

ORIGINAL ARTICLE

Evaluation of Antibiotic Prophylaxis Prescriptions for Infectious Endocarditis Before Oral Procedures Between Cardiologists and Dentists

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Abstract

Background: Infective endocarditis (IE) is a serious disease with a high mortality rate. Antibiotic prophylaxis for bacterial endocarditis before invasive procedures has been recommended in patients with predisposing cardiac conditions since 1960, but contemporary guidelines worldwide have proposed changes.

Objective: To evaluate the knowledge and pattern of prescription by cardiologists and dentists regarding antibiotic prophylaxis for bacterial endocarditis before risky oral procedures.

Methods: This is an observational and cross-sectional study. Data were obtained from an online questionnaire, sent to cardiologists and dentists linked to specialty societies, in the first semester of 2021. Data analysis was performed using descriptive statistics, and comparisons between variables were done in an exploratory approach. The significance level adopted was 5%.

Results: From 613 responders, 82.5% of cardiologists and 79.5% of dentists reported prescribing antibiotic prophylaxis for patients at high and moderate risk for IE. Of dental procedures capable of generating bacteremia, all were correctly identified by more than 50.0% of the sample. As for the habits of daily living, flossing and toothbrushing had almost 50.0% of correct answers, chewing had only 17.3%, and 40.9% reported that none of the actions presented a risk of bacteremia. When comparing variables, the correct prescription of amoxicillin (2 g, 30–60 minutes before the procedure) was more prevalent among cardiologists and in responders with less than 20 years of graduation ($p < 0.01$).

Conclusion: In the present study, the prescription of antibiotic prophylaxis for IE were frequent for high- and moderate-risk patients, before oral/dental procedures. Partial knowledge was found about endocarditis, which highlights the need for continuous medical/dental education.

Keywords: Bacterial Endocarditis; Antibiotic Prophylaxis; Prescriptions; Oral Surgical Procedures; Cross-sectional Study.

Introduction

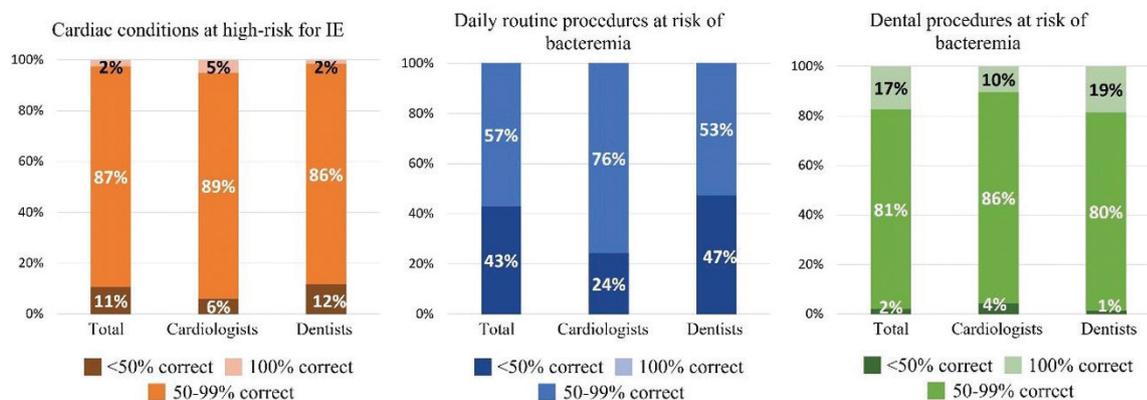
Infective endocarditis (IE), despite its low incidence, is a serious disease, with hospital mortality of 15–20%, reaching up to 40% per year.¹ For almost 70 years, several international guidelines have recommended antibiotic use to prevent IE in patients considered at risk, before procedures capable of generating bacteremia.^{2–5}

At the beginning of the 20th century, oral cavity was recognized as an important and frequent entry point for bacteremia.^{1,2,6} Subsequently, antibiotic usage was shown to reduce the incidence of bacteremia after dental extraction, which supported the recommendation for the use of antibiotic prophylaxis before risky oral/dental procedures to prevent IE in patients with risky cardiac conditions.⁶

