Dentists' use of caries risk assessment in children: Findings from the Dental Practice-Based Research Network

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This study surveyed Dental Practice-Based Research Network (DPBRN) member dentists (from four regions in the U.S. and Scandinavia) who perform restorative dentistry in their practices. The survey asked a range of questions about caries risk assessment in patients aged 6–18. Among respondents, 73% of dentists reported performing caries risk assessment among these patients, while 14% assessed caries risk by using a special form. Regions in which most dentists were in a private practice model were the least likely to perform caries risk assessment, while regions where most dentists practiced in a large group practice model were the most likely to use a special form for caries risk assessment. Recent graduates from dental school were more likely to use a caries risk assessment compared to older graduates. Current oral hygiene, decreased salivary flow, and the presence of active caries were rated as the most important caries factors. Some differences by region were also evident for the risk factor ratings.

These results suggest that not all community dentists assess caries risk. The results of this study also indicate considerable variability in dentists' views concerning the importance of specific caries risk factors in treatment planning and weak evidence that caries risk assessment is driving clinical practice when preventive treatment recommendations are being considered.

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Any pediatric caries preventive program must be able to assess a child's risk of developing the disease.[1] Risk factors for childhood dental caries include a variety of environmental and behavioral factors that can apply to any age group. The presence of active caries lesions has been identified as a risk for future lesions.[2] Some studies investigating toothbrushing and/or oral hygiene have found a strong, consistent relationship between toothbrushing/oral hygiene and the incidence and prevalence of caries.[3-5] Sugar consumption is an indicator of caries risk, particularly among those who do not have regular exposure to fluoride; socioeconomic status and education are also related to caries risk.[3-9] The clinician's subjective assessment also has been supported as valid when assessing caries risk; however, the authors have seen no studies concerning a subjective ranking of these risk factors in terms of importance.[10] It is also unclear how and if dentists systematically incorporate this information into their treatment decisions.[11]

The American Academy of Pediatric Dentistry (AAPD) has indicated that caries risk assessment is an essential part of clinical care.[12] By 1998, virtually all dental schools in the U.S. and Canada included lecture and clinical content on caries risk assessment and management.[13] The discrepancy between what is taught in dental schools and what actually occurs in daily clinical practice with pediatric patients is poorly understood.

This descriptive study sought to characterize dental practice patterns related to caries risk and risk assessment of pediatric dental patients. The authors have quantified the use of risk assessment in pediatric patients from a large multi-region sample of dental practices, tested the hypothesis that use differs significantly by geographic region and other practice characteristics, identified the caries risk factors considered most important by clinical dentists, and tested for an association between the use of individualized caries risk assessment and dentist's ratings of importance of specific risk factors.

Materials and methods

The DPBRN is a consortium of participating practices and dental organizations committed to advancing knowledge of and ways to improve dental practice. The DPBRN is composed of five regions: Alabama/Mississippi (AL/MS); Florida/Georgia (FL/GA); dentists employed by HealthPartners and private

Table 1. Ratings of importance of caries risk factors for treatment plan.

Risk factor	Mean rating of importance (SD)
Current oral hygiene	4.6 (0.5)
Decreased salivary function	4.3 (0.9)
One or more active caries lesions	4.2 (0.8)
Commitment to return for follow-up	4.2 (0.8)
Current diet	4.0 (0.9)
Recent caries	4.0 (0.8)
Presence of dental appliances	3.9 (0.8)
Dentist's subjective assessment	3.9 (0.8)
Patients' (guardians') understanding of caries progression	3.8 (0.8)
Presence of several large restorations	3.6 (0.8)
Age of patient	3.5 (0.9)
Current use of fluorides	3.5 (0.9)
Parents' caries status	3.2 (1.1)
Socioeconomic status	2.6 (1.0)

Table 2. Distribution of participating DPBRN dentists by region.

Region	Number of dentists
AL/MS	298
FL/GA	100
MN	30
PDA	51
SK	30

practitioners in Minnesota (MN); Permanente Dental Associates in cooperation with Kaiser Permanente Center for Health Research (PDA); and dentists in Denmark, Norway, and Sweden (SK).[14] DPBRN participants were recruited through a mass mailing sent to licensed dentists in the participating regions. As part of enrollment in the DPBRN, all practitioner-investigators complete an enrollment questionnaire about their practice characteristics and themselves. The enrollment questionnaire and other details about the DPBRN are provided at www.DentalPBRN.org. Previous studies have demonstrated that DPBRN dentists have much in common with dentists at large.[15]

A survey about practice patterns was sent to the 932 DPBRN member dentists who perform restorative dentistry in their practices. The study was approved by the respective Institutional Review Boards (IRBs) of all participating regions. Participants who were not exempt from IRBs signed the appropriate informed consent form. The 534 participating DBPRN dentists who returned the survey represent an overall return rate of 57%. There were no participation differences by gender, area of specialty, or years since dental school graduation.

