Caries risk assessment in dental practices by dentists from a Brazilian community

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Abstract: Data on dental practices related to caries risk assessment (CRA) are scarce among Brazilian dentists. This study aimed to determine the prevalence of CRA use by dentists and factors associated with its use, as well as to quantify dentists' ratings of the importance of specific factors when treatment planning. Dentists registered at the Regional Council of Dentistry of São Paulo State – Araraquara region were sent two paper questionnaires that comprised: a) characteristics of dentists themselves, their practices, and their patients; and b) the translated version of the "Assessment of Caries Diagnosis and Caries Treatment" Questionnaire from the U.S. National Dental Practice-Based Research Network. Participants were 206 dentists who currently practiced in Araraquara and treated dental caries. Descriptive statistics and multiple logistic regression analyses were used for data analysis. Thirty-six percent of the dentists reported they perform CRA and, among them, 36% indicated they record the assessment on a special form that is kept in the patient chart. More years since dental school graduation (OR = 1.1, p = 0.002) and holding an advanced academic degree (OR=2.6, p=0.005) were associated with a higher likelihood of performing CRA, whereas exclusively using a private practice model (OR = 0.5, p = 0.016) was associated with a lower likelihood of performing CRA. The current oral hygiene and commitment to return for follow-up were the most important risk factors for treatment planning. In conclusion, CRA was not a routine procedure in daily practice among the majority of participating dentists. Specific demographic, practice and academic education characteristics were associated with performing CRA.

Keywords: Dental Caries; Practice Patterns, Dentists'; Risk.

Introduction

Caries risk assessment (CRA) is one of the essential aspects of modern dental caries management,[1,2] reflecting an overall conservative, preventive, and evidence-based approach. This approach is characterized by personalized diagnosis and treatment, to include detection and monitoring of individual lesions in an effort to remineralize and/or prevent their progression, all of which is designed to preserve tooth structure.[3] Assessing caries risk involves the process of determining the probability that a patient will develop new carious lesions in the near future,[4] as well

as the probability of a change in the size or activity of that patient's carious lesions.[5]

CRA can guide dental practitioners in the decision-making process related to disease management, the need for patients to return for follow-up, and the need to use additional methods of caries detection[1] in their routine dental practice. In public health, a population-based CRA model can identify moderate- and high-risk populations, assist in setting priorities, estimate the resource needs for improving oral health, and justify investment of cost-effective measures for a public health care system.[6]

Considering the essential role that CRA has for effective caries management,[7] along with the circumstance that dental caries is the most prevalent disease in 195 countries,[8] it is important to identify whether there is a gap between what scientific evidence suggests should be occurring with regard to CRA and what is actually occurring in everyday dental practice. In Brazilian dental schools, CRA was judged a relevant issue for cariology, which is a specific discipline within the curriculum of 32% of Brazilian dental schools or is taught by operative dentistry, pediatric dentistry or public health disciplines.[9]

Dentists from a Brazilian community participated in the first study using the Brazilian translated version of the "Assessment of Caries Diagnosis and Caries Treatment" Questionnaire from the National Dental Practice-Based Research Network (National Dental PBRN). The objective of this study was to determine among Brazilian dentists the prevalence of CRA use and factors associated with its use, as well as to quantify dentists' ratings of the importance of specific factors when treatment planning.

Methodology

Study design

This cross-sectional study is part of a major research project that assessed dentists' practices regarding caries diagnosis and treatment, by means of paper questionnaires.

Ethical aspects

The major research project has been conducted in full accordance with ethical principles, including the World Medical Association Declaration of Helsinki, and has been approved by the Research Ethics Committee of the School of Dentistry of Araraquara, São Paulo State University (Unesp) (protocol number #78/11). The research was undertaken with the understanding and written consent of each subject and according to the above mentioned principles.