Recently, however, many specialty societies began to question the effectiveness of this approach, due to

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Central Illustration: Evaluation of Antibiotic Prophylaxis Prescriptions for Infectious Endocarditis Before Oral Procedures Between Cardiologists and Dentists

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IE: infective endocarditis.

the lack of adequate studies demonstrating a beneficial effect of antibiotic prophylaxis against IE in humans after invasive procedures.^{2,7} Furthermore, IE seems to result more from frequent random bacteremia due to individuals' daily routine, such as brushing or chewing, than from intense and punctual bacteremia caused by oral invasive procedures.⁸ Finally, the risk of adverse effects from antibiotics and the emergence of resistant bacteria may outweigh the benefit of IE prevention, if it exists.^{2,7}

The American Heart Association (AHA) and the European Society of Cardiology (ESC) currently recommend antibiotic prophylaxis for IE only for patients at high risk of severe disease outcomes and who will undergo risky oral/dental procedures.^{7,8} The National Institute for Health and Care Excellence (NICE), also considering the low cost-effectiveness of these procedures, stopped recommending systematic antibiotic prophylaxis under any circumstances.⁹ On the other hand, the update of the Brazilian Guidelines for Valvular Heart Diseases, in 2020, still maintained the recommendation of antibiotic prophylaxis for IE prior to risky oral/dental procedures for patients with high and moderate risk of heart disease.¹⁰

In 2022, Thornhill et al.¹¹ showed a significant temporal association between IE and invasive dental procedures, particularly extractions and oral surgery,¹² in patients with high-risk cardiac conditions, and a significant association between antibiotic prophylaxis

use and IE incidence reduction in this population. However, other studies, including a recent Cochrane review, showed that it remains unclear whether antibiotic prophylaxis is effective in preventing IE in at-risk patients before invasive dental procedures since there is no clinical trial to prove it.^{13,14}

International studies have identified a partial implementation of the new guidelines on IE among prescribers, in addition to heterogeneous knowledge about risk factors, adverse drug events, appropriate antibiotic regimens, and the impact of daily routine habits on the occurrence of the disease.¹⁵⁻²⁰ Brazilian professionals are advised by national guidelines, but they are also based on international documents in their clinical practice. Therefore, this study aims to evaluate the prescription pattern of cardiologists and dentists regarding antibiotic prophylaxis for IE before risky dental procedures, besides describing the characteristics of the professionals interviewed and exploring potential factors associated with the prescription pattern found.

Methods

Design

This is an observational, cross-sectional study that evaluated the practice of prescribing antibiotic prophylaxis for IE before risky oral/dental procedures in the state of Bahia, Brazil.

Study procedures

Data collection took place between January 01 and April 25, 2021. An anonymous online questionnaire was applied with objective questions that could be answered within 20 minutes. The questionnaire was adapted to specific terms for each specialty, but the questions were equivalent in content and information on demographic characteristics, academic background, professional practice, prescription of antibiotic prophylaxis for bacterial endocarditis, and knowledge of current clinical guidelines on the topic (Appendices 1 and 2).

The contact with the research participants was done by e-mail, with the dissemination of the form by the Brazilian Society of Cardiology - Bahia Section (SBC-BA) and by the Brazilian Association of Odontology - Bahia Section (ABO-BA) to their members that represent the professionals active in the state, and via WhatsApp, with direct dissemination to the contacts of the researchers who suited the profile of the participants. The forms were sent every 15 days, up to 90 full days after the first contact, to increase adherence to the survey, reduce recall bias and allow access at a time defined by the participant and at their convenience. Free and informed consent was obtained from all participants.

This study was conducted in accordance with the principles of the Declaration of Helsinki and approved by the Research Ethics Committee of the Professor Edgard Santos University Hospital, from the Federal University of Bahia, on December 4, 2020.

