A nationwide survey of French dentists' knowledge and implementation of current guidelines for antibiotic prophylaxis of infective endocarditis in patients with predisposing cardiac conditions

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Objectives. To prevent infective endocarditis in patients with predisposing cardiac conditions, antibiotic prophylaxis is recommended worldwide, except in the United Kingdom. To determine the relevance of this strategy, investigating how the current guidelines are applied is crucial. The first aim of this study was to assess dentists' implementation of the current guidelines. The secondary aims were to identify relevant areas to improve the training of dentists and to determine temporal trends in practitioners' attitudes by comparison with 2 previous surveys conducted in 1991 and 2001.

Study Design. An electronic national survey was sent to the 12,000 member practitioners of the French Union for Oral Health.

Results. Even though 58.9% of the respondents stated that their knowledge of current guidelines was good, a scoring system showed that only 34.5% had overall knowledge of these guidelines.

Conclusions. This study revealed relevant areas to improve the training of dentists, such as knowledge of some cardiac conditions, the potential side effects of the antibiotics used, and the pathogenesis of infective endocarditis. Consequently, dentists' knowledge should be improved before any conclusions can be drawn on the relevance of this antibiotic prophylaxis strategy and its influence on infective endocarditis incidence. (Oral Surg Oral Med Oral Pathol Oral Radiol 2018;125:295–303)

Infective endocarditis (IE) is a rare (<7 cases per 100,000 persons per year) and severe disease (20% early mortality, 40% at 5 years).[1-3] This disease exhibits a high morbidity rate and cost burden. To prevent IE, since 1955, antibiotic prophylaxis (AP) has been recommended in the United States for patients with predisposing cardiac conditions (PCCs) undergoing invasive procedures.[4] The strategy for this AP prescription is based on the recognition of the PCCs that have a risk of IE and the procedures that pose a risk of IE-induced bacteremia. Although regularly updated during past few decades, guidelines on IE AP are now discordant between the United Kingdom (and recently Sweden) and the rest of the world. In the United Kingdom, until recently, the National Institute for Health and Care Excellence recommended complete cessation of any IE AP in any circumstances.[5] In 2016, this institute amended its position, stipulating that in individual cases in which the patient's risk of IE is perceived to be sufficiently high or when the patients themselves express a preference for it, AP may be appropriate.[6] The rest of the world restricts systematic AP to patients with PCCs at the highest risk of IE and undergoing the most invasive procedures (American Heart Association in 2007[7]; European Society of Cardiology in 2009, updated in 2015[8]; French National Agency for Drug Safety in 2011).[9] All agreed on the highest-risk PCCs (prosthetic valve, previous IE, cyanotic CHD) and AP regimen. The discrepancy between the United Kingdom and the rest of the world is mainly based on the assessment of benefit of IE AP. Whether AP is a crucial factor for the prevention of IE remains debatable because only 1 case-control study showed evidence of an association between dental procedures and streptococcal IE, whereas 3 others did not.[10-13] It is important to note that none of the studies was sufficiently powered to demonstrate the effectiveness of IE AP. Before any conclusion can be drawn, however, the primary question, as suggested by several authors, is whether the current guidelines are implemented by dental pratctitioners.[8,9]

To date, no detailed large-scale data are available on the implementation of the current guidelines. The first

Statement of Clinical Relevance

Current guidelines for antibiotic prophylaxis to prevent infective endocarditis are correctly implemented by only 34.5% of French dentists. Training may improve the knowledge deficits identified. National rates of guideline implementation are relevant to conclusions of population-level benefit of antibiotic prophylaxis.

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aim of this study was performed in a large population of dental practitioners to assess their knowledge of the current guidelines on IE AP in terms of PCCs, invasive dental procedures at risk of IE-induced bacteremia, and appropriate antibiotic regimens. This assessment was undertaken using a multidimensional questionnaire, which also investigated compliance with these guidelines and the factors favoring or limiting the impact of these guidelines. The secondary objectives were, first, to identify specific areas to improve in the training and knowledge of French dentists and, second, to determine temporal trends in practitioners' attitudes in a context of IE AP restriction in comparison with 2 previous surveys conducted in 1991 and 2001.