Participants and data collection

During study planning, we received a list with contact information of 722 dentists registered at the Regional Council of Dentistry of São Paulo State – Araraquara region, in 2011. Because data were collected in 2014-2015, we updated the list by consulting internet sources, which increased the list to 801 dentists. The following strategies were used to increase response rate: pre-paid return envelope, questionnaires sent to work address; a second copy of the questionnaire to non-respondents; precontact by telephone; collection of completed questionnaires at work address).[10] Dentists had to meet these criteria to be considered eligible: currently practices in Araraquara; treats dental caries; not retired. After sending the questionnaires, we received confirmation that 113 of the 801 did not meet these criteria, for a final sampling frame of 688. Therefore, the response rate was 217/688, or 31.5%. For the present paper, data of nine participants were withdrawn because they did not report CRA (caries risk assessment) for individual patients in any way and an additional two did not indicate the ages of their patients, leaving data from 206 dentists for analysis.

Therefore, the present report addresses the use of CRA in pediatric and adult patients among dentists who completed a questionnaire about CRA in their practices and indicated the ages of patients seen in their practice.

Measures

Two paper questionnaires were sent to participating dentists: a) one about the characteristics of the dentists, their practices, and their patient populations, and b) a translated version of the "Assessment of Caries Diagnosis and Caries Treatment" from the U.S. National Dental Practice-Based Research Network,

obtained after the following steps: initial translation, back-translation, committee review,[11] and pre-testing.

Information about dentists' sociodemographic, professional and practice profiles was taken from a self-administered questionnaire formulated by the main researcher, based on questions from the enrollment form for studies from the Dental Practice-Based Research Network (DPBRN).

The "Assessment of Caries Diagnosis and Caries Treatment" questionnaire was originally designed to gather information from dentists on assessment and treatment of dental caries. It has 34 questions dealing with diagnosis, prevention and treatment of dental caries, including various case scenarios and different topics designed by experts in cariology and behavioral sciences. The original instrument was evaluated for test-retest reliability with 35 practitioners.[12] The Brazilian translated questionnaire was evaluated for test-retest reliability with 17 dentists (Intraclass Correlation Coefficients: 42% of the questions with satisfactory correlation and 58% with excellent correlation) and detailed information about the translation and adaptation process, as well the Brazilian version of the questionnaire are published elsewhere.[10]

Regarding caries risk assessment, some questions asked dentists whether they *"assess caries risk for individual patients in any way?"* If they responded yes, then they were asked if they *"record the assessment on a special form that is kept in the patient chart?"* The dentists were then asked how strongly they agree with the statement *"A dentist's assessment of caries risk for a patient can predict whether or not that patient develops new caries in the future?"* Forced response choices were 1 = strongly disagree, 2 = somewhat disagree, 3 = neither agree nor disagree, 4 = somewhat agree, 5 = strongly agree.

The dentists were asked a series of questions about caries risk factors and rated their importance when designing a treatment plan including recall intervals, interventions, and operative treatment. These questions were asked for pediatric and adult patients. Forced response choices were as follows 1 = not at all important, 2 = slightly important, 3 = moderately important, 4 = very important, 5 = extremely important.

Statistical methods

Descriptive statistics were calculated for the caries risk assessment and caries risk factor questions. Multiple logistic regression was used to test for practice and dentist characteristics as predictors of CRA, dichotomized as "yes" or "no". These variables included dentist gender (male = 0 and female = 1), years since dental school graduation, dental school attended as private or public (public = 0 and private = 1), if they have completed an advanced degree (no advanced degree=0, master's or doctorate = 1), reporting an area of specialization (no = 0, yes = 1) and whether they work exclusively in a private practice model (public health or hybrid private/public health models = 0, private = 1). Next, multiple logistic regression was used to examine the relationship between the dentist's subjective importance of risk factors and the primary variable of interest: whether or not caries risk was assessed. An alpha level of 0.05 was used as the threshold for statistical significance.