Sampling and statistical analysis process

The sample was selected using the snowball sampling method, a non-probabilistic sampling technique, in which a contact with a connection with other members of the target population (sample seed) shares the invitation, recruiting new participants for research. With the target population of cardiologists and dentists from Bahia, Brazil, the SBC-BA, ABO-BA, and WhatsApp contacts of the researchers were used as "seeds".

A sample size was calculated with the intention of having a minimal numerical representation of the population of interest. Knowing that in the state of Bahia, there were a total of 8,000 dentists and 700 cardiologists associated with defined professional societies, the proportion of visits to patients at risk of endocarditis was used as a parameter (Cardiology probability of 90%; Dentistry probability of 10%), $\epsilon = 0.05$ and $\alpha = 5\%$, resulting in a minimum sample of 116 cardiologists and 136 dentists.

In descriptive statistics, categorical variables were described as proportions and quantitative variables as means (standard deviation [SD]). The normality of the quantitative variables was evaluated by the Shapiro-Wilk statistical test and by the characteristics of the distribution. Prevalence ratios and their respective 95% confidence intervals (CI) were calculated between the variables of interest, aiming to compare the characteristics of antibiotic prophylaxis prescription among cardiologists and dentists, as well as to compare the practice of antibiotic prescription with the graduation time of the professionals. For exploratory inferential statistics, Pearson's chi-square (χ^2) or Fisher's exact tests were used, when applied. The significance level adopted was 5%. Statistical analysis was performed using R software for Windows, version 3.6.3.

Results

Of the 8,700 potential participants, 618 responses were obtained. Of these, five refused to participate, resulting in a final sample of 613 participants composed of 115 cardiologists and 498 dentists. The average time to answer the questionnaire was 13 min 37s.

Sample characterization

The mean age was 40.6 (SD ± 11.0) years, being higher in cardiologists than in dentists. Females were more frequent among dentists (64.5%), while males predominated among cardiologists (56.9%).

As for graduation time, each established interval (<10; 10–20; >20 years) was represented by about one-third of the participants, and the distribution between the groups was inverse, with most cardiologists having graduated for more than 20 years and most dentists for less than 10 years. The maximum academic degree of most of the sample was specialization (except residency) since almost 50% of dentists were in this category. However, almost 60% of cardiologists had medical residency as their maximum degree. Among cardiologists, the most prevalent specialty was general cardiology (47.8%) followed by echocardiography (34.8%), and in dentistry it was general practice (25.2%).

Most participants (80.4%) worked in private health services, although almost half also worked in public services, and 87 (14.2%) were university professors. Table 1 and Table 2 presents the general characteristics of the sample.

Table 1 – Sample characterization.

| | Total (n = 613) | Cardiologists (n =115) | Dentists (n =498) |
|---|-----------------|------------------------|-------------------|
| Age (years) - mean (SD) | 40.6 (11.0) | 46.5 (10.6) | 39.2 (10.6) |
| Sex (female) - n (%) | 371 (60.5) | 49 (43.1) | 322 (64.59) |
| Place of birth* - n (%) | | | |
| Salvador/BA | 244 (40.1) | 45 (39.7) | 199 (40.4) |
| Another city in Bahia | 234 (38.5) | 52 (44.8) | 182 (36.9) |
| Another state in Brazil | 130 (21.4) | 18 (15.5) | 112 (22.7) |
| Years after graduation - n (%) | | | |
| <10 | 202 (32.9) | 14 (12.2) | 188 (37.8) |
| 10–20 | 221 (36.1) | 44 (38.3) | 177 (35.5) |
| >20 | 190 (31.0) | 57 (49.5) | 133 (26.7) |
| Academic degree - n (%) | | | |
| Graduation | 106 (17.3) | 1 (0.9) | 105 (21.1) |
| Specialization (except residency) | 248 (40.4) | 16 (14.7) | 232 (46.5) |
| Residency | 98 (16.0) | 69 (59.4) | 29 (5.8) |
| Master | 96 (15.7) | 20 (17.2) | 76 (15.3) |
| Doctorate | 65 (10.6) | 9 (7.8) | 56 (11.3) |
| Current occupation - n (%) | | | |
| Private service | 493 (80.4) | 112 (97.4) | 341 (68.5) |
| Public service | 266 (43.4) | 65 (56.5) | 199 (40.0) |
| College professor | 87 (14.2) | 14 (12.1) | 73 (14.7) |
| Others | 19 (3.1) | - | 19(3.8) |
| *N=608. SD: standard deviation; OMST: Oral and Maxillofacial Surgery and Traumatology; DPSN: Dentistry for Patients with Special Needs. | | | |