MATERIALS AND METHODS

Study design

An online national survey was sent to the 12,000 dentist members of the French Union for Oral Health (UFSBD) (out of 39,805 dentists in France).[14] The UFSBD acts as a World Health Organization Collaborating Center for the prevention and promotion of oral health. The survey was anonymous and did not require ethics approval, according to French legislation.

Data collection

A treelike questionnaire comprising 136 questions was constructed. Its construction was mostly based on 2 previous surveys, which were managed by the Association for the Study and Prevention of Infective Endocarditis and conducted in 1991 and in 2001 among French practitioners. A minimum of 45 responses and a maximum of 67 were needed per respondent.

This questionnaire was divided into 4 sections: (1) demographic and practice-related characteristics; (2) general knowledge of the current guidelines (general considerations; knowledge of IE pathogenesis); (3) detailed knowledge of the current guidelines (knowledge of the IE risk of 9 predefined IE PCCs: 3 PCCs at high risk for IE, 2 PCCs at moderate risk for IE, and 4 PCCs at low risk for IE), knowledge of the indications for AP according to the 9 predefined PCCs, knowledge of the indications for AP according to 7 predefined dental procedures (5 requiring AP for a patient with valvular prosthesis and 2 not requiring such AP), and knowledge of antibiotic regimens; and (4) compliance with the current guidelines. On the basis of the results of this questionnaire, 2 additional parts of the survey were built: (5) scoring; and (6) temporal comparisons between surveys as described in the following.

The questionnaire was formatted using SurveyMonkey software (SurveyMonkey Europe Sarl, Luxembourg City, Luxemburg). Its validity was previously ascertained among a limited cohort of 30 dentists in the Dental School of Nantes (Nantes, France). Thereafter, a survey link was sent to all the UFSBD members and was posted on its website for 1 month.

Scoring

Four composite numerical scores were built to synthesize the data and to identify determinants for knowledge of and compliance with the guidelines (Table I).

Score A assessed the general knowledge of the French guidelines, which were unaffected by the 2011 update and were therefore common to the 2002 and 2011 French guidelines (Supplemental Table S1, available online). This score was based on the knowledge of 3 items: (1) the IE risk of 9 predefined PCCs and whether AP was indicated for each; (2) the risk of bacteremia of 3 predefined dental procedures (1 requiring an AP for a patient with a valvular prosthesis and 2 not requiring AP); (3) the characteristics of the antibiotic regimen (2 g amoxicillin, 1 dose taken 1 hour preoperatively). A cutoff point (score A = 13/15) had been defined according to the response distribution, corresponding to the third quartile of appropriate responses (Supplemental Figure S1, available online).

Score B assessed the knowledge of recommendations that were modified by the French 2011 update. Knowledge of these guidelines was considered present specifically if the respondents reported not prescribing an IE AP for mitral valve prolapse and cardiac valvulopathy (score = 2). Otherwise, knowledge of the 2011 guidelines was considered absent.

Score C assessed overprescription of antibiotics. Antibiotic prescription was considered inappropriate if it was prescribed (1) to patients with 1 of the 6 PCCs carrying a low or moderate risk; (2) for a noninvasive dental procedure; or (3) at the wrong time.

Score D assessed the compliance with the guidelines on antibiotic prescription, dosages, and frequencies according to the current guidelines. Dentists were considered "noncompliant" when they did not change all these points (score = 0), "partially compliant" when they only changed 1 or 2 points (score = 1 or 2, respectively), and "totally compliant" when they changed all of them (score = 3).

Temporal comparisons between surveys

The 1991, 2001, and 2012 surveys shared common questions, which allowed for statistical comparisons on the management of patients at risk for IE, assessment of the IE risk, prevention of IE, and follow-up of patients at risk for IE.

Data analysis

Descriptive statistics were performed using Microsoft Excel 2007 (Microsoft Corporation, Issy-les-Moulineaux, France). The data were compared using the χ^2 test (SAS 9.2; SAS Institute Inc., Cary, NC). Differences were considered significant if $P < .05$.

