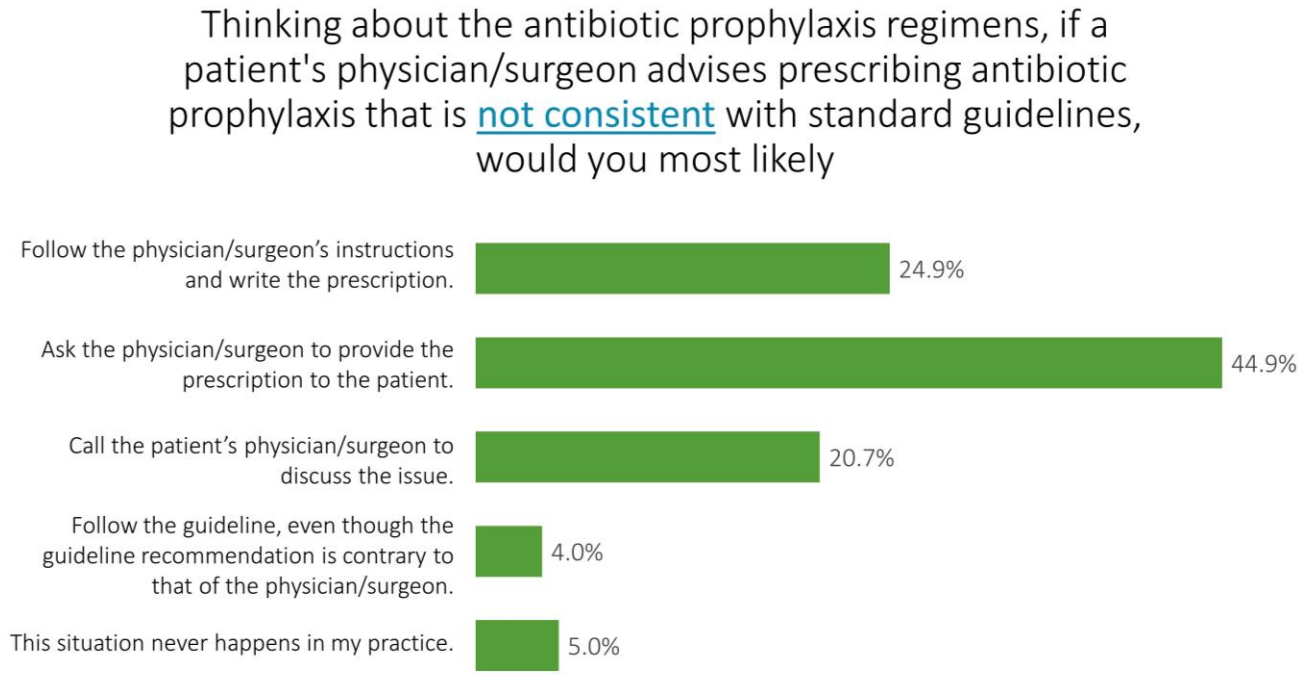

Thinking about the antibiotic prophylaxis regimens, if a patient's physician/surgeon advises prescribing antibiotic prophylaxis that is not consistent with standard guidelines, would you most likely
Follow the physician/surgeon's instructions and write the prescription.
24.9%
Ask the physician/surgeon to provide the prescription to the patient.
44.9%
Call the patient's physician/surgeon to discuss the issue.
20.7%
Follow the guideline, even though the guideline recommendation is contrary to that of the physician/surgeon.
4.0%
This situation never happens in my practice.
5.0%