Theoretical basis of prescribers on prophylaxis for IE

Considering the total sample, 91% of the participants reported using clinical guidelines to direct the prescription of prophylaxis for IE, and only 2.6% of cardiologists and 10.5% of dentists reported not following any. Among cardiologists, the most used documents were the Brazilian Guidelines for Valvular Heart Disease (62.5%)¹⁰ and the Guidelines on the Prevention, Diagnosis, and Treatment of IE (15.6%).⁷ Among dentists, although the Prevention of IE, from the AHA 2007 or 2017, was the most mentioned (21.7%), followed by the Brazilian guidelines (11.3%), most were unable to mention which was the document used (42.9%).

As for knowledge about antibiotics adverse events, almost half were unable to mention which of the drugs was more associated with serious events.

Regarding the oral/dental procedures questioned, all were correctly identified regarding the risk for bacteremia by more than half of the sample, regardless of profession, except for subgingival scaling (scaling of tartar), which obtained only 40% of correct answers among cardiologists (Figure 1).

In the case of daily procedures/actions capable of generating bacteremia, within the total sample, flossing and tooth brushing obtained almost 50% of correct answers, while chewing was identified by only 17.3% of participants. In addition, 40.9% of the total reported that none of the

Table 2 – Professional characterization of respondents.

| Specialization – n (%) | Cardiologists (n = 115) | Dentists (n =498) |
|----------------------------------|----------------------------|----------------------|
| General cardiologist | 55 (47.8) | - |
| Hemodynamicist cardiologist | 5 (4.3) | - |
| Arrhythmia specialist | 8 (7.0) | - |
| Pediatric cardiologist | 4 (3.5) | - |
| Echocardiographer | 40 (34.8) | - |
| General practitioner | - | 125 (25.2) |
| OMST specialist | - | 29 (5.8) |
| Stomatologist | - | 15 (3.0) |
| DPSN specialist | - | 8 (1.6) |
| Periodontist | - | 13 (2.6) |
| Specialist in prosthesis implant | - | 12 (2.4) |
| Endodontist | - | 8 (1.6) |
| Others | 3 (2.6) | 288 (57.8) |

DPSN: Dentistry for Patients with Special Needs; OMST: Oral and Maxillofacial Surgery and Traumatology.

actions mentioned presented a risk of bacteremia, and cardiologists were more correct than dentists (Figure 1).

About high-risk cardiac conditions for IE, almost 90% of the total sample correctly identified more than 50% of heart diseases that would justify the prophylactic use of antibiotics, as recommended by the AHA.²¹ However, only 5% of cardiologists and 2% of dentists identified all of them. In addition, moderate-risk heart diseases were often mentioned when the question was about high-risk IE heart diseases. Rheumatic valvopathies with moderate/severe reflux (68.2%) even surpassed some of the conditions considered to be of high risk for the disease, such as congenital heart diseases corrected with prosthetic material (57.3%), unrepaired cyanotic heart diseases (60%), or repaired cyanotic heart diseases that evolved with residual lesion (50.2%) (Figure 1).