Results

Dentist, practice, and patient characteristics for the 206 dentists who participated in the present study are presented in Table 1. Participant dentists were primarily middle-aged adults, most were female (60%), graduated from a public dental school (77%), with some specialization (55%), and with most patients aged 19–64 years. Almost half (49%) of the dentists worked exclusively in private practice.

Thirty-six percent of the dentists (n = 75) reported they perform caries risk assessment (CRA). Of the 75 who perform CRA, 36% (n = 27) indicated they record the assessment on a special form that is kept in the patient chart. Eighty-three percent (n = 172) of the dentists agreed (somewhat or strongly agreed) that a dentist's assessment of caries risk for a patient can predict whether or not that patient develops new caries in the future. The association between the "assessment of caries risk" variable and "dentists can predict new caries" variable was not significant [x^2 (4) = 6.876, p = 0.143]. Responses to questions about caries assessment and prediction are presented in Table 2.

Table 3 presents the regression coefficients and estimates of odds ratios (OR) for practice and dentist

Table 1. Dentist, practice, and patient characteristics for the 206 dentists who participated in the study.

Characteristic	Percentage (n) or Mean (SD)
Age of dentist	42.3 (SD = 12.0)
Gender (female)	60% (n = 123)
Type of practice	
Private practice	49% (n = 100)
Private/public hybrid	27% (n = 55)
Public health	19% (n = 39)
Other	6% (n = 12)
Years since dental school graduation	19.8 (SD = 11.8)
Advanced degrees	
None	70% (n = 144)
Master's	5% (n = 11)
Doctorate	25% (n = 51)
Type of dental school	
Public institution	77% (n = 158)
Private institution	23% (n = 48)
Specialization	
Not completed specialization training	37% (n = 76)
Specialization but not Pediatric	55% (n = 113)
Pediatric specialization	8% (n = 17)
Age groups by percent seen in practice	
Under 19 years of age	24% (SD = 26)
19–44 years of age	33% (SD = 18)
45–64 years of age	30% (SD = 18)
65 years of age or older	13% (SD = 11)

SD: standard deviation.

Table 2. Responses from the 206 dentists to questions about caries assessment and caries prediction.

Variables	Percentage (n)
Perform caries risk assessment [a]	36% (n = 75)
Use a special form (asked of those who assess risk) [b]	36% (n = 27)
Dentist can predict new caries [c]	
Strongly disagree	2% (n = 5)
Somewhat disagree	9% (n = 18)
Neither agree or disagree	6% (n = 12)
Somewhat agree	38% (n = 79)
Strongly agree	45% (n = 92)

[a]Responded yes to: Do you assess caries risk for individual patient in any way?; [b] Responded yes to: Do you record the assessment on a special form that is kept in the patient chart?; [c]How strongly do you agree with this statement "A dentist's assessment of caries risk for a patient can predict whether or not that patient develops new caries in the future?". The association between the "assessment of caries risk" variable and "dentists can predict new caries" variable was not significant [x^2 (4) = 6.876, p = 0.143].

characteristics as predictors of performing CRA. Years since dental school graduation (OR = 1.1, p = 0.003) and holding an advanced academic degree (OR = 2.6, p = 0.004) were associated with a higher likelihood of performing CRA. Exclusively using a private practice model (OR = 0.5, p = 0.023) was associated with a lower likelihood of performing CRA.

The importance that respondents ascribed to specific risk factors when treatment planning is shown in Tables 4 and 5. Of the 206 dentists who participated, 48 reported that less than 10% of their patients are 18 years of age or younger; these dentists were excluded from analyses that involved pediatric caries risk factors. Ten dentists reported that 100% of their patients were 18 years of age or younger; these dentists were excluded from analyses that involved adult caries risk factors. Tables 4 and 5 present the mean rating and standard deviation (SD) for the importance of caries risk factors when developing a caries treatment plan for pediatric and adult patients, respectively. The current oral hygiene and commitment to return for follow-up were the most important risk factors for treatment planning in both pediatric and adult patients. In the pediatric patient model (Table 4), high ratings of importance for current oral hygiene (OR = 3.5, p =0.025) and current diet (OR = 1.6, p = 0.046) were associated with performing CRA. In the adult patient model (Table 5), high ratings of importance for decreased salivary flow (OR = 1.7, p = 0.035) and recent caries activity (OR = 2.2, p = 0.002) were associated with performing CRA.