Table I. Building the 4 composite numerical scores

Score A: Global knowledge of the previous and current guidelines	*Points*
Correct recognition of the IE risk degree of 9 cardiac conditions	9
Correct assessment of the risk of bacteremia of 3 dental procedures in a patient with high risk of IE	3
Adequacy of the AP prescription with the guidelines according to the molecule, the taking time, and the posology	3
Total	$\sum = 15$
Global knowledge was estimated as good or very good	$S \geq 13$
Global knowledge was estimated as insufficient or average	$S < 13$
Score B: Specific knowledge of the current guidelines	*Points*
No IE AP prescription for 2 cardiac conditions at moderate risk	2
Total	$\sum = 2$
2011 guidelines known	$S = 2$
2011 guidelines not known	$S < 2$
Score C: Antibiotics overprescription	*Points*
Prescription for a cardiac condition at low or moderate risk for IE (6 cardiac conditions)	6
Prescription for a noninvasive dental procedure (1 procedure)	1
Inappropriate timing of IE AP prescription (too early and/or after the procedure)	1
Total	$\sum = 8$
Practice with an increased risk of antibiotic adverse events	$S \geq 1$
Practice without an increased risk of antibiotic adverse events	$S = 0$
Score D: Compliance with current guidelines	*Points*
Prescription changes about molecules	1
Prescription changes about dosing	1
Decrease in the number of prescriptions	1
Total	$\sum = 3$
Total compliance	$S = 3$
Partial compliance	$S = 1$ or 2
Noncompliance	$S = 0$

AP, antibiotic prophylaxis; IE, infective endocarditis; S, score.

RESULTS

Demographic and practice-related characteristics of the respondents

Nine hundred and six dentists responded to the survey (response rate 7.8%); 376 were excluded because they were not dentists practicing in France or because the questionnaire was not fully completed. The 530 remaining were included. The sex ratio was 1. Practitioners were mainly in the age range of 35 to 50 years (38.7%), and more than half had an individual private practice (54.7%); 93.6% stated that they managed, on average, 1.4 (±2.3) patients at risk of IE per month; 62.6% followed the recommended twice-yearly follow-up for these patients.[9]

General knowledge of the current guidelines

General considerations. Of the surveyed dentists, 57% correctly mentioned the appropriate publication date of the current guidelines.[9] Sources of information were the professional press (48.1%), university training (30%), and the Internet (27.5%). Of those surveyed, 58.9% self-assessed their knowledge of these guidelines as "good" or "very good."

Knowledge of IE pathogenesis. The concept of "everyday" oral bacteremia was known by 36% of the dentists, and 14.9% thought that this bacteremia could be involved in IE pathogenesis.

Detailed knowledge of the current guidelines

Knowledge of the IE risk of 9 predefined IE-predisposing cardiac conditions. Among the 9 predefined PCCs, 2 of the 3 high-risk conditions for IE (prosthetic cardiac valve and previous IE) were correctly identified as PCCs at high risk for IE by 93.4% and 90.9% of the respondents, respectively, whereas the last condition (unrepaired cyanotic CHD) was correctly identified by only 61.7% (Figure 1). The 2 PCCs at moderate risk for IE, mitral valve prolapse and cardiac valvulopathy, were correctly identified by 60.6% and 43% of the respondents, respectively. Of the 4 PCCs at low risk for IE, pacemakers and arterial hypertension were correctly identified by 96.2% and 72.8% of the respondents, respectively, and coronary artery bypass surgery and coronary heart disease were correctly identified by 54.5% and 57.7%, respectively. Taken together, only 13% of the dentists correctly identified the risk of developing IE for the 9 predefined PCCs.

