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Examining the association between parenting stress and the development of early childhood caries

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Abstract – *Objectives:* Numerous studies have explored the effects of pediatric health on parenting stress, but very little work has been carried out to explore the opposite and equally as compelling relationship of how parenting stress might affect child health, especially as it relates to oral health. This study examined the association between parenting stress and early childhood caries (ECC) in 97, 4- to 5-year-old Australian children attending preschools in the North Brisbane Health Region, Australia. *Methods:* Using a cross-sectional study design, clinical examinations were conducted to evaluate the caries status of each child. Two caregiver questionnaires were completed – one soliciting demographic and oral health behavior information, and the other, information on parenting stress. *Results:* This study demonstrated a significant bivariate association between parenting stress and ECC experience as measured by dmft; however, the association did not persist in the two-part forward-selection logistic and linear regression models. A negative association between social desirability (defensive responding) and extent of caries was also determined. *Conclusions:* Our findings suggest the need to conduct longitudinal studies to give proper consideration to the temporal aspect of caries development and clarify the results obtained by on the relationship between parenting stress and oral health. Further study is also warranted to more clearly elucidate the association between social desirability (defensive responding) in parents and their children's ECC experience.

Key words: early childhood caries; parenting stress; social desirability

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Stress has emerged in recent years as a variable of considerable interest in the study of disease (1, 2), with an expanding body of evidence examining stress in the context of the parent–child dyad. Numerous studies have confirmed that a child's health can affect parenting stress (3–5), but very little work has been carried out to explore the opposite and equally compelling relationship of how parenting stress might affect child health, especially oral health.

In an early effort to examine this relationship, LaValle and colleagues (6) studied parenting stress in relation to pediatric oral health in 5- to 12-year-olds. Their 90 subjects included mainly young, uneducated mothers of low socioeconomic status (SES). Using Abidin's Parenting Stress Index (7) (PSI) to quantify the stress factors within the parent–child relationship, they compared different aspects of parenting stress to a caries index derived from their children's dental records. This study showed that the Child Domain of PSI, assessing child characteristics that influence parenting stress, and lower levels of caregiver age and education, were predictive of poorer child oral health. They concluded there was a need for further research to

obtain information among a more generalized population.

In another effort, Quinonez et al. (8) used the Parenting Stress Index – Short Form (9) (PSI/SF) to examine the association between parenting stress, parent–child dysfunction, and early childhood caries (ECC) in 18- to 36-month-old children. This study enrolled 150 subjects – mainly minorities of low SES – and collected psychosocial data (parenting stress), behavioral data (oral health behavior), biological data (S. mutans counts in saliva samples and fluoride levels in nail clippings), and clinical data (dmft/dmfs). In the bivariate analysis, Total parenting stress was significantly correlated to the presence of caries and the number of carious teeth, but the data proved inconclusive when controlling for factors such as child relation to caregiver, oral hygiene duration, ethnicity, bacterial counts, enamel defects, and night feeding.

Understanding the role of psychosocial variables in relation to caries development in children remains an important agenda item in dental research, particularly because it can help define the populations at greatest risk and identify specific indications of vulnerability to developing disease. This study continues to examine the potential relationship between parenting stress and pediatric oral health when a child is still dependent upon the caregiver to provide, teach, and monitor appropriate preventive oral health behaviors. We hypothesized that parents who are subject to higher stresses within the parent–child relationship are less likely to be able to provide these caregiver functions than parents who are experiencing lower levels of stress. We considered ECC as a main outcome variable and parenting stress as the main effect variable.

Methods

The data for this study was collected as part of a larger, biannual, cross-sectional survey conducted by the Children's Oral Health Service that examined 2515, 4- to 6-year-old children attending state-operated preschools in the North Brisbane Health region of Queensland, Australia (10). This ongoing investigation explored the potential association of ECC with selected social and demographic variables such as gender, age, socio-economic status (SES), child ethnicity, and language spoken at home. The study protocol was prepared and approved by the Research Ethics Committee of the Royal Children's Hospital and the Performance Measurement Office, Education Queensland, as well as the Institutional Review Board of the University of North Carolina at Chapel Hill.