Discussion

To our knowledge this is the first paper describing results from a Brazilian community about practices related to caries risk assessment and associated factors, as well as the importance of specific factors when treatment planning by dentists.

Most dentists who completed the questionnaires were female (60%), middle-aged (42.3 years), graduated from a public dental school (77%), received specialty training (63%) and worked in a private or private+public model (76%). Data on demographic and practice profile have shown that most Brazilian[13] and Araraquara

Table 3. Practice and dentist characteristics as predictors of CRA.

Variable	B (SE)	Significance	OR (95% CI)
Gender (female)	0.586 (0.344)	0.088	1.8 (0.9–3.5)
Years since graduation	0.045 (0.015)	0.003	1.1 (1.1–1.2)
Advanced degree (master's or doctorate)	0.979 (0.337)	0.004	2.6 (1.3–5.2)
Specialization	-0.219 (0.389)	0.595	0.8 (0.4–1.6)
Practice model (private)	-0.691 (0.324)	0.023	0.5 (0.3–0.9)
Dental school attended (public)	-0.595 (0.422)	0.158	0.6 (0.2–1.3)

Model fit: $x2$ (6) = 30.444, p < 0.001.

Table 4. Ratings of importance of caries risk factors for treatment planning in pediatric patients.

Risk factor	Rating of importance*	Caries risk associated with dentist's use of CRA	
	Mean (SD)	OR (95%CI)	p.-value
Current oral hygiene	4.8 (0.4)	3.5 (1.2–10.6)	0.025
Parent's (guardian's) commitment to return for follow-up	4.5 (0.7)	1.4 (0.8–2.4)	0.185
Patient has one or more active caries	4.4 (0.7)	1.1 (0.7–1.7)	0.798
Patient's (guardian's) understanding of caries progression	4.4 (0.7)	1.1 (0.7–1.7)	0.714
Presence of dental appliances	4.3 (0.7)	1.4 (0.8–2.3)	0.256
Current diet of the patient	4.3 (0.8)	1.6 (1.1–2.6)	0.046
Patient has several large restorations	4.3 (0.8)	1.0 (0.7–1.6)	0.853
Decreased salivary function	4.2 (0.9)	1.1 (0.7–1.6)	0.721
Patient has had caries recently	4.1 (0.7)	1.5 (0.9–2.5)	0.114
Current use of fluorides by the patient	4.0 (0.8)	0.9 (0.6–1.3)	0.875
Your own subjective assessment about the patient	4.0 (0.9)	1.1 (0.7–1.6)	0.737
Patient's age	3.8 (0.9)	1.4 (0.9–2.1)	0.100
Patient's socioeconomic status	3.5 (1.0)	1.3 (0.9–1.8)	0.172
Caries status of the parents	3.4 (1.0)	0.9 (0.6–1.5)	0.479

*Scored: 1: not at all important; 2: slightly important; 3: moderately important; 4: very important; 5: extremely important.

Table 5. Ratings of importance of caries risk factors for treatment planning in adult patients.