Knowledge of the indication for an AP according to the 9 predefined PCCs. Of the respondents, 98.5% correctly identified prosthetic cardiac valve and 98.3% identified previous IE as PCCs requiring an IE AP before an invasive dental procedure. Only 80.4% correctly identified unrepaired cyanotic CHD as a PCC requiring an IE AP. Only 30.4% did not prescribe IE AP to a patient

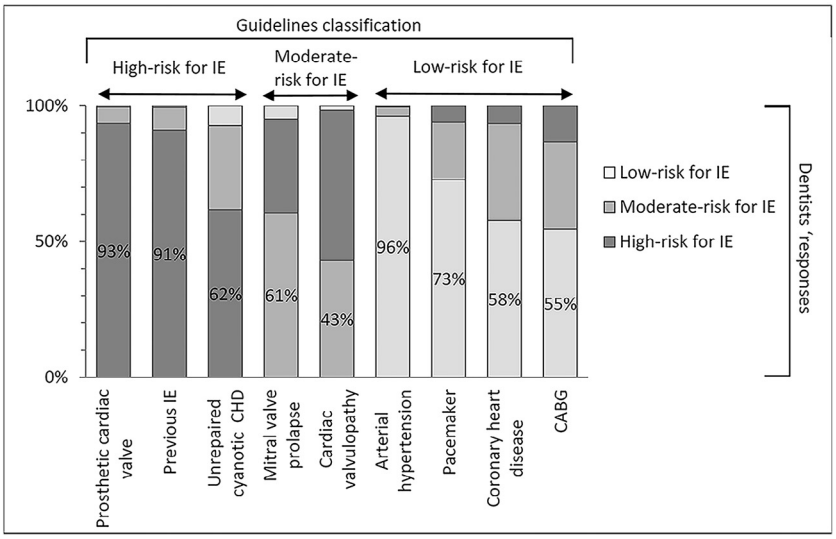

Fig. 1. Identification by dentists of infective endocarditis (IE) risk for various cardiac conditions according to the current guidelines. CHD, congenital heart disease; CABG, coronary artery bypass graft surgery. Percent values in the histograms underlined the correct-answer rate (2012 survey).

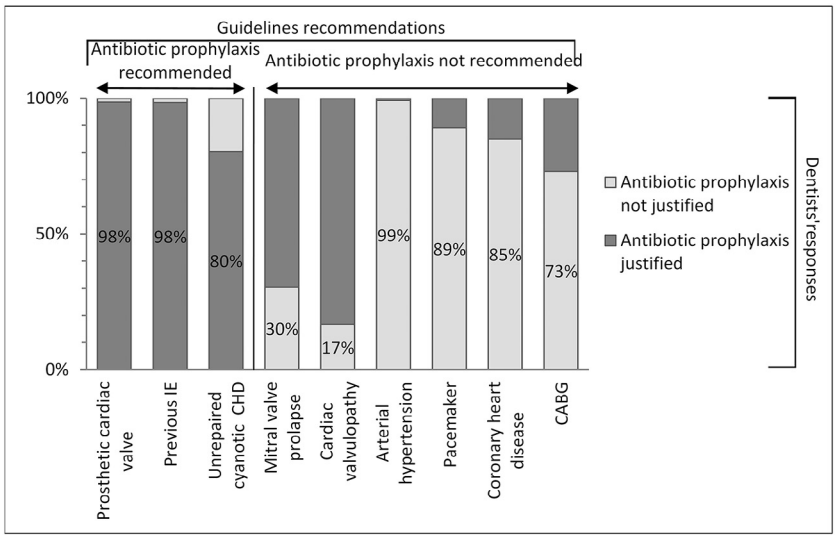

Fig. 2. Identification by dentists of indications for infective endocarditis antibiotic prophylaxis for various cardiac conditions according to the current guidelines. CHD, congenital heart disease; CABG, coronary artery bypass graft surgery. Percent values in the histograms underlined the correct-answer rate (2012 survey).

with a mitral valve prolapse, and 16.6% did not prescribe IE AP to a patient with a cardiac valvulopathy as stated by the current guidelines (Figure 2). Taken together, only 9.4% of the study's dentists accurately identified all of the indications for IE AP.

Knowledge of the indication for an AP according to the 7 predefined dental procedures. Of 7 dental procedures proposed, the 5 requiring IE AP in patients with a high risk for PCC were identified by 84.9% of the respondents. The 2 procedures that did not require prophylaxis, treatment of caries without pulp exposure and prosthetic preparation, were correctly identified as not requiring IE AP by 90.4% and 70.4% of the dentists, respectively. Taken together, only 51.7% of the dentists correctly identified the IE risk of all 7 predefined dental procedures (Figure 3).