Selection criteria

The survey methodology (administered by KH, Children's Oral Health Service, Royal Children's Hospital) involved sampling of preschool children whose parents had consented previously to oral examination and completed a legible questionnaire. Our study involved a convenience sample of 97 caregivers from the larger pool of 2515 subjects who had been telephoned in advance and had indicated a willingness to further participate in our study. Participation was limited to caregivers of children 71 months of age and younger.

Measures

Parenting Stress Index – Short Form

The PSI/SF (Table 1) was created to address 'the need for a valid measure of stress in the parent–child system that could be administered in <10 min' (11). Castaldi's factor-analysis research on the full-length, 120-item PSI (12) led to the development of a three-factor model for measuring parenting stress that included the parent, the child, and their interactions. Thus, the PSI/SF, consisting of 36 items answered on a five-point Likert scale, gener-

Table 1. Sample questions: Parenting Stress Index – Short Form*

Parental distress**						
1	As having a child, I feel that I am almost never able to do things that I like to do	SA	A	NS	D	SD
Parent–child dysfunctional interaction						
2	I expected to have closer and warmer feelings for my child than I do and this bothers me	SA	A	NS	D	SD
Difficult child						
3	My child reacts very strongly when something happens that my child does not like	SA	A	NS	D	SD

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**Select questions from parental distress are summed to calculate the defensive responding score.

SA-strongly agree; A-agree; NS-not sure; D-disagree; SD-strongly disagree.

ates a score evaluating total stress based contributions from parental distress, parent–child dysfunctional interaction, and difficult child subscores. Coefficient alpha for the total stress score has been calculated at 0.91, indicating a high degree of internal consistency for this measure. Test-retest reliability for the total stress has been calculated at 0.84 over a 6-month interval. The PSI/SF also includes a separate, continuous measure of defensive responding derived from the widely accepted Crowne–Marlowe Social Desirability Scale (13) (CMSDS). No independent validity research has been conducted on the PSI/SF, but it exhibits a high degree of correlation to the PSI (14), which has been well validated in many research and clinical activities among many cultures around the world (15).

Early childhood caries

This study follows the recommendation proposed in a 1998 workshop sponsored by the National Institute of Dental and Craniofacial Research, the Health Resources and Services Administration, and the Health Care Financing Administration, in which participants 'defined the term ''early childhood caries'' to indicate the presence of one or more decayed (noncavitated or cavitated lesions), missing (because of caries), or filled tooth surfaces in any primary tooth' (16).

The presence of decay was assessed by an examiner who systematically evaluated each child's caries experience using the dmft index as described from the World Health Organization (17). Only one examiner (KH) examined participating children in our study. Only definite cavitations of tooth surfaces were recorded as dental caries. Missing mandibular anterior primary teeth were not used in the calculation of dmft because of the possibility of loss from physiological exfoliation, although their absence was noted on the examination form. Other missing primary teeth were considered to have had extensive dental caries and were recorded as five carious surfaces. All clinical data were recorded on the examination form by a trained dental assistant.

Questionnaire

Demographic information and oral health knowledge, behaviors, and attitudes were solicited by means of a self-administered 36-item questionnaire completed in by a primary caregiver. Questionnaires were sent to caregivers in advance of a designated date. On that date, the questionnaire was returned to the investigators and the child's oral examination subsequently conducted according to the procedures outlined below.

Procedures

Each child's caries experience was systematically evaluated by an examiner from the 12 o'clock position with the child seated on a conventional school chair within their preschool setting on a nominated day during the survey time frame. Clinical examinations were conducted according to British Association for the Study of Community Dentistry standardized criteria (18), using a disposable illuminated mouth mirror (Denlite, Welch Allyn, Ltd., Navan, Co., Meath, Ireland) and a blunt ball-ended probe with 0.5 mm diameter (Diagnostic Probe, Hu-Freidy Dental, Chicago, IL, USA) No tooth drying measures were used. The probe was used to remove oral debris and to assist in identification of sealants in occlusal fissures. Necessary infection control steps, including the use of disposable examination gloves and plastic sleeves, were taken to prevent cross-contamination between children (19). Caregivers were concurrently interviewed on the premises using the PSI/SF instrument by an examiner (RQ) blinded to the data from the clinical exam and questionnaire. Following the interview and child examination, caregivers were informed of any dental needs.

Statistical analysis

All statistical analyses were conducted using SAS 8.02 with our primary outcome of interest being ECC experience. Our analysis strategy treated the parent–child dyad as the unit of analysis and included sociodemographic control variables such as gender, age, race, and education.