Risk factors	Rating of importance*	Caries risk associated with dentist's use of CRA	
	Mean (SD)	OR (95%CI)	p.-value
Current oral hygiene	4.7 (0.5)	1.3 (0.7–2.6)	0.446
Commitment to return for follow-up	4.5 (0.6)	1.0 (0.6–1.7)	0.915
Presence of dental appliances	4.3 (0.8)	1.3 (0.8–2.1)	0.220
Patient has one or more active caries	4.3 (0.8)	1.3 (0.8–2.0)	0.228
Patients understanding of caries progression	4.3 (0.7)	0.9 (0.6–1.5)	0.813
Decreased salivary function	4.2 (0.9)	1.7 (1.1–2.7)	0.035
Presence of several large restorations	4.1 (0.9)	1.2 (0.9–1.8)	0.378
Current diet	4.1 (0.9)	1.4 (0.9–2.2)	0.090
Recent caries	4.1 (0.7)	2.2 (1.4–3.7)	0.002
Dentist's subjective assessment	3.9 (1.0)	0.9 (0.7–1.4)	0.892
Age of patient	3.6 (0.8)	1.2 (0.8–1.7)	0.425
Current use of fluorides	3.5 (1.0)	1.2 (0.9–1.7)	0.215
Socioeconomic status	3.4 (1.0)	1.3 (0.9–1.8)	0.152

*Scored: 1: not at all important; 2: slightly important; 3: moderately important; 4: very important; 5: extremely important.

dentists[14] are female and younger than 50 years of age, indicating that the demographic profile of dentists who participated in this study was similar to Brazilian and Araraquara dentists overall.

In this study, about one third of dentists (36%) reported they perform CRA. These findings are higher than those found among Japanese dentists (26%)[15] and Indian dental practitioners (25%),[16] but are much lower than those found among members of the Texas Academy of Pediatric Dentistry (93%),[17] dentist members of a Scandinavian and US dental PBRN (73%;[18] 69%[19]) and French general dental practitioners (62%).[20] Taking into account the possibility that questionnaire surveys overestimate positive results,[20] it is possible that the actual percentage is even lower.

Several researchers have argued that CRA should be included in contemporary treatment plans to facilitate the decision making process,[21] recall appointments, need for additional diagnostic procedures,[1] and patient education.[22] Additionally, overall contributions of CRA to public health include identifying and targeting persons as high risk for caries, assisting personnel at community health centers and in the definition of priorities, estimating the need for resources to improve oral health and justifying the investment of economic measures for the public health system.[6] Specifically in Brazil, oral health teams of the Family Health Strategy and the National Primary Health Care Policy could use some form of CRA to identify individuals at high caries risk who need additional preventive measures besides water fluoridation and fluoridated dentifrice for preventing and controlling dental caries.

Regarding the use of a special form for CRA, 36% (n = 27) indicated they do so and keep it in the patient chart. Although several CRA tools have been developed,[23,24,25,26,27,28,29,30,31,32] using a special form to perform CRA is also not commonly a part of dental practice among US, Scandinavian and Japanese PBRN dentists,[15,18,19] nor among French general dental practitioners[20] or Indian dental practitioners.[16] The use of a separate CRA form may be a systematic means to help monitor individual patients' risk factors longitudinally, even considering the limited evidence for CRA tools in relation to their effectiveness in caries assessment and prediction.[33]

It seems that there is substantial room for improvement among Brazilian dentists with regard to their use of CRA as a routine procedure in their practices. Although eighty-three percent of them agreed that a dentist's assessment of caries risk for a patient can predict whether that patient develops new caries in the future, most Brazilian dentists do not use CRA. The reasons for not performing CRA were not investigated in this study, but it is possible that they are similar to those reported by French dentists, such as lack of time, problem of billing or reimbursement, insufficient knowledge, and dentist's perception of lack of usefulness.[20] Another aspect that warrants consideration is how much emphasis is placed on caries risk assessment in dental education. Cariology is taught to undergraduate students in public dental schools[34] and caries risk assessment is judged a relevant issue for the Cariology Curriculum, according to 93.6% of the Brazilian dental schools coordinators.[9] On the other hand, a survey with Brazilian public dental schools has demonstrated that in spite of their engagement to teach Cariology, special importance is given to clinical disciplines that disfavor integrated training of dental students.[34] Future studies should address the reasons for not performing CRA among Brazilian dentists as well as the training provided to dental students.

