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Dentists' decisions to conduct caries risk assessment in a Dental Practice-Based Research Network

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Abstract

Objectives—1) To quantify the importance that dentists place on caries risk factors when developing a caries treatment plan, and 2) to test the hypothesis that the ratings of importance for specific factors are significantly associated with whether or not the dentist performs caries risk assessment (CRA).

Methods—This study used a cross-sectional study design consisting of a questionnaire survey. The study queried dentists who worked in outpatient dental practices who were affiliated with the Dental Practice-Based Research Network Japan (JDPBRN), which seeks to engage dentists in investigating research questions and sharing experiences and expertise (n=282). Participants (n=189) were asked to rate the importance of caries risk factors when developing a caries treatment plan in both adult and pediatric patients.

Results—Oral hygiene status was rated as the most important risk factor when developing a treatment plan in both adult and pediatric patients, whereas the use of fluorides was rated as the least important. Results of multiple logistic regression analysis showed that the odds ratios for the decision to perform CRA in the adult patient for past caries experience and use of fluorides were 2.61 (95% confidence interval [CI]: 1.29–5.29) and 1.85 (95% CI: 1.12–3.04), respectively,

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whereas that for oral hygiene was 3.84 (95% CI: 1.15–12.79) and use of fluorides 1.79 (95% CI: 1.06–3.03) in the pediatric patient.

Conclusions—These results suggest that enhancing dentists' concept of the importance of current use of fluorides when developing a treatment plan may increase the percentage of dentists who conduct CRA in both adult and pediatric patients (clinicaltrials.gov registration number: NCT01680848).

Keywords

dental caries; risk assessments; dentist's practice pattern; evidence-based dentistry; clinical research; dental practice-based research

INTRODUCTION

Caries risk assessment (CRA) is essential in diagnosing and treating dental caries (1–3) as well as in determining the probability of developing new carious lesions during a specific period and experiencing a change in the size or activity of existing lesions in the mouth (4–6). The 2001 National Institutes of Health Consensus Statement officially recognized the paradigm shift in caries management toward more-conservative treatment of caries (7). As a result, current standards of care recommend that treatment planning for caries include a risk assessment for each patient so that an individualized prevention and treatment program can be developed (8–10). However, while the importance of CRA has been reported, few studies have examined dentists' subjective ratings of the importance of specific caries risk factors or tested the extent to which dentists use this information when treatment planning (11).

The recent establishment of the Dental Practice-Based Research Network Japan (JDPBRN) has facilitated international comparisons in dental practice patterns (12). The JDPBRN is a consortium of dental practices with a broad representation of practice types, treatment philosophies, and patient populations, sharing its mission with DPBRN (13), which subsequently evolved to become the National Dental PBRN (<http://www.nationaldentalpbrn.org>). Our previous collaborative study (12) showed that CRA was conducted by only 26% (N=49) of JDPBRN dentists as a routine part of treatment planning, as opposed to approximately 69% (N=344) of dentists in the US DPBRN (14). This study also revealed that dentists who did not perform CRA would perform surgical restorative treatment in high-risk patients when the caries lesion was still confined to the enamel (12).

A previous study by the Dental Practice-Based Research Network (DPBRN), which included practitioners from both the United States and Scandinavia, noted substantial variation in the dentist's subjective importance of specific caries risk factors (11, 15). These studies reported that current oral hygiene status and decreased salivary flow were rated as the most important risk factors, whereas the age of patient, parents' caries status and socioeconomic status were rated least important. Dentists who fail to consider these “less important” risk factors in treatment planning may therefore miss important information when diagnosing dental caries. However, no previous studies conducted in Japan have examined the impact of differences in dentists' subjective importance of caries risk factors when treatment planning.

In this current paper, we quantified dentists' subjective ratings of the importance of specific caries risk factors when they develop a caries treatment plan in adult and pediatric patients. We also tested the hypothesis that the ratings of importance for specific factors are significantly associated with whether or not the dentist performs CRA.

METHODS

Study Design

We conducted a cross-sectional study consisting of a questionnaire survey in Japan between May 2011 and February 2012. This study was approved by the Ethics Committee of Kyoto University Graduate School and Faculty of Medicine (No. E1157) in accordance with the Declaration of Helsinki. We used the same questionnaire as that used in the DPBRN Study, "Assessment of Caries Diagnosis and Caries Treatment" (14), and the DPBRN Enrollment Questionnaire (16). Four dentists and clinical epidemiologists translated these questionnaires into Japanese (available at [http://www.dentalpbrn.org/uploadeddocs/Study%20\(Japanese%20Version\).pdf](http://www.dentalpbrn.org/uploadeddocs/Study%20(Japanese%20Version).pdf)). Dentists were asked about assessment of caries diagnosis and treatment, dentists' individual characteristics, practice setting, patient population characteristics, and procedure-related characteristics data (12).