When analyzing the performance of the participants for the grouping of correct answers regarding the risks for IE, it was evidenced partial knowledge about the oral/dental procedures, and daily oral habits capable of generating bacteremia, as well as about the high-risk heart diseases for IE. Dental surgeons tended to be more

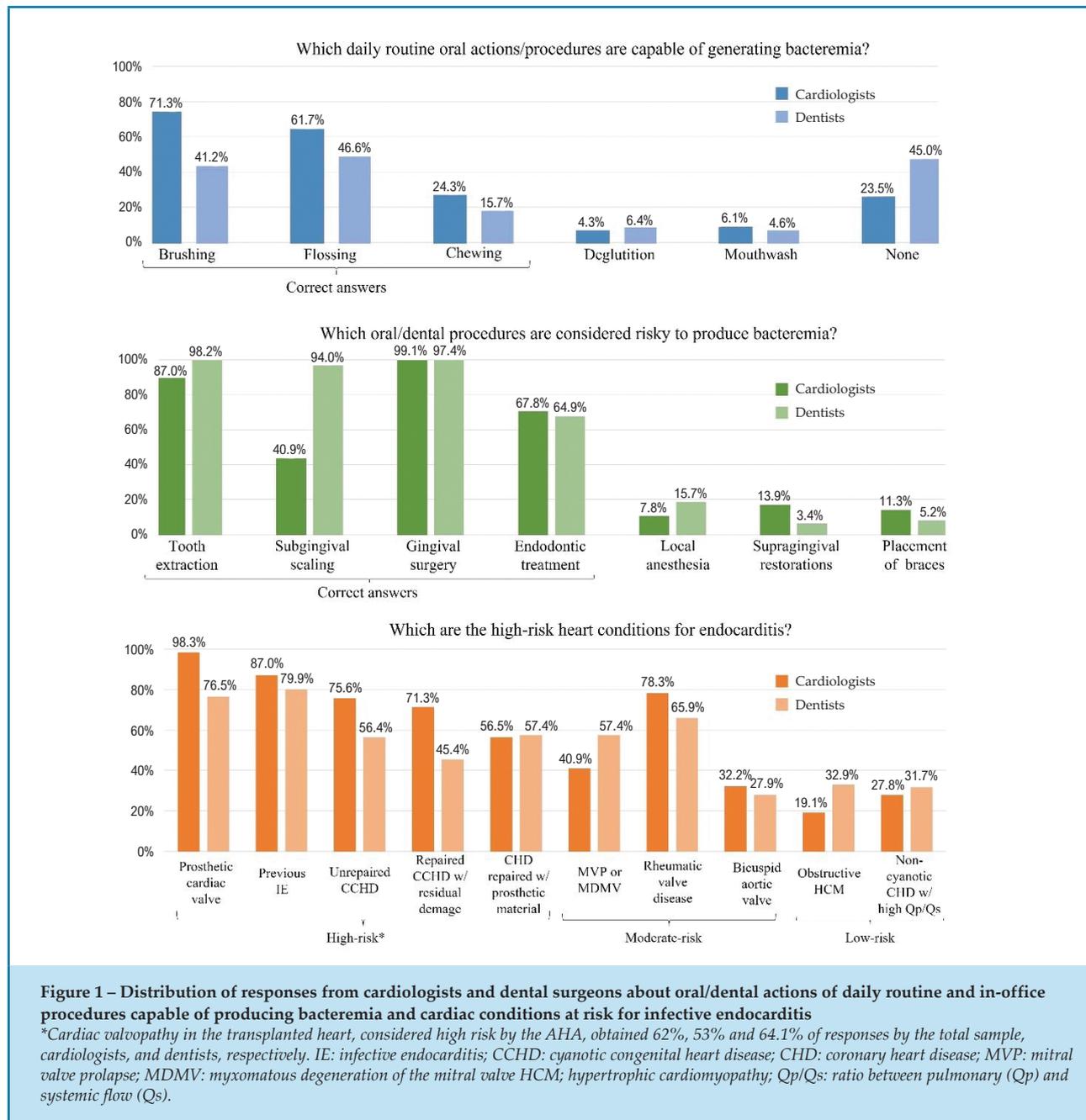
correct regarding the oral/dental procedures both that increase the risk of bacteremia and those that do not, which was also observed in cardiologists in relation to high-risk heart diseases for endocarditis, but in a smaller percentage. In the case of day-to-day oral procedures/actions, cardiologists tended to hit more correctly both the procedures that cause bacteremia and those that do not cause it. However, none of the research participants correctly identified the set of all daily procedures associated with bacteremia and those not associated.