Figure 6

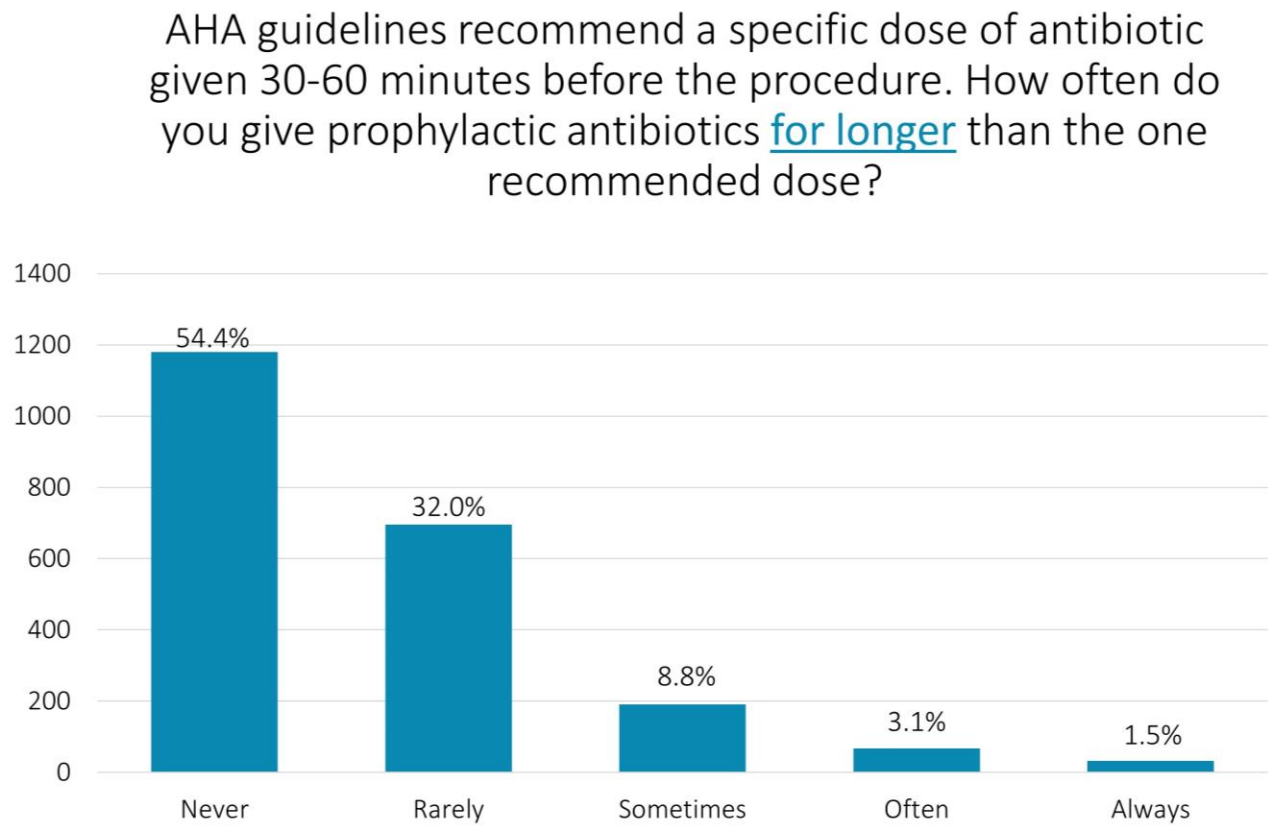


Figure 7

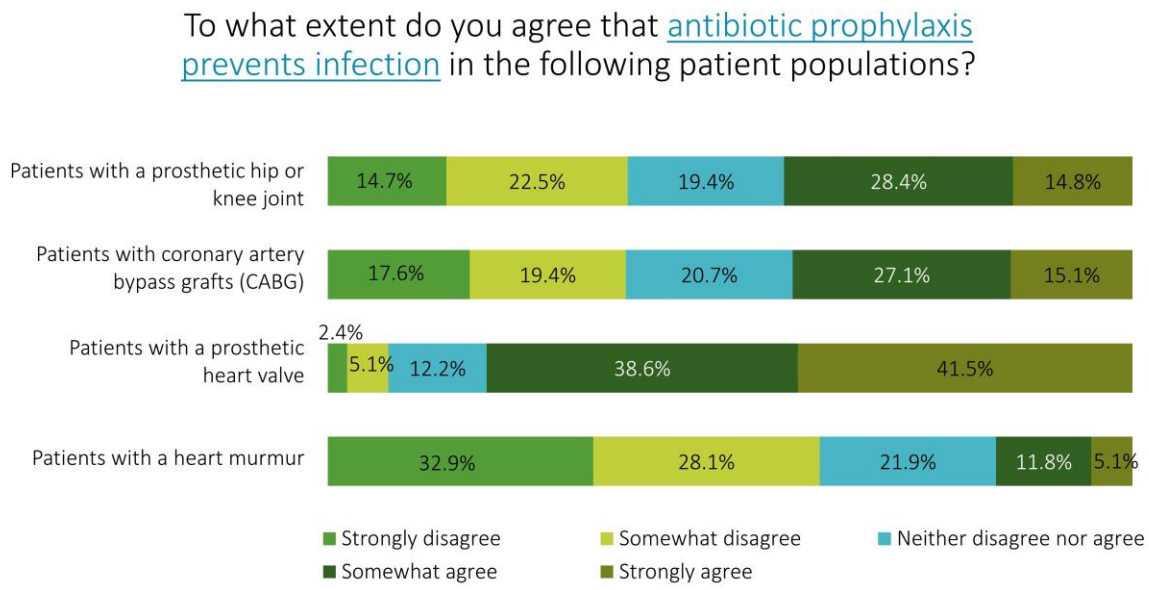

To what extent do you agree that antibiotic prophylaxis prevents infection in the following patient populations?
Patients with a prosthetic hip or knee joint
14.7%
22.5%
19.4%
28.4%
14.8%
Patients with coronary artery bypass grafts (CABG)