Knowledge of antibiotic regimens. Of the dentists surveyed, 79.9% prescribed AP before an at-risk dental procedure, but only 22.5% prescribed an appropriate adult first-line AP (2 g of amoxicillin, 1 dose taken 1 hour preoperatively); 43% prescribed the appropriate molecule (clindamycin) in case of allergy to penicillin. Only 53%

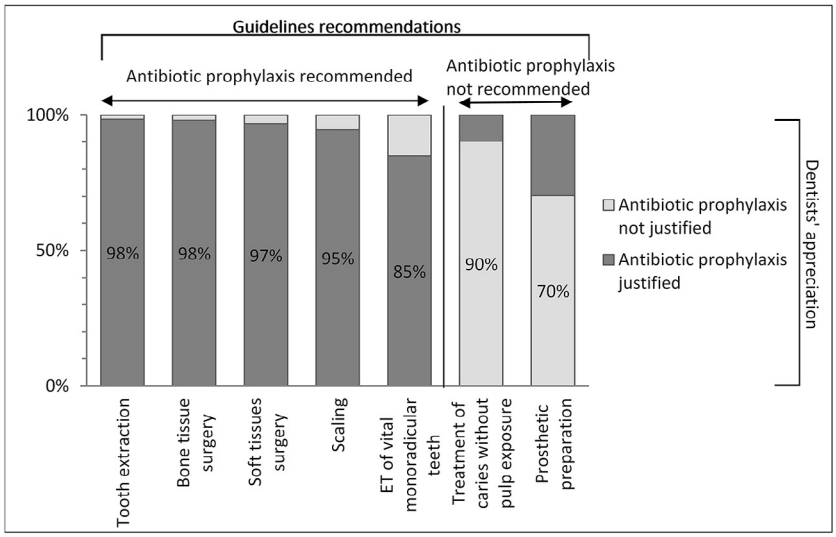

Fig. 3. Identification by dentists of dental procedures depending on whether they require antibiotic prophylaxis for a patient with a valvular prosthesis according to the current guidelines. ET, endodontic treatment. Percent values in the histograms underline the correct-answer rate (2012 survey).

Table II. Self-assessed knowledge of the guidelines: overall knowledge of the previous and current guidelines (score A) and specific knowledge of the current guidelines (score B) (2012 survey)

	Self-assessed knowledge of the guidelines				
	Insufficient or average n = 218 (41.1%)		*Good or very good n = 312 (58.9%)*		χ^2 *test*
	n	*%*	*n*	*%*	P *value*
Knowledge assessed through questionnaire responses					
Global knowledge of the previous and current guidelines (score A)					
Insufficient or average, n = 347 (65.5%)	172	49.6	175	50.4	<.0001
Good or very good, n = 183 (34.5%)	46	25.1	137	74.9	
Specific knowledge of the current guidelines (score B)					
Unknown, n = 464 (87.5%)	204	44.0	260	56.0	=.0004
Known, n = 66 (12.5%)	14	21.2	52	78.8	

of the dentists were aware of one of the potential side effects of IE AP. Allergies and development of bacterial resistance were more frequently mentioned (44.7% and 42.1%, respectively), whereas the lethal side effect was reported by only 18.5% of the respondents.

Compliance with the current guidelines

Of the dentists surveyed, 40.9% declared having modified their practice on the basis of the current guidelines, but only 5.3% were totally compliant (score D = 3, see below). Dentists tended to follow the recommendations on drugs (63.9%) more than the decrease in the number of prescriptions (41.8%) and the proper antibiotic dosages (23.3%). The selection criteria for AP prescription were based on the guidelines (90.4%), the dentists' own clinical experience (24.5%), patient requests (4%), and a colleague's opinion (2.3%). Difficulty accessing the guidelines was reported by 50.6% of the respondents. The level of scientific evidence supporting these guidelines and their exhaustiveness were criticized by 40.1% and 41.1% of the respondents, respectively.