The network regions of the JDPBRN represent all seven districts in Japan (Hokkaido, Tohoku, Kanto, Chubu, Kansai, Chugoku-Shikoku, and Kyushu). Each region has a Regional Coordinator who distributed and gathered the questionnaires (13). Dentists were asked to complete the questionnaire by hand and return it to the assigned Regional Coordinator in a pre-addressed envelope. Upon receipt, the Regional Coordinator reviewed the questionnaire for completeness (12, 14, 17).

Participants

This study queried dentists working in outpatient dental practices who have affiliated with JDPBRN to investigate research questions and share experiences and expertise (n=282). Participants were recruited from the JDPBRN website and mailing among those who indicated that they perform some measure of restorative dentistry in their practices. All participants provided informed consent prior to participation in this study.

Assessment of CRA and ratings of importance of caries risk factors for treatment plan

The questionnaire asked network dentists whether or not they assessed caries risk for individual patients in any way. If they responded yes, they were then asked whether or not they record the assessment on a special form kept in the patient chart. Participants were then asked to rank the following risk factors from 1 to 5 (1 [not at all important], 2 [slightly important], 3 [moderately important], 4 [very important], and 5 [extremely important]) in importance in deciding on a treatment plan for both adult (aged > 18 years) and pediatric (aged 6 to 18 years) patients: "patient has one or more active caries lesions", "patient has had caries recently", "patient has several large restorations", "current oral hygiene", "presence of dental appliances", "current use of fluorides by the patient", "current diet of the patient", "decreased salivary function", "your own subjective assessment about the patient", "patient's (or guardian's) understanding of caries progression", "patient's (or guardian's)

commitment to return for follow-up”, “patient’s age”, “patient’s socio-economic status”. For pediatric patients (age 6 to 18 years), “caries status of the parents” was added to the above items.

Statistical Analysis

Descriptive statistics were calculated to relate whether or not the dentist performs CRA as a routine part of treatment planning, to the dentist’s subjective importance of caries risk factors when treatment planning. Multiple logistic regression analysis was conducted to examine the relationship between explanatory variables (dentist’s subjective importance of risk factors: examined as continuous variables) and the main outcome of interest (whether or not the dentist performs CRA). We also adjusted for the following potential risk factors revealed by our previous study (12): gender, years since graduation from dental school, and type of practice. The odds ratios were calculated together with the 95% confidence intervals (CIs). All statistical analyses were performed with IBM SPSS Statistics® software (version 19.0, IBM Corporation, Somers, NY, USA). Statistical significance was set at $p < 0.05$.

RESULTS

Demographic information on participants

Questionnaires were distributed to 282 dentists, and 189 (67%) were ultimately collected. Demographic characteristics of study participants are shown in Table 1 (12). The mean number of years elapsed since graduation from dental school was 18.5 ± 9.9 , and participants were predominantly male ($N=154$, 82%). Race/ethnicity was almost entirely Asian ($N=186$, 99%). With regard to type of practice, 77 (41%) were employed by another dentist. Forty-nine (26%) dentists reported that they assess caries risk for individual patients in some way (12), with 15 (31%) of those using a special form.

Importance of specific caries risk factors when treatment planning

Table 2 shows ratings of importance of caries risk factors when developing a caries treatment plan. In both adult and pediatric patients, “current oral hygiene” and “commitment to return for follow-up” were rated as the most important risk factors. “Dentist’s subjective assessment” and “current use of fluorides” were rated as the least important in the adult patients, whereas “current use of fluorides” and “parents’ caries status” were rated as the least important items in the pediatric patient model.

Influence of dentists’ subjective importance of risk factors on decision to perform CRA

The results of multiple logistic regression analysis are shown in Table 3. In the adult patient model, odds ratios (95% confidence intervals) for “recent caries” and “current use of fluorides” were 2.61 (95% CI: 1.29–5.29) and 1.85 (95% CI: 1.12–3.04). In the pediatric patient model, odds ratios for “current oral hygiene” and “current use of fluorides” were 3.84 (95% CI: 1.15–12.79) and 1.79 (95% CI: 1.06–3.03), respectively.