Pivotal Figure presents the performance of the total sample, cardiologists and dental surgeons, on questions about high-risk heart disease for bacterial endocarditis, oral/dental procedures at risk of producing bacteremia, and daily habits capable of generating bacteremia. Responses were evaluated considering fully correct responses, in which the options of increased risk were marked and those that do not increase the risk of IE or bacteremia were not marked.

Antibiotic prophylaxis prescription pattern for IE

Most of the total sample reported prescribing antibiotic prophylaxis for IE for both high- and moderate-risk heart disease patients. Among dentists, 17.7% stated they would leave the decision to the patient's cardiologist, while only 0.9% of cardiologists said they would leave the decision to the dentist. The correct prescription for prophylaxis (2 g of amoxicillin, 30–60 minutes before the oral/dental procedure) was indicated by 88.7% of cardiologists and 74.8% of dentists. The most common error among cardiologists was prescribing amoxicillin, orally, 2 g, 30–60 minutes before the procedure in addition to 1 g, 6 hours after the first dose (7.8%), and, among dentists, it was amoxicillin, orally, only 1 g, 30–60 minutes before the procedure (10.8%). For penicillin-allergic patients, clindamycin was the most prescribed by both groups, followed by azithromycin and clarithromycin. Only 10.9% of the total sample prescribed cephalixin (indicated only in the AHA guideline).⁸

Most prescribers (83.1%) reported being concerned about the occurrence of antibiotic side effects and only 4.6% of the sample reported having already followed up patients who had adverse events to antibiotic prophylaxis against bacterial endocarditis. Of these, 71.2% reported that patients had gastrointestinal symptoms consistent with known adverse events; 10.7% mentioned serious events such as anaphylaxis and angioedema; 3.6% related oral candidiasis; and the others, mild adverse events such as skin rash.



In comparison to potentially predictive variables, the correct prescription of amoxicillin (2g, 30–60 minutes before the oral/dental procedure) was more prevalent among cardiologists than dentists and in responders with a graduation time of less than 20 years, as described in Table 3. Other variables surveyed did not show a statistically significant association with antibiotic prescription. Regarding penicillin-allergic patients, considering how they were prescribed for clindamycin, azithromycin, or clarithromycin (Brazilian Guidelines for Valvular Heart Diseases, 2020),¹⁰ the

prevalence ratios did not reach statistical significance, even in the comparison with time of graduation. On the other hand, professionals with a shorter graduation time (<20 years) prescribed antibiotic prophylaxis more correctly than professionals trained longer before (Table 3).

Discussion

In the present study, among the cardiologists, only 2.6% of the participants denied prescribing antibiotic

Table 3 – Association of variables with correct prescription of antibiotic prophylaxis.

| Amoxicillin, orally, 2 g, 30–60 minutes before procedure | | | |
|--|------------|------------------|---------|
| Years after graduation | n (%) | PR (95%CI) | p-value |
| <20 years | 339 (81.9) | 1.19 (1.09–1.29) | <0.001 |
| ≥20 years | 135 (67.8) | 1 | |
| Especialization | | | |
| Years after graduation | n (%) | PR (95%CI) | p-value |
| Cardiologists | 102 (88.7) | 1.21 (1.09–1.34) | <0.001 |
| Dentists | 372 (74.8) | 1 | |
| Clindamycin (600 mg), azithromycin, and clarithromycin (500 mg), orally, 30–60 minutes before the procedure* | | | |
| Years after graduation | n (%) | PR (95%CI) | p-value |
| <20 years | 367 (88.6) | 1.22 (1.12–1.34) | <0.001 |
| ≥20 years | 144 (72.4) | 1 | |

PR: Prevalence ratio; CI: confidence interval.

prophylaxis for patients at high risk for IE and 85.3% continue to prescribe it for patients at moderate risk, even though this is different from the most current recommendations of the main international guidelines.^{8,22} This high rate of prescription for moderate-risk patients, on the other hand, agrees with the finding that the Brazilian Guidelines for Valvular Heart Diseases (2020),¹⁰ that maintained the prophylaxis recommendations for this group of heart diseases, was the document most used by physicians to guide their prescriptions (62.5%). In the group of dentists, only 11.6% reported using the Brazilian guidelines as a practical guide for conduct, although the majority (78.1%) prescribed antibiotic prophylaxis for patients at moderate risk. This difference shows that, even among prescribers who reported following clinical guidelines that no longer recommend the use of antibiotics for patients at lower risk of IE, there is still a high number of professionals who prescribe.