17.6%
19.4%
20.7%
27.1%
15.1%
Patients with a prosthetic heart valve
2.4%
5.1%
12.2%
38.6%
41.5%
Patients with a heart murmur
32.9%
28.1%
21.9%
11.8%
5.1%
Strongly disagree
Somewhat disagree
Neither disagree nor agree
Somewhat agree
Strongly agree

Figure 8

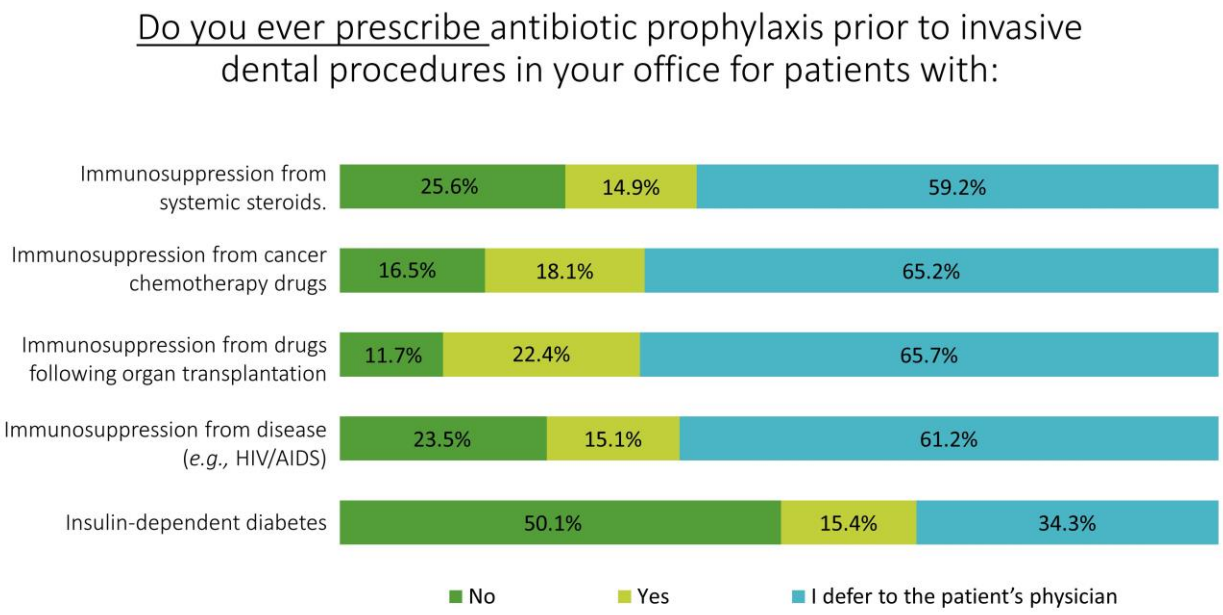
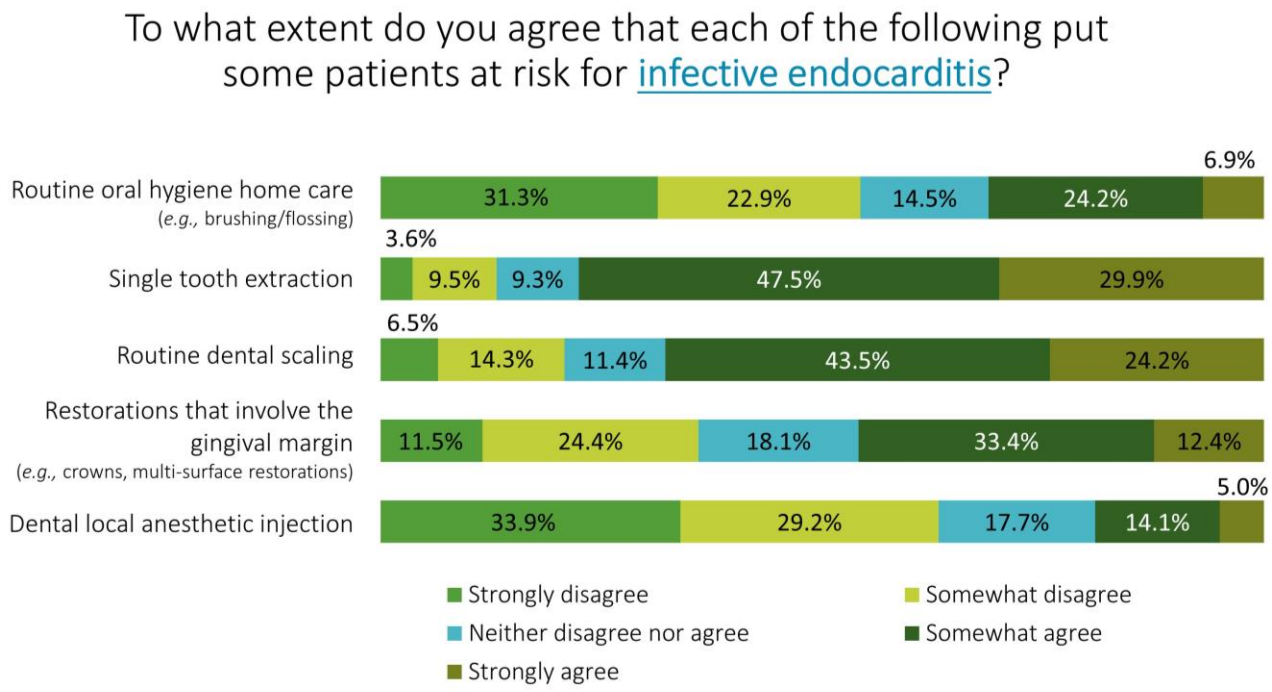