DISCUSSION

In the present study, current oral hygiene status and commitment to return for follow-up were rated as the most important risk factors for consideration when developing a caries treatment plan, whereas the dentist's subjective assessment and current use of fluorides were rated as the least important for both adult and child patients, with parents' caries status rated as the least important in the pediatric model. The results of multiple logistic regression analysis showed that past caries experience and current use of fluorides were significantly associated with whether or not the dentist performs CRA in the adult patient model, and current oral hygiene and current use of fluorides in the pediatric patient model.

Results of the same scenario survey conducted by US DPBRN (11, 15) showed that current oral hygiene was rated the most important risk factor, whereas socioeconomic status was rated as the least important in both adult and pediatric patients. While both the US DPBRN and this present JDPBRN study identified current oral hygiene status as the most important risk factor for consideration, the least important factor in both adult and child patients clearly differed between the two studies. The scores for "current use of fluorides" assessed by the JDPBRN in both adults and children were lower than in the US DPBRN study. In the adult patient model in particular, there is almost a 1-SD (Standard Deviation) difference in score between JDPBRN (2.6 ± 1.0) and US DPBRN (3.4 ± 0.9) (11), a bigger difference than in the pediatric patient model: JDPBRN; 3.0 ± 1.0 , DPBRN; 3.5 ± 0.9 (11). Because the effectiveness of fluoride use for preventing dental caries has been well established by epidemiological studies (18), an "evidence-practice gap" regarding fluoride use may exist among Japanese dentists. The translation of research findings to routine clinical practice is complex (19, 20), and continuing education to dental clinicians about caries risk factors may therefore be necessary. Alternatively, this discrepancy in findings may be due to the lack of clinical studies conducted in Japanese settings that demonstrate the effectiveness of using in-office fluorides.

In addition, results of multiple logistic regression analysis showed that dentists who rated highly the importance of past caries experience and current use of fluorides in adult patients, and current oral hygiene and current use of fluorides in child patients, tended to perform CRA. As a first step to increase the percentage of dentists who conduct CRA, dentists should recognize the importance of current use of fluorides, as recognition among participants in the present study was associated with a decision to conduct CRA and they also rated this as the least important, in both adult and child patients. Additionally in adult patients, dentists should rate the importance of past caries experience, as this is the caries risk marker with the strongest evidence of correlation to future disease according to the literature (7, 8, 21) and dentists rated as slightly less important in this study.

In the current study, the percentage of dentists who use a special form to perform CRA was relatively low (31%). It may be beneficial to implement such a form in the clinical setting (3, 22–24). However, limited evidence is available that documents the validity for existing CRA forms. Valid, reliable methods for CRA that are based on the best evidence for prediction and disease management, rather than opinions of experts, are strongly needed (25).

The present study featured a relatively diverse population of participants, with respondents hailing from all over Japan. The age and gender distribution of this study sample was similar to the actual distribution in Japan (26), thereby enhancing the generalizability of the findings. However, two limitations to the present study warrant mention. First, participants were not selected by random sampling. Second, given the cross-sectional nature of our study, causative relationships between factors and use of CRA were difficult to assess.

In conclusion, the present findings suggest that enhancing dentists' concept of the importance of current use of fluorides when developing a treatment plan may increase the percentage of dentists who conduct CRA in both adult and pediatric patients. Continuing education of dental clinicians about caries risk factors will be necessary, and an evidence-based form for conducting CRA should be developed and disseminated among dental practices.

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Table 1

Distribution of dentist, practice, patient, and dental procedure characteristics of participants by whether or not they performed CRA. [Kakudate et al., 2012]