Practice of caries risk assessment

Dentists were asked whether they assess caries risk in any way. A follow-up question asked those who did assess caries risk if they use a special form that becomes part of the patient's chart. A caries risk assessment index was created as follows: Risk not assessed = 0, risk is assessed but not using a special form = 1, risk is assessed with a special form = 2.

Caries risk factors

The dentists were asked a series of questions about caries risk factors (see Table 1): Full-time/part-time status was determined by asking dentists if they worked 32 hours or more per week (full-time) or less than 32 hours per week (part-time). The number of years in dental practice was calculated by subtracting the year of dental school graduation from the year of participation.

Regional differences in the caries risk assessment index and ratings of importance of caries risk factors were tested using the Mann-Whitney U test. To interpret regional differences, pair-wise comparisons were performed using a Bonferroni correction ($p = 0.005$). Other associations involving nominal and ordinal data were tested using the Pearson chi-square and gamma statistics, respectively. Because of the large number of bivariate associations performed, the $p = 0.005$ criteria was used for these analyses as well.

Results

Of the 534 practitioners who returned the survey, 509 (419 male, 90 female) acknowledged treating patients 6–18 years of age in their practices; 93% ($n = 472$) of respondents were general practitioners, 5% ($n = 27$) were pediatric dentists, and the remaining 2% ($n = 8$) were "other."

Table 2 lists the participating dentists as distributed by region. Two of the 30 dentists in the MN region were in private practice and not employed by HealthPartners. Two dentists in each of the AL/MS

Table 3. Dentists' practice of caries risk assessment by region. The sample size for this table is 479, as 30 of the dentists surveyed did not complete both questions.

Region	Caries risk not assessed (%)	Caries risk assessed, no form (%)	Caries risk assessed with a special form (%)
AL/MS	98 (34)	190 (66)	1 (<1)
FL/GA	31 (35)	56 (64)	1 (<1)
MN	1 (4)	7 (30)	15 (65)
PDA	1 (2)	5 (12)	44 (86)
SK	2 (7)	23 (79)	4 (14)
Total	133 (27)	281 (59)	65 (14)

Table 4. The six highest-rated caries risk factors by region (%).

Region	Current oral hygiene	Decreased salivary flow	One or more active caries	Commitment to return	Current diet	Recent caries
AL/MS	99	87	77	85	70	71
FL/GA	96	80	77	78	70	71
MN	84	77	100	80	79	90
PDA	84	78	94	77	75	86
SK	93	96	93	89	96	69

(n = 298) and FL/GA (n = 100) regions work in public health clinics; the others were private practitioners. The SK region consisted of 15 public health dentists and 15 private practitioners.

Overall, 73% of network dentists acknowledged performing a caries risk assessment; 59% did not use a form to assess caries risk, while the other 14% did use a form. Table 3 lists caries risk assessment practices for the entire DPBRN by region. Dentists in the PDA and MN regions were significantly more likely to use a caries risk assessment form than dentists in the SK, AL/MS and FL/GA regions, while dentists in the SK region were more likely to practice caries risk assessment than those in the AL/MS and FL/GA regions.

There was a significant association between caries risk assessment variable and number of years in dental practice, in that the dentists who graduated most recently from dental school scored highest on the caries risk assessment variable. Gender, specialty, or full-/part-time variables were not associated with the practice of caries risk assessment.

Using a five-point scale (with 1 meaning "not at all important" and 5 meaning "extremely important"), dentists were asked to rate the importance of various caries risk factors when creating a treatment plan (see Table 2). Current oral hygiene, decreased salivary flow, and the presence of active caries were rated as the most important factors, while parents' caries status and family socioeconomic status were rated as the least important.

Regional differences were found for only four of the risk factors. Table 4 lists the percentage of dentists who rated these risk factors as very important or extremely important. *One or more active caries* was rated as more important by a larger percentage of dentists from the PDA and MN regions than by dentists from the AL/MS and FL/GA regions. The presence of several large restorations was rated as more important by a larger percentage of FL/GA and AL/MS dentists than by those from the SK region. *Current oral hygiene* was rated as more important by a larger percentage of dentists from the AL/MS and FL/GA regions compared with dentists from the PDA and MN regions. *The current use of fluoride* was rated as more important by PDA region dentists than dentists from the AL/MS, FL/GA, and MN regions.