Similar results were found in studies conducted in France (2018)¹⁵ and the United States (2017)¹⁸ regarding the percentage of antibiotic prescription for the prevention

of IE before oral/dental procedures in moderate-risk heart disease patients (87.5% and 50.0%, respectively). This was observed, even though in the clinical guidelines of these countries, prophylaxis for patients at moderate risk for the disease has not been recommended since 2009 and 2007, respectively. It is noted, then, that there is still a high rate of prescription of antibiotics for this group of patients in the world, reflecting a lack of knowledge about the new recommendations or a disagreement of professionals in relation to them.

The high-risk cardiopathies best identified by cardiologists and dentists were history of IE and heart valve prosthesis, as observed in previous studies.^{17,23,24} Among dentists, a greater fragility in knowledge regarding cyanotic congenital heart diseases was perceived, a finding also reported in the literature, which may be due to the greater specificity of this group of heart diseases, its low prevalence, and possible confusion with non-cyanotic congenital disorders, which do not represent a high risk for IE.^{15,17,23,24}

Corroborating a study from the Dominican Republic, the present study found that the moderate-risk heart disease for IE most mentioned among the high-risk conditions was rheumatic heart disease with moderate to severe valvular regurgitation.²⁵ Differently, in France and Saudi Arabia, the most cited moderate-risk heart disease was mitral valve prolapse with reflux and, in Japan, aortic regurgitation.^{15,23,26} The findings suggest that rheumatic heart disease is a more frequent concern among health professionals working in developing countries, where rheumatic heart disease still has a high prevalence among valvular heart disease and is still an important public health problem, allied to the often precarious living conditions of part of the affected population.^{27,28}

Hypertrophic obstructive cardiomyopathy and non-cyanotic congenital heart diseases were mentioned as high-risk heart diseases for IE by approximately 30% of the sample. These groups of diseases are no longer included in the indications for antibiotic prophylaxis against IE in the various current clinical guidelines, which shows a possible over-prescription of antibiotics for this group among professionals.^{8,10,22}

Regarding dental procedures, more than 80% of the sample correctly identified those that would be capable of generating bacteremia, with similar performance between the two professional groups. This high rate of hits was also verified by Cloitre et al.,¹⁵ Tong et al.,¹⁷ Al-Fouzan et al.,²³ and Lauber et al.,²⁴ and can be explained

by the stability of these recommendations and little variability in knowledge about them over the last few years. Thornhill et al.¹² recently calculated the number of invasive procedures, extractions, or surgical procedures needing antibiotic prophylaxis to prevent an endocarditis case and found 244, 143, and 71 values, respectively.

When assessing knowledge about daily oral habits capable of generating bacteremia, less than 60% of the sample was able to correctly identify most of the risky actions and no research participant got all of them right. Interestingly, in this area of knowledge, the performance of cardiologists was better than that of dentists, since 23.5% of cardiologists reported that none of the procedures would be capable of generating bacteremia, while 45% of dentists made the same statement.

In an English study, the authors found that more than 90% of professionals considered that oral actions of daily life influenced the occurrence of IE.¹⁶ Greater knowledge about the risk of daily bacteremia may be a result of the NICE (2008) recommendation to discontinue antibiotic prophylaxis for IE and the consequent debate on the routine risks of bacteremia and IE, which favored the valorization of oral health care in the disease prevention.⁹

The first-line antibiotic regimen was correctly indicated by 74.8% of dentists and 88.7% of cardiologists, in contrast to the results found in a Canadian study, in which the performance of dentists (88%) was considerably superior to that of cardiologists (48%).²⁴ This divergence is possibly because, in Brazil, the decision on antibiotic prophylaxis for IE still seems to be more attributed to physicians. In the present study, almost 20% of the dental surgeons reported leaving the prophylactic prescription at the discretion of the patient's physician, and almost 100% of the cardiologists responded that they assumed this responsibility for themselves.