	CRA group (n=49)	Non-CRA group (n=140)	Total (n=189)
Dentists' Individual Characteristics			
Years since graduation from dental school* (N=185)	18.6±9.7	18.5±9.9	18.5±9.9
Gender, n (%) (N=187)			
Male	40 (83%)	114 (82%)	154 (82%)
Female	8 (17%)	25 (18%)	33 (18%)
Race/ethnicity, n (%) (N=188)			
Asian			186 (99%)
White			1 (0.5%)
Native Hawaiian or Other Pacific Islander			1 (0.5%)
Patient Population			
Patient age distribution*			
1–18 years (%) (N=183)	18.0±16.9	15.5±11.7	16.1±13.2
19–44 years (%) (N=188)	25.0±14.4	23.9±10.4	24.8±11.0
45–64 years (%) (N=183)	29.2±12.9	30.8±10.5	30.4±11.2
65+ years (%) (N=183)	26.8±18.0	29.1±17.2	28.5±17.4
Dental Procedure Characteristics			
Using special form for caries risk assessment, n (%) (N=49)	15 (31%)	—	—
Percent of patient contact time spent each day doing extractions (%)* (N=177)	8.2±4.6	8.9±6.7	8.8±6.2
Percentage of patients who receive diet counseling (%)* (N=183)	26.9±29.2	19.5±26.3	21.4±27.2
Percent of patient contact time spent each day doing restorative procedures (%)* (N=183)	26.9±15.7	29.4±13.6	28.7±14.2
Practice Setting			
Practice busyness, n (%) (N=181)			
<i>Too busy to treat all people requesting appointments</i>	5 (11%)	14 (10%)	19 (10%)
<i>Provided care to all, but the practice was overburdened</i>	13 (28%)	59 (44%)	72 (40%)
<i>Provided care to all, but the practice was not overburdened</i>	16 (35%)	43 (32%)	59 (33%)
<i>Not busy enough</i>	12 (26%)	19 (14%)	31 (17%)
City population (government-ordinance-designated city), n (%) (N=189)	26 (53%)	50 (36%)	76 (40%)
Type of practice, n (%) (N=182)			
<i>Employed by another dentist</i>	13 (27%)	64 (46%)	77 (41%)
<i>Self-employed without partners and without sharing of income, costs, or office space</i>	31 (63%)	74 (53%)	105 (56%)

CRA: Caries Risk Assessment

* Mean±SD

Table 2

Ratings of importance of caries risk factors for caries treatment planning on adult and pediatric patients, shown in decreasing order importance rating for adult patients

Variable*	Adult patient (Mean±SD)	Pediatric patient (Mean±SD)
Current oral hygiene	4.56±0.65	4.68±0.59
Commitment to return for follow-up	4.20±0.81	4.19±0.82
One or more active caries lesions	4.07±0.85	4.12±0.92
Patient's (guardian's) understanding of caries progression	4.07±0.81	3.98±0.84
Presence of dental appliances	3.76±0.93	3.82±0.94
Decreased salivary function	3.75±1.01	3.38±1.11
Current diet	3.73±0.99	3.80±0.95
Presence of several large restorations	3.66±0.93	3.64±0.89
Recent caries	3.50±0.99	3.52±0.95
Age of patient	3.49±0.96	3.61±0.93
Socioeconomic status	3.49±1.02	3.27±0.98
Dentist's subjective assessment	3.24±1.05	3.08±1.08
Current use of fluorides	2.58±0.99	2.97±1.02
Parents' caries status	—	2.90±1.06

* All of the factors presented are on a scale of 1 to 5.

Table 3

Caries risk factors associated with dentists' use of CRA

Variable*	Adult patient			Pediatric patient		
	OR**	95% CI Lower Upper	p value	OR**	95% CI Lower Upper	p value
Current oral hygiene	1.45	0.58 3.63	0.423	3.84	1.15 12.79	0.028
Commitment to return for follow-up	0.98	0.50 1.95	0.965	1.56	0.79 3.09	0.197
One or more active caries lesions	1.31	0.70 2.47	0.400	1.20	0.64 2.25	0.572
Patient's (guardian's) understanding of caries progression	0.86	0.44 1.67	0.661	0.75	0.40 1.40	0.368
Presence of dental appliances	0.87	0.52 1.45	0.587	1.14	0.67 1.92	0.636
Decreased salivary function	0.90	0.53 1.52	0.685	0.76	0.45 1.29	0.315
Current diet	1.17	0.71 1.91	0.544	1.26	0.73 2.18	0.399
Presence of several large restoration	0.64	0.35 1.16	0.142	0.73	0.40 1.33	0.310
Recent Caries	2.61	1.29 5.29	0.008	1.68	0.91 3.12	0.986
Age of patient	0.78	0.47 1.31	0.349	0.79	0.45 1.38	0.399
Socioeconomic status	0.87	0.54 1.40	0.568	1.04	0.65 1.67	0.870
Dentist's subjective assessment	1.03	0.65 1.61	0.909	1.07	0.69 1.66	0.771
Current use of fluorides	1.85	1.12 3.04	0.016	1.79	1.06 3.03	0.031
Parents' caries status	—	—	—	1.26	0.77 2.05	0.354

C statistic (area under the receiver operating characteristic (ROC) curve) is 0.790 in the adult patient model, and 0.786 in the pediatric patient model. Statistically significant odds ratios are highlighted in bold italic font.

* All of the factors presented are on a scale of 1 to 5 and examined as continuous variables.

** Adjusted for dentist's gender, years since graduation from dental school, and type of practice