The nonparametric Cochran–Mantel–Haenszel correlation statistic (20) was used to determine bivariate associations between independent variables selected *a priori* based on availability and conceptual rationale. These variables included parent oral health beliefs, parenting stress, defensive responding, parent age, child eating and drinking habits, income, and oral health behaviors.

Traditionally, studies have looked at caries in a dichotomous fashion. However, Lewsey et al. (21) have demonstrated greater accuracy when using a two-step model separately that considers the presence of caries (dichotomous model) and the extent of caries, if present (linear model). On this basis, we used a two-part model to estimate the probability of a child's having ECC as well as the extent of ECC. The first part of our two-part model was a

forward selection logistic regression model that identified the significant variables predicting the presence of caries. The second part relied upon ordinary least squares to predict the extent of caries conditional upon having had any caries. In this second step, we used a forward selection linear regression model to identify the significant variables associated with the extent of caries. Using the forward selection method of analysis, all variables ultimately determined to be nonsignificant were discarded except Total Parenting Stress, which was forced in as the main variable of interest.

Based on Cohen's research (22) on power and effect sizes, we determined *a priori* that a sample size of 91 subjects would be sufficient to detect a medium-sized difference – conventionally defined as 'an effect likely to be visible to the naked eye of a careful observer' – at power = 0.80 for $\alpha = 0.05$ using five variables in the regression model.

Results

Sample description

Ninety-seven children were enrolled in the study. Table 2 summarizes the salient characteristics of these children and their caregivers.

Parenting stress

Total parenting stress was normally distributed (mean = 77.54, SD ±18.38, minimum = 25, maximum = 130). Defensive responding, a separate measure of a respondent's tendency to self-report positively biased information because of his or her perception of what is socially desirable, ranged from 8 to 28 (mean = 15.8, SD ±4.3) with a distribution strongly skewed towards high scorers. As the defensive responding scale is inversely related to defensiveness, higher scores are indicative of lower defensiveness.

Caries

Thirty-six percent of the subjects ($n = 35$) had one or more carious lesions. The distributions of dmft in these subjects were normally distributed around a mean of 3.5. Higher levels of carious activity were found to be strongly associated with lower income levels ($P < 0.01$), Total parenting stress ($P < 0.05$) and defensive responding ($P < 0.01$).

Modeling analysis

Nine of the 97 subjects were not included in the logistic regression for the dichotomous caries outcomes model because of missing data. Only lower family income ($P < 0.05$) was found to be a significant predictor of the presence of ECC. In the

Table 2. Child and caregiver characteristics ($n = 97$)

Variable	Percent or mean ± SD	Range
Child		
Age (months)	59.6 ± 3.91	44–69
Sex		
Male	51.6	
Female	48.4	
Race		
Caucasian	92.4	
Other	7.6	
Caries		
dmft	1.37 ± 2.70	0–16
Caregiver		
Age (year)	31.7 ± 5.50	
Relationship to child		
Mother	97.9	
Father	2.1	
Education		
Less than high school	63.2	
Vocational/ technical school	24.2	
University	11.6	
Do not know	1.0	
Family income (AUD)		
<$20 000/a*	27.3	
$20 000–$35 000/a	34.1	
$35 000–$50 000/a	23.8	
>$50 000/a	14.8	
Parenting stress		
Total stress	77.4 ± 18.3	25–130
Parent distress	26.6 ± 6.4	13–45
Parent–child dysfunctional interaction	22.3 ± 7.0	0–41
Difficult child	28.5 ± 7.8	0–46
Defensive responding	15.8 ± 4.3	8–28

*Australian Bureau of Statistics defines poverty level as <$20 000 annual income.

Table 3. Regression analyses for variables selected using the forward selection model

Parameter	Estimate	SE	$P > \chi^2$
Model 1: presence of caries			
Intercept	1.3482	1.857	0.4678
Total parenting stress	0.00814	0.0146	0.5761
Family income	−0.6442	0.2632	0.0144
Parameter	**Estimate**	**SE**	$P > \lvert t \rvert$
Model 2*: extent of caries			
Intercept	−1.8102	2.022	0.377
Total parenting stress	−0.0002	0.033	0.994
Defensive responding	0.3367	0.142	0.024

*$R^2 = 0.2527$.

linear regression analysis of caries severity, we determined that of 35 subjects with carious lesions, only defensive responding was a significant factor ($P < 0.05$), with an estimated increase in one carious lesion for every increase of three points (i.e. decrease in defensiveness) on the defensive responding scale. In both the dichotomous and linear models, no association was found between ECC and total parenting stress (Table 3).