Do you ever prescribe antibiotic prophylaxis prior to invasive dental procedures in your office for patients with:
Immunosuppression from systemic steroids.
25.6%
14.9%
59.2%
Immunosuppression from cancer chemotherapy drugs
16.5%
18.1%
65.2%
Immunosuppression from drugs following organ transplantation
11.7%
22.4%
65.7%
Immunosuppression from disease (e.g., HIV/AIDS)
23.5%
15.1%
61.2%
Insulin-dependent diabetes
50.1%
15.4%
34.3%
No
Yes
I defer to the patient's physician

Figure 9


To what extent do you agree that each of the following put some patients at risk for infective endocarditis?
Routine oral hygiene home care (e.g., brushing/flossing)
31.3%
22.9%
14.5%
24.2%
6.9%
Single tooth extraction
3.6%
9.5%
9.3%
47.5%
29.9%
Routine dental scaling
6.5%
14.3%
11.4%
43.5%
24.2%
Restorations that involve the gingival margin (e.g., crowns, multi-surface restorations)
11.5%
24.4%
18.1%
33.4%
12.4%
Dental local anesthetic injection
33.9%
29.2%
17.7%
14.1%
5.0%
Strongly disagree
Somewhat disagree
Neither disagree nor agree
Somewhat agree
Strongly agree

..

Supplemental Table 1. Count and Percentage for All Figures

	N	Col %
Figure 1. Approximately how often do you see the following patient populations in your practice?		
a. Patients at risk for infective endocarditis (as per the 2007 American Heart Association Guidelines)		
Never	26	1.2
Less than once per year	158	7.3
Once per year	407	18.8
Once per month	811	37.4
Once per week	405	18.7
Multiple times per week	362	16.7
b. Patients with a prosthetic knee or hip joint		
.	1	0.0
Never	69	3.2
Less than once per year	101	4.7
Once per year	131	6.0
Once per month	461	21.3
Once per week	511	23.6
Multiple times per week	895	41.3
Figure 2a. Thinking about the 2007 American Heart Association guidelines and your patients who are at risk for infective endocarditis, to what extent do you agree with the following statements?		
a. The 2007 American Heart Association guidelines on the use of antibiotic prophylaxis are well defined and clear.		
.	3	0.1
Strongly disagree	35	1.6
Somewhat disagree	267	12.3
Neither disagree nor agree	183	8.4
Somewhat agree	971	44.8
Strongly agree	710	32.7
b. Guidelines concerning the use of antibiotic prophylaxis for patients with prosthetic joints are well defined and clear.	2	0.1