Scoring

Score A—Overall knowledge of the guidelines not modified by the French 2011 update. Of the respondents, 65.3% had a score A that was below the cutoff, revealing a lack of overall knowledge of the 2011 guidelines in areas unaffected by the update (score A < 13). Dentists who self-assessed as knowing these guidelines well had a better score A than those who self-assessed as not knowing them ($P < .0001$; Table II). Younger and the more recently graduated practitioners had a better score A ($P < .0001$), as did those working in a private clinic or hospital versus individuals in private practice

Table III. Scores of item comparisons

Score A: Global knowledge of the previous and current guidelines	χ^2 *test* P *value*
Age	<.0001
Year of graduation	<.0001
Practice type	.0022
Follow-up of more or fewer than 10 patients at risk for IE per year	.043
Management of patient with previous IE	.0072
Knowledge of the prevention card	<.0001
Self-assessed guideline knowledge	<.0001
Antibiotic prophylaxis prescribing doctor	<.0001
Refer patients with anticoagulant problems to hospital	.0318
Refer patients with prosthetic cardiac valve to hospital	.0049
Refer patients with allergy to antibiotic to hospital	.0002
Score B: Determinants for specific knowledge of the current guidelines	χ^2 *test* P *value*
Age	.0005
Year of graduation	<.001
Follow-up of more or fewer than 10 patients at risk for IE per year	.0046
Self-assessed guidelines knowledge	.0004
Score C: Determinants for an antibiotics overprescription	χ^2 *test* P *value*
Age	.0003
Year of graduation	.0026
Follow-up of more or fewer than 10 patients at risk for IE per year	.0326
Guideline knowledge	<.0001
Self-assessed guideline knowledge	<.0001
Refer patients with allergy to antibiotic to hospital	.0293
Score D: Determinant for the compliance with current guidelines	χ^2 *test* P *value*
Knowledge of concept of spontaneous bacteremia	.0081

IE, infective endocarditis.

($P < .01$) and those following more than 10 patients at risk for IE per year ($P < .05$) (Table III).

Score B—Specific knowledge of the current guidelines. Of the survey's respondents, 80.5% did not know the current guidelines specifically (score B < 2).

Score C—Antibiotic overprescription. Of the respondents, 90.6% overprescribed antibiotics (score C ≥ 1).

Score D—Compliance with current guidelines. Only 5.3% of the respondents were totally compliant with the current guidelines (score D = 3).

Temporal comparisons between surveys

Between the 2001 and 2012 surveys, overall knowledge of guidelines improved (score A ≥ 13: 6.0% vs 34.5%; $P < .0001$). In the 1991, 2001, and 2012 surveys, management of patients at risk for IE became more frequent over time ($P < .0001$; Table IV). The systematic investigation of cardiac disease history, checking AP intake before an invasive procedure, appropriate AP prescription, knowledge of the second-line IE AP, and follow-up of patients at risk for IE increased from 1991 to 2012 ($P < .0001$). The identification of dental procedures requiring AP for patients at IE risk also improved from 1991 to 2012 ($P < .001$) but not identification of those that did not require AP. Cardiologists appeared to prescribe an increasing proportion of IE AP with time ($P < .0001$).

DISCUSSION

In this large study examining dentists' attitudes concerning IE AP, we found poor implementation of the current guidelines by French dentists. Interestingly, for the first time, this study provided specific areas to improve in the training of French dentists.

This survey revealed heterogeneous knowledge of the different IE risk factors (poor for some cardiac conditions, such as unrepaired cyanotic CHD, mitral valve prolapse, or cardiac valvulopathy, and appropriate for most of the dental procedures) and poor knowledge of the potent side effects, particularly lethal side effects, of the antibiotics used for IE AP. Moreover, this survey underlined the lack of knowledge regarding IE pathogenesis, particularly the concept of "everyday" oral bacteremia that occurs after toothbrushing, flossing, or chewing, which may outweigh postdental procedure bacteremia in terms of risk of IE.[15-19]