Discussion

Like other studies (23), our study found a significant inverse correlation between the presence of dental caries in children and family income level. Hallett (24) noted the strong potential for income to confound measurements of the dental caries experience in all age groups, citing Chen's (25) explanation that low income and low education masks other variables, both at an individual and a community level.

The importance of family stress as a risk-factor or mediator in the natural history of a children's disease like ECC, seems intuitive, and has been reported by other pediatric oral health researchers (26). On the bivariate level, our study confirms the findings of previous studies suggesting that parenting stress plays a definite role in that process. However, the modeling analysis seems to indicate parenting stress has little true effect on ECC occurrence or severity. If, indeed, an association exists, as we first hypothesized, perhaps its contribution was overwhelmed by the much stronger effect of classic social and behavioral determinants such as childhood nutrition (27), ethnicity, and SES (24).

The temporal aspect of caries development was not well addressed in this study, a failing due in part to the contemporary nature of the PSI/SF, but also in part because of intrinsic paradox of trying to draw temporal conclusions – determinants for disease occurrence – using a cross-sectional methodology. While the data analysis strategies employed assessed potential relationships between effect and outcome variables, the psychosocial variables and behavioral practices present at the time of onset of a child's caries may have differed markedly from what was measured at the point of study of the population sample. Unfortunately, this limitation probably hinders the discovery of many important variables that are never further explored via more appropriate, albeit expensive, longitudinal study designs.

Further limitations of this study include the small convenience sample of parent–child dyads and, despite its general acceptance worldwide (17), the inherent limitations of the dmft index used to measure ECC status. Also, as few oral health studies have explored the potential association between parenting stress and ECC, there is no research confirming the use of the PSI/SF instrument as the most appropriate and relevant tool for determining if such an association exists. All these shortcomings introduce potential sources of error that limit the generalizability of our study's findings. Finally, the lack of standardized diagnostic criteria for reporting ECC in the literature makes it difficult to compare our study results to others using ECC as the main outcome of interest.

Limitations notwithstanding, a rather striking correlation we encountered was between Defensive Responding and caries rates. In our linear regression model, we found there was an inverse, linear relationship between parent defensiveness and child caries severity (i.e. the more defensive the parent, the lower the child's dmft score). According to Abidin, extremely low scores on the defensive responding scale (i.e. highly defensive respondents) suggest a parent is either strongly biased towards presenting him/herself in the best possible light, is not an engaged parent, or is a particularly competent parent, but the results do not indicate which of these possibilities is most likely (28).

The measure of defensive responding in the PSI/SF addresses the potential for inaccuracies in data collected using self-inventory instruments because of the perceived pressure subjects may feel to answer in a manner conforming to societal norms. As mentioned previously, the measure of defensive responding is derived from the CMSDS, a well-accepted measure of social desirability, and thus could be considered an indicator of a parent's motivation to appear socially acceptable – a quantification of his or her need for approval.

Parents who are overly conscious of how others view them and their children may be more motivated to engage in preventive health behaviors (PHB), especially behaviors with highly visible results, like good oral hygiene. Assuming that good oral hygiene behaviors lead to less disease, then, theoretically, both parents and children in such families would be less likely to experience caries.

This proposed mechanism for the protective correlation between social desirability and the presence/extent of caries is indirectly supported in a public health study published in 1984 by Kristiansen and Harding, who included specific measures related to oral health in their exploration of the relationship between social desirability and PHB. Their study concluded 'social conformity and cautiousness may well be associated with PHB, and attitudes toward dull tasks may be, as well, if one assumes that good PHB is relatively less exciting than poor PHB' (29).

Although the results of our study showed a significant correlation between social desirability and the presence/extent of caries, further exploration of this topic would more appropriately use the CMSDS itself, or another instrument dedicated to measuring social desirability, and would also include measures of the presence/extent of caries in parents as well as their children.