The prescription inadequacies were more prevalent in professionals who graduated more than 20 years ago, and the most frequent errors were related to amoxicillin dose (2 g) and the second dose of amoxicillin (6 hours after the first dose), which has not been recommended for some decades. This finding can be justified by an insufficient scientific update of the professionals on the subject, some still keeping outdated practices. There are reports in the literature suggesting that more experienced professionals are less receptive to new standards of care and are less familiar with the growing concept of evidence-based medicine, having greater resistance to its application.^{29,30} Regarding the drug of choice for

penicillin-allergic patients, 94% of the respondents stated that they prescribed it appropriately (mainly macrolides), diverging from what was found in France, where only 43% got the right prescription.¹⁵

In this context, in 2021, the AHA released a scientific document no longer indicating clindamycin as an antibiotic prophylaxis option for bacterial endocarditis because of its side effects.³¹

The present study has limitations. Initially, the sampling process may hinder the generalization of the findings outside the state of Bahia. The sample size was calculated with the intention of having a minimum numerical representativeness of the population of interest, using only one variable. Although the sample size was not reached completely regarding cardiologists, it is believed that the difference of only one answer probably does not change the validity of the sample. Besides, even reaching almost the calculated sample size, only 7.1% of the associates answered the questionnaire. Professionals who believed they did not have enough knowledge of the subject may have chosen not to answer, configuring a potential source of selection bias. Another limitation is the possibility that professionals may have performed scientific consultations on the subject during the time they were answering the form. However, the average response time to the questionnaire was short (14 minutes), making this possibility more unlikely. The study is exploratory and may have limited external validity. It would be interesting if similar studies were applied in other Brazilian states.

Despite the limitations, this research provides relevant and, as far as we know, unpublished information on the standard of conduct of the main prescribers regarding antibiotic prophylaxis for IE in Brazil, as well as identifying the knowledge gaps and non-conformities of practices reported by our professionals in relation to the main current scientific recommendations. It is important to highlight that insufficient knowledge of the recommendations can result in the misuse of antibiotics and induce bacterial resistance to drugs. In addition, the present study innovates by investigating the practice of prescribing antibiotic prophylaxis for IE among cardiologists, which is very scarce in the international literature.

Conclusion

The study revealed that cardiologists and dentists, for the most part, maintain the prescription of antibiotic

prophylaxis for IE before risky oral procedures, for patients considered at high and moderate risk of the disease. The correct prescription of prophylaxis was higher among cardiologists and professionals with a graduation time of less than 20 years. In addition, satisfactory knowledge was evidenced by the professionals' prescription on dental procedures capable of causing bacteremia and regular knowledge regarding daily habits that can generate bacteremia and high-risk cardiopathies for IE.

Author Contributions

Conception and design of the research: Brandão MM, Latado L, Braga ALL; acquisition of data: Brandão MM, Latado L, Oliveira LB, Sarmiento VA, Braga ALL; analysis and interpretation of the data: Brandão MM, Braga ALL; statistical analysis: Oliveira LB; writing of the manuscript: Brandão MM, Latado L, Sarmiento VA, Braga ALL; critical revision of the manuscript for intellectual content: Oliveira LB, Sarmiento VA, Braga ALL.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

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Study Association

This article is part of the thesis of graduation submitted by Mariana Mattos Brandão, from Escola Bahiana de Medicina e Saúde Pública in partnership with Universidade Federal da Bahia.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the Comitê de Ética em Pesquisa do Hospital Universitário Professor Edgard Santos under the protocol number 40526720.8.000.0049. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

Erratum

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*Supplemental Materials

For additional information, please access appendice 1 and appendice 2