The main change introduced by the 2011 French guidelines was the limitation of AP to a population of patients undergoing high-risk PCCs, but a large proportion of dentists (87.5%) still prescribed AP to patients at moderate risk for IE before an invasive dental procedure. This is worse than the rate reported in the United States, where 70% of dentists still prescribed an IE AP for PCCs that no longer required this treatment.[20] In contrast, high-risk PCCs, such as prosthetic valves, were correctly identified as an indication for AP by most practitioners, in accordance with previous studies.[21,22] Among high-risk PCCs, cases of unrepaired cyanotic CHD were less correctly identified. This may be explained by a low prevalence of unrepaired cyanotic CHD in France and therefore the rare management of such patients by French dentists.[23] Excluding these cases of CHD with cyanosis, the results showed that most PCCs requiring an IE AP according to 2011 French guidelines are covered.

As expected, dentists better identified invasive dental procedures that induce bacteremia compared with PCCs. Tong et al. also reported this trend in Singapore.[24] This could be explained by the stability of these specific recommendations, which have not been modified for many years. Although nearly 75% of the dentists correctly defined AP, an appropriate first-line AP regimen was prescribed less in France than in other countries—22.5% versus 44% in Iran,[21] 56% in India,[12] and 88% in Canada.[25] The main inadequacies were a 3 g dosage of amoxicillin (instead of 2 g in the current guidelines), and clindamycin,

Table IV. Temporal comparisons of 1991, 2001, and 2012 surveys

Variables	*1991 (n = 200)*		*2001 (n = 200)*		*2012 (n = 530)*		χ^2 *test* P *value*
	n	*%*	*n*	*%*	*n*	*%*	
Management of patients at IE risk	106	53.0	176	88.0	486	93.6	<.0001
Evaluation of IE risk							
Systematic investigation of cardiac disease history	164	82.0	172	86.0	505	95.3	<.0001
Correct assessment of dental procedures requiring AP for patients at IE risk							
No AP for treatment of caries without pulp exposure	172	86.0	182	91.0	479	90.4	NS
AP for ET of monoradicular teeth with vital pulp	150	75.0	180	90.0	450	84.9	.0002
AP for teeth extraction	186	93.0	196	98.0	522	98.5	.0002
Prevention of IE							
Checking patient compliance with AP before invasive dental procedure	104	52.0	158	79.0	524	98.9	<.0001
Appropriate first-line AP prescription	20	10.0	79	39.5	307	57.9	<.0001
Second-line AP prescription							
Clindamycin	0	0	50	25.0	228	43.0	<.0001
Pristinamycin	6	3.0	58	29.0	163	30.8	<.0001
Prescriber of IE AP							
Dentist	146	73.0	180	90.0	389	73.4	<.0001
Cardiologist	8	4.0	34	17.0	105	19.8	<.0001
Physicians	20	10.0	18	9.0	31	5.8	NS
Follow-up of patient at IE risk							
Annual control or more	104	52.0	158	79	486	91.7	<.0001

AP, antibiotic prophylaxis; ET, endodontic treatment; IE, infective endocarditis.

the second-line antibiotic in case of penicillin allergy, was prescribed by only 43% of the French dentists, which is a slightly better rate than in Iran (38%)[21] but worse than in Canada (84%).[25] This may be explained by the 1-year interval between the publication of the current guidelines stipulating a reduction in the amoxicillin dosage and recommending clindamycin rather than another antibiotic and the time of this survey.

Only a minority of dentists (40.9%) declared altering their prescriptions according to the current guidelines. Clinicians' compliance with guidelines depends on 3 categories of factors related to the characteristics of the guidelines, the practitioners, and the environment, allowing identification of barriers to physicians' adherence to clinical practice guidelines.[26] The factors related to guidelines are predominant because guidelines were the first selection criterion for IE AP prescription (90.4%), as indicated by previous studies.[27] Two major reasons for the noncompliance related to this factor were identified in the present study. The first one is a lack of assimilation of the current guidelines. Two-thirds of the dentists were not aware of "everyday" bacteremia, and this appeared as the only significant facilitating factor for good compliance in this study. Interestingly, among British dentists, who appear to be more compliant with their current guidelines (75%), routine daily activities, and not invasive dental procedures, substantially contribute to the development of IE.[28] This is consistent with the idea that practitioners who understand the rationale behind the guidelines are more likely to be compliant with them.[29] The second reason is the low level of scientific evidence supporting these guidelines. These guidelines are mainly based on expert opinions. Controversies concerning the relevance of IE AP could also explain this lack of compliance.[30] It has been proposed that additional evidence needs to be established through a randomized controlled trial.[29]