Along with our appreciation for other risk factors such as low SES, a better understanding of the protective effect of social desirability could allow us to more specifically and effectively identify populations at risk. Such a multi-layered method of risk assessment would ultimately lead to a better-informed allocation of public health dollars for targeting and assisting populations in need.

Conclusion

In a sample of 97 parent–child dyads, we found a statistical association between parenting stress and caries rates of children between the ages of four and five on the bivariate level, but this association did not persist in the two-part modeling analysis: neither in the measurement of caries presence, nor in its extent. We did, however, observe a significant inverse correlation between the level of a parent's defensiveness and the contemporary measurement of the child's carious activity.

These findings suggest the need to conduct longitudinal studies to give proper consideration to the temporal aspect of caries development and to deepen our understanding of the results obtained by existing cross-sectional studies relating parenting stress to oral health. Further study is also warranted to more clearly elucidate the association between social desirability (defensive responding) in parents and their children's caries rates.

References

1. Cohen S, Kessler R, Underwood GL, (editors). Measuring stress: a guide for health and social scientists. New York: Oxford University Press; 1995.
2. Lemyre L, Tessier R. Measuring psychological stress. Concept, model, and measurement instrument in primary care research. Can Fam Physician 2003;49:1159–60, 1166–8.
3. Frank SJ, Olmsted CL, Wagner AE, Laub CC, Freeark K, Breitzer GM, et al. Child illness, the parenting alliance, and parenting stress. J Dev Behav Pediatr 1990;16:321–5.
4. Carson DK, Schauer RW. Mothers of children with asthma: perceptions of parenting stress and the mother-child relationship. Psychol Rep 1992;71:1139–48.
5. Wysocki T, Huxtable K, Linscheid TR, Wayne W. Adjustment to diabetes-mellitus in preschoolers and their mothers. Diabetes Care 1989;12:524–9.
6. LaValle PS, Glaros A, Bohaty B, McCunniff M. The effect of parental stress on the oral health of children. J Clin Psychol 2000;7:197–201.
7. Abidin R. Parenting stress index. Charlottesville, VA: Pediatric Psychology Press; 1992.
8. Quinonez RB, Keels MA, Vann WF Jr, McIver FT, Heller K, Whitt JK. Early childhood caries: analysis of psychosocial and biological factors in a high-risk population. Caries Res 2001;35:376–83.
9. Abidin R. Parenting stress index – short form. Charlottesville, VA: Pediatric Psychology Press; 1995.
10. Hallett KB, O'Rourke PK. Dental caries experience of preschool children from the North Brisbane region. Aust Dent J 2002;47:331–8.
11. Abidin R. Parenting stress index: professional manual. 3rd edn. Odessa, FL: Psychological Assessment Resources, Inc.; 1995. p. 53.
12. Castaldi J. Affective and cognitive patterns in the mother-child relationship during the second year of life. PhD dissertation. Charlottesville: University of Virginia; 1990.
13. Crowne DP, Marlowe D. A new scale of social desirability independent of psychopathology. J Consult Psychol 1960;24:349–54.
14. Abidin R. Parenting stress index: professional manual. 3rd edn. Odessa, FL: Psychological Assessment Resources, Inc., 1995. p. 57–61.
15. Abidin R. Parenting stress index: professional manual. 3rd edn. Odessa, FL: Psychological Assessment Resources, Inc.; 1995. p. 36–51.
16. Drury TF, Horowitz AM, Ismail AI, Maertens MP, Rozier RG, Selwitz RH. Diagnosing and reporting early childhood caries for research purposes. A report of a workshop sponsored by the National Institute of Dental and Craniofacial Research, the Health Resources and Services Administration, and the Health Care Financing Administration. J Public Health Dent 1999;59:192–7.
17. World Health Organization. Oral health surveys. Basic methods. 4th edn. Geneva: World Health Organization; 1997.
18. British Association for the Study of Community Dentistry. Criteria for standardized clinical

assessment of dental health. Cardiff, UK: British Association for the Study of Community Dentistry; 1992.
19. Summers CJ, Gooch BF, Marianos DW, Malvitz DM, Bond WW. Practical infection control in oral health surveys and screenings. J Am Dent Assoc 1994;125:1213–7.
20. SAS. SAS Release 8.02. Cary, NC, USA: SAS Institute Inc.; 1999–2001.
21. Lewsey JD, Gilthorpe MS, Bulman JS, Bedi R