Having one or more recent caries lesions and diet were rated as more important risk factors by a larger percentage of female dentists compared to male dentists. Dentists with more years of practice experience (that is, a greater number of years since graduation) gave higher ratings of importance for active caries and lower ratings of importance for socioeconomic status. No other practice characteristics were significantly associated with ratings of importance.

Four of the factors demonstrated a significant association with the caries risk assessment index. Dentists who used a risk assessment form considered *active caries* and *current use of fluoride* to be a more important risk factor than dentists who assessed risk without using a form or did not assess risk factors. Conversely, dentists who assessed risk without using a special form

or did not assess risk factors at all considered *current oral hygiene* to be more important, compared to dentists who used a special form to assess risk. *Current diet* was rated as very/extremely important by a larger percentage of dentists who assessed risk using a special form compared to dentists who assess risk without a form or do not assess risk factors.

Discussion

Overall, 73% of dentists reported practicing risk assessment for individual pediatric patients, although the survey did not ask whether all children within an office received such an assessment. The dentists in the PDA and MN regions were most likely to practice individual risk assessment; in fact, 98% of PDA practices reported performing caries risk assessments. A recent postal survey study of Texas pediatric dentists found that 36% of the 204 practices surveyed provided caries risk assessments for more than 76% of their patients and only 9% of dentists did not assess caries risk; however, this study did not find an association between the use of caries risk assessment and years in practice.[16]

The two regions that constitute large group practice models (PDA and MN) demonstrated dramatically higher use of formal caries risk assessment forms. Such forms could reflect practice policy that takes advantage of resources available to large organizations, but use of such forms also indicates good clinical practice. Several authors have designed caries risk assessment forms and suggested practical procedures to assist both dental and non-dental health care providers with these evaluations.[17] Trueblood *et al* found that 39% of Texas pediatric dentists who responded to the survey used both verbal and written caries risk assessments.[16] The present study found that more recent dental school graduates were more likely to perform caries risk assessments, which may suggest a trend for an increase in the use of caries risk assessment.

Caries risk assessment is considered a necessary component in the clinical decision-making process and the standard of care.[18] From a legal perspective, it is important for dentists to document a patient's risk status and show evidence of patient education about risk factors and preventive recommendations. To be effective, risk assessment must be accompanied by appropriate intervention, prevention and/or surgical treatment, and patient education. Trueblood *et al* provided evidence that the families of pediatric patients are receptive to caries-related education and that parental interest was not associated with socioeconomic status.[16]

Caries risk factors are variables that either cause the disease directly (for example, microflora) or have been shown to be useful in predicting it (for example, socioeconomic status). Knowledge of these risk factors should guide clinical management of caries by helping to identify subjects who require caries prevention, guide treatment planning decisions, and determine the timing of recall appointments.[12] DPBRN dentists rated current oral hygiene, decreased salivary flow, the presence of active caries, the patient's commitment to return for follow-up, and diet as the most important factors to consider when creating a treatment plan. There were few significant associations between the risk factors' importance and practice characteristics.

By contrast, when Trueblood *et al* asked dentists what they considered to be the most important caries risk factors, diet was considered most important (88%), followed by a history of caries (82%) and socioeconomic status (46%); 5% or fewer respondents considered salivary flow, oral hygiene, and parental attitudes to be important.[16] A systematic review of the literature concerning caries risk in primary and permanent teeth concluded that previous caries experience was the best predictor.[18] Studies using multivariate models have shown a number of factors that might predict future caries activity, including active caries, caries history, diet, oral bacteria counts, salivary markers, and fluoridation history.[19-23]

There were regional differences in the present study when the relative importance of several caries risk factors were assessed, which could reflect differences in patient populations or could relate to practice philosophy or clinical training. The use of caries risk assessment was associated with higher ratings for some of the more important risk factors, which suggests that dentists who perform risk assessment would consider these risk factors when treatment planning.

The AAPD and others have indicated that caries risk assessment should be part of clinical care and should guide individualized caries prevention.[1,12] The results of this study indicate that a number of dentists are not systematically documenting caries risk. These data also suggest that practicing dentists are not in agreement when rating the importance of certain caries risk factors.

Conclusion

Of the DPBRN network dentists surveyed, 73% reported performing some kind of caries risk assessment. Regions whose dentists participated in a private practice model were the least likely to perform caries risk assessment. More recent graduates from dental school were more likely

to use caries risk assessment in their practices than older dentists. Among all dentists surveyed, current oral hygiene, decreased salivary flow, and the presence of active caries were rated as the most important caries factors.