The significant improvement in the implementation of these guidelines by French dentists between 1991-2001 and 2012 may be attributed to the generational renewal of dentists, with the younger and the more recently graduated having better knowledge of the guidelines ($P < .0001$). Optimization of the guidelines' distribution to practitioners by professional organizations is probably also a facilitating factor.

Lack of dentist knowledge of and compliance with the current guidelines results in antibiotic misuse. Dentists overprescribe IE AP with potential medical (including anaphylactic reactions), ecologic (the emergence of drug-resistant microorganisms), and cost consequences.[30] In this context, amoxicillin is comparatively safe for patients without a history of amoxicillin allergy, whereas the use of clindamycin has been associated with significant rates of fatal and nonfatal adverse drug reactions

related to *Clostridium difficile* infections.[31] One of the main reasons for overprescription could be the lack of awareness on the part of nearly half of the respondents about the potential IE AP side effects, including lethal anaphylactic reactions. These practitioners seem to think that AP is totally safe, and it can be hypothesized that in their minds, overuse is associated with overprotection from IE.

Therefore, improvement in the implementation of the guidelines by practitioners is urgently needed, and one of the priorities is to optimize access to the guidelines because French dentists are less aware of the current guidelines (57%) compared with American (98%)[30] and British (99%)[27] dental practitioners. It is also important to increase dentists' understanding of the guidelines by focusing on IE pathogenesis and by explaining the importance of complying with the current recommendations. Because this could be relevant to improving the implementation of the current guidelines, use of the "prevention card" (issued in France by cardiologists to patients with IE risk) should be promoted among all the health care providers. Moreover, the complexity of these guidelines, particularly with regard to identifying uncommon cardiac conditions at high risk of IE, such as unrepaired cyanotic CHD (indeed, dentists are not cardiologists), and changes to the guidelines could also be factors causing this lack of implementation. Simplifying the wording of the recommendations and clarifying each one could improve implementation.

This survey has several limitations. Only members of the UFSBD, accounting for approximately 30% of the French dentist population, were surveyed. Despite the low 7.8% response rate to this online survey, the number of these responses made this study one of the most reliable. Even though only 530 respondents were included in this survey, the profile of the respondents is roughly comparable with that of the French dentist population according to sex and age distributions (Supplemental Table S2, available online). The extent to which the practitioners who responded to the questionnaire were knowledgeable about these guidelines can also be questioned. This may have led to an overestimation of the implementation of these guidelines. To determine the real extent of the implementation of the guidelines, a controlled recording of IE AP in patients, prescribed according to risk of IE, is warranted. Moreover, this survey was conducted only 1 year after the publication of the updated guidelines. This could have allowed too little time for dentists to modify their practices. However, Zadik et al., who conducted a survey in an American dentist population 1 year after the publication of the 2007 American Heart Association guidelines, found a high level of knowledge.[32] Despite these limitations, this prospective study is the largest and the most detailed survey to date on IE AP in a dentist population.

CONCLUSIONS

Although IE incidence has not increased in the United States,[33] Canada,[34] and France[35] since the restrictions placed on IE AP, the interpretation of these data are confusing, given the weak implementation of guidelines revealed by this survey. It is crucial to improve compliance with current guidelines by sustaining medical education in the training of French dentists, particularly on specific areas revealed by this survey. This survey should also be conducted in a population of cardiologists because they appear to be significant prescribers of IE AP. Only then can the relevance of such guidelines be properly assessed.

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SUPPLEMENTARY DATA

Supplementary data related to this article can be found at https://doi.org/10.1016/j.oooo.2017.10.002.

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