.		
Strongly disagree	332	15.3
Somewhat disagree	559	25.8
Neither disagree or agree	219	10.1
Somewhat agree	703	32.4
Strongly agree	354	16.3
Figure 2b. Thinking about the 2007 American Heart Association guidelines and your patients who are at risk for infective endocarditis, to what extent do you agree with the following statements?		
a. The patient groups who should receive antibiotic prophylaxis are well defined and clear. (IE)		
.	3	0.1
Strongly disagree	55	2.5
Somewhat disagree	307	14.2
Neither disagree nor agree	189	8.7
Somewhat agree	963	44.4
Strongly agree	652	30.1
b. The patient groups (e.g. knee replacement, hip replacement) who should receive antibiotic prophylaxis are well defined and clear. (PJ)		
.	2	0.1
Strongly disagree	308	14.2
Somewhat disagree	573	26.4
Neither disagree or agree	261	12.0
Somewhat agree	655	30.2
Strongly agree	370	17.1
Figure 2c. Thinking about the 2007 American Heart Association guidelines and your patients who are at risk for infective endocarditis, to what extent do you agree with the following statements?		
a. The dental procedures that require antibiotic prophylaxis are well defined and clear. (IE)		
.	1	0.0
Strongly disagree	65	3.0
Somewhat disagree	322	14.8
Neither disagree nor agree	221	10.2
Somewhat agree	913	42.1

Strongly agree	647	29.8
b. The dental procedures that require antibiotic prophylaxis are well defined and clear. (PJ)		
.	2	0.1
Strongly disagree	203	9.4
Somewhat disagree	452	20.8
Neither disagree or agree	291	13.4
Somewhat agree	758	34.9
Strongly agree	463	21.3
Figure 2d. Thinking about the 2007 American Heart Association guidelines and your patients who are at risk for infective endocarditis, to what extent do you agree with the following statements?		
a. The antibiotic prophylaxis regimens (drugs and dosages) are well defined and clear. (IE)		
.	1	0.0
Strongly disagree	30	1.4
Somewhat disagree	107	4.9
Neither disagree nor agree	119	5.5
Somewhat agree	692	31.9
Strongly agree	1220	56.2
b. The antibiotic prophylaxis regimens (drugs and dosages) are well defined and clear. (PJ)		
.	2	0.1
Strongly disagree	129	5.9
Somewhat disagree	240	11.1
Neither disagree or agree	192	8.9
Somewhat agree	730	33.7
Strongly agree	876	40.4
Figure 3a. Thinking about the 2007 American Heart Association guidelines and your patients who are at risk for infective endocarditis, to what extent do you agree with the following statements?		
a. I feel the need to consult with the patient's cardiologist/physician about whether or not antibiotic prophylaxis is needed. (IE)		
.	1	0.0
Strongly disagree	234	10.8
Somewhat disagree	513	23.7

Neither disagree nor agree	367	16.9
Somewhat agree	653	30.1
Strongly agree	401	18.5
b. I feel the need to consult with the patient's orthopedist/physician about whether or not antibiotic prophylaxis is needed. (PJ)		
.	2	0.1
Strongly disagree	210	9.7
Somewhat disagree	367	16.9
Neither disagree or agree	322	14.8
Somewhat agree	661	30.5
Strongly agree	607	28.0
Figure 3b. Thinking about the 2007 American Heart Association guidelines and your patients who are at risk for infective endocarditis, to what extent do you agree with the following statements?		
a. I think the patient's cardiologist/physician should decide if a patient needs antibiotic prophylaxis when undergoing invasive dental procedures. (IE)		
.	3	0.1
Strongly disagree	165	7.6
Somewhat disagree	308	14.2
Neither disagree nor agree	320	14.8
Somewhat agree	612	28.2
Strongly agree	761	35.1
b. I feel the patient's orthopedist/physician should decide if a patient should receive antibiotic prophylaxis when undergoing invasive dental procedures. (PJ)		
.	3	0.1
Strongly disagree	158	7.3
Somewhat disagree	242	11.2
Neither disagree or agree	230	10.6
Somewhat agree	611	28.2
Strongly agree	925	42.6
Figure 4. I prescribe alternative antibiotics (e.g., metronidazole) rather than those recommended by the American Heart Association or American Dental Association for my patients who require antibiotic prophylaxis prior to dental procedures.		
.	1	0.0