In our study, multiple logistic regression showed the following variables associated with higher use of CRA: years since dental school graduation, advanced academic degree (these two were positively associated), and private practice model (negatively associated). Our finding that dentists with more years since dental school graduation were more likely to perform CRA contrasted with the finding reported by Riley et al.,[18,19] who found that dentists with less years since dental school graduation were more likely to practice caries risk assessment. The authors believed that students leave dental school confident in their abilities to determine caries risk.[18]

In our study, dentists with an advanced academic degree were more likely to perform CRA, a finding similar to that found among French general practitioners in which CRA was more likely among those who had recently participated in a continuing education course and who had read scientific papers

on the topic.[20] Another variable associated with CRA was the practice model. Dentists working exclusively in a private practice model were less likely to perform CRA. This finding is similar to that from Riley et al.,[19] in which dentists practicing in a large group setting (or public health clinics) were more likely to perform CRA. It is possible that the lack of compensation for the procedure would influence the choice for performing CRA. Another possible explanation is that participation in continuing education courses could influence positively the use of CRA for dentists who work in the public sector, since data not presented in this paper showed that most dentists with master's (62%) or doctoral (64%) degrees worked in public service (exclusively or not). For specialization degrees, 50% worked in public service (exclusively or not).

Among factors considered when treatment planning, current oral hygiene and commitment to return for follow-up were the most important risk factors for treatment planning in both pediatric and adult patients, according to participant dentists. Our findings are identical to those found by Kakudate et al.[15] and similar to those from Doméjean et al.[20] and Riley et al.[19] Poor oral hygiene, in addition to frequent ingestion of fermentable carbohydrates and inadequate fluoride exposure, have been considered as the main behaviors causative of dental caries.[35] An unexpected finding was the low level of importance given by current use of fluorides for adult patients. However, this finding is consistent with that found by Kakudate et al.[15] that suggested an 'evidence-practice gap' regarding fluoride use among Japanese dentists. Considering the caries reduction achieved in recent decades because of the rational use of fluoride, mainly with the daily use of fluoride toothpaste,[35] and the effectiveness of water or salt fluoridation in reaching many children,[36] this suggests that participating dentists place less importance on these factors than warranted based on evidence in the literature.

In the pediatric patient model, high ratings for the importance of current oral hygiene and current diet were associated with dentists performing CRA. These factors were also considered the most important ones in a CRA for adult patients, according to French

dentists.[20] In the adult patient model, dentists' high ratings for the importance of decreased salivary flow and recent caries when treatment planning were associated with performing CRA. Because the role of saliva secretion in preventing bacterial flora imbalance and maintaining oral health is crucial[37] and past caries experience has been considered the most important predictor of future caries,[4] we speculate that participating dentists more likely to perform CRA were aware of scientific knowledge regarding caries prediction and the function of saliva in oral health maintenance.

Limitations of this study include: a) the cross-sectional nature of the study design; b) the use of a convenience sample from a Brazilian city that may not reflect practices on risk assessment throughout the country; c) the presumption that the reported preventive measures are actually what the dentists perform in routine practice;[19] d) the lack of questions about the use of electronic charts that may incorporate caries risk assessment systems; e) although certain socioeconomic variables were included in the study, other factors such as educational level were not. Nonetheless, the similarity of demographic characteristics among participant dentists and non-participating dentists,[38] dentists from Araraquara[14] and Brazilian[13] dentists, as well as the feasibility of the questionnaire to compare dental practice patterns globally[38] are the strengths of the study, and can help advance the knowledge base for a specific country, for an assessment of the topic on undergraduate courses, and to increase awareness among dentists seeking continuing education on the topic.

Conclusion

Caries risk assessment was not a routine procedure in daily practice among the majority of participating dentists. The variables years since graduation, advanced degree and practice model were associated with performing CRA. This study suggests that a gap exists between what scientific evidence suggests should be occurring with regard to CRA and what is actually occurring in everyday dental practice among dentists from a Brazilian community.

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