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Disclaimer

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References

1. Rozier RG. Effectiveness of methods used by dental professionals for the primary prevention of dental caries. J Dent Educ 2001;65(10):1063-1072.
2. Anusavice KJ. Present and future approaches for the control of caries. J Dent Educ 2005;69(5):538-554.
3. Reisine ST, Psoter W. Socioeconomic status and selected behavioral determinants as risk factors for dental caries. J Dent Educ 2001;65(10):1009-1016.
4. Tagliaferro EP, Pereira AC, Meneghim Mde C, Ambrosano GM. Assessment of dental caries predictors in a seven-year longitudinal study. J Public Health Dent 2006;66(3):169-173.
5. David J, Wang NJ, Astrom AN, Kuriakose S. Dental caries and associated factors in 12-year-old schoolchildren in Thiruvananthapuram, Kerala, India. Int J Paediatr Dent 2005;15(6):420-428.
6. Burt BA, Pai S. Sugar consumption and caries risk: A systematic review. J Dent Educ 2001;65(10):1017-1023.
7. Cook SL, Martinez-Mier EA, Dean JA, Weddell JA, Sanders BJ, Eggertsson H, Ofner S, Yoder K. Dental caries experience and association to risk indicators of remote rural populations. Int J Paediatr Dent 2008;18(4):275-283.
8. Bratthall D, Hansel Petersson G. Cariogram—A multifactorial risk assessment model for a multifactorial disease. Community Dent Oral Epidemiol 2005;33(4):256-264.
9. Pereira SM, Tagliaferro EP, Ambrosano GM, Cortelazzi KL, Meneghim Mde C, Pereira AC. Dental caries in 12-year-old schoolchildren and its relationship with socioeconomic and behavioural variables. Oral Health Prev Dent 2007;5(4):299-306.
10. Bader JD, Perrin NA, Maupome G, Rindal B, Rush WA. Validation of a simple approach to caries risk assessment. J Public Health Dent 2005;65(2):76-81.
11. Bader JD, Shugars DA. What do we know about how dentists make caries-related treatment decisions? Community Dent Oral Epidemiol 1997;25(1):97-103.
12. American Academy of Pediatric Dentistry Clinical Affairs Committee; American Academy of Pediatric Dentistry Council on Clinical Affairs. Guideline on periodicity of examination, preventive dental services, anticipatory guidance, and oral treatment for children. Pediatr Dent 2005;27(7 Suppl):84-86.
13. Yorty J, Brown B. Caries risk assessment/treatment programs in U.S. dental schools. J Dent Educ 1999;63(10):745-747.
14. Gilbert GH, Williams OD, Rindal DB, Pihlstrom DJ, Benjamin PL, Wallace MC; DPBRN Collaborative Group. The creation and development of The Dental Practice-Based Research Network. J Am Dent Assoc 2008;139(1):74-81.
15. Makhija SK, Gilbert GH, Rindal DB, Benjamin PL, Richman JS, Pihlstrom DJ, Qvist V, for the DPBRN Collaborative Group. Dentists in practice-based research networks have much in common with dentists at large: Evidence from the Dental PBRN. Gen Dent 2009;57(3):270-275.
16. Trueblood R, Kerins CA, Seale NS. Caries risk assessment practices among Texas pediatric dentists. Pediatr Dent 2008;30(1):49-53.
17. Featherstone JD, Domejean-Orliaguet S, Jenson L, Wolff M, Young DA. Caries risk assessment in practice for age 6 through adult. J Calif Dent Assoc 2007;35(10):703-713.
18. Zero D, Fontana M, Lennon AM. Clinical applications and outcomes of using indicators of risk in caries management. J Dent Educ 2001;65(10):1126-1132.
19. Zukanovic A, Kobaslija S, Ganibegovic M. Caries risk assessment in Bosnian children using Cariogram computer model. Int Dent J 2007;57(3):177-183.
20. Stenlund H, Mejare I, Kallestal C. Caries rates related to approximal caries at ages 11-13: A 10-year follow-up study in Sweden. J Dent Res 2002;81(7):455-458.
21. Skeie MS, Raadal M, Strand GV, Espelid I. The relationship between caries in the primary dentition at 5 years of age and permanent dentition at 10 years of age—A longitudinal study. Int J Paediatr Dent 2006;16(3):152-160.
22. Burt BA. Prevention policies in the light of the changed distribution of dental caries. Acta Odontol Scand 1998;56(3):179-186.
23. David J, Raadal M, Wang NJ, Strand GV. Caries increment and prediction from 12 to 18 years of age: A follow-up study. Eur Arch Paediatr Dent 2006;7(1):31-37.