Strongly disagree	1834	84.6
Somewhat disagree	209	9.6
Neither disagree nor agree	85	3.9
Somewhat agree	21	1.0
Strongly agree	19	0.9
Figure 5. Thinking about the antibiotic prophylaxis regimens (drugs and dosages), if a patient's physician/surgeon advises prescribing antibiotic prophylaxis that is not consistent with the standard guidelines, would you most likely (select one response):		
.	12	0.6
Follow the physician/surgeon's instructions and write the prescription.	540	24.9
Ask the physician/surgeon to provide the prescription to the patient.	973	44.9
Call the patient's physician/surgeon to discuss the issue.	449	20.7
Follow the guideline, even though the guideline recommendation is contrary to that of the physician/surgeon.	87	4.0
This situation never happens in my practice.	108	5.0
Figure 6. The American Heart Association guidelines recommend a specific dose of antibiotic given 30-60 minutes before the procedure. How often do you give prophylactic antibiotics for longer than the one recommended dose?		
.	4	0.2
Never	1180	54.4
Rarely	695	32.0
Sometimes	191	8.8
Often	67	3.1
Always	32	1.5
Figure 7. To what extent do you agree that antibiotic prophylaxis prevents infection in the following patient populations?		
a. Patients with a prosthetic hip or knee joint		
.	4	0.2
Strongly disagree	318	14.7
Somewhat disagree	489	22.5
Neither disagree nor agree	420	19.4
Somewhat agree	617	28.4
Strongly agree	321	14.8

b. Patients with coronary artery bypass grafts (CABG)		
.	4	0.2
Strongly disagree	382	17.6
Somewhat disagree	421	19.4
Neither disagree nor agree	448	20.7
Somewhat agree	587	27.1
Strongly agree	327	15.1
c. Patients with a prosthetic heart valve		
.	4	0.2
Strongly disagree	51	2.4
Somewhat disagree	111	5.1
Neither disagree nor agree	265	12.2
Somewhat agree	837	38.6
Strongly agree	901	41.5
d. Patients with a heart murmur		
.	5	0.2
Strongly disagree	713	32.9
Somewhat disagree	609	28.1
Neither disagree nor agree	475	21.9
Somewhat agree	256	11.8
Strongly agree	111	5.1

Figure 8. Do you ever prescribe, or request prescriptions, for antibiotic prophylaxis prior to invasive dental procedures in your office for patients with?:

a. Immunosuppression from systemic steroids		
.	5	0.2
No	556	25.6
Yes	324	14.9
I defer to the patient's physician.	128	59.2
b. Immunosuppression from cancer chemotherapy drugs		

.	4	0.2
No	357	16.5
Yes	393	18.1
I defer to the patient's physician.	141	65.2
c. Immunosuppression from drugs following organ transplantation		
.	4	0.2
No	253	11.7
Yes	486	22.4
I defer to the patient's physician.	1426	65.7
d. Immunosuppression from disease (e.g. HIV/AIDS)		
.	4	0.2
No.	509	23.5
Yes	328	15.1
I defer to the patient's physician.	1328	61.2
e. Insulin-dependent diabetes		
.	4	0.2
No	1086	50.1
Yes	335	15.4
I defer to the patient's physician.	744	34.3
Figure 9. To what extent do you agree that each of the following dental procedures put some patients at risk for infective endocarditis?		
a. Routine oral hygiene home care (e.g. brushing/flossing)		
.	4	0.2
Strongly disagree	679	31.3
Somewhat disagree	496	22.9
Neither disagree nor agree	315	14.5
Somewhat agree	525	24.2
Strongly agree	150	6.9
b. Single tooth extraction		

.	5	0.2
Strongly disagree	79	3.6
Somewhat disagree	205	9.5
Neither disagree nor agree	202	9.3
Somewhat agree	1030	47.5
Strongly agree	648	29.9
c. Routine dental scaling		
.	5	0.2
Strongly disagree	140	6.5
Somewhat disagree	310	14.3
Neither disagree nor agree	247	11.4
Somewhat agree	943	43.5
Strongly agree	524	24.2
d. Restorations that involve the gingival margin (e.g. crowns, multi-surface restorations)		
.	5	0.2
Strongly disagree	250	11.5
Somewhat disagree	529	24.4
Neither disagree nor agree	393	18.1
Somewhat agree	724	33.4
Strongly agree	268	12.4
e. Dental local anesthetic injection		
.	4	0.2
Strongly disagree	735	33.9
Somewhat disagree	633	29.2
Neither disagree nor agree	383	17.7
Somewhat agree	305	14.1
Strongly agree	109	5.0

Total	2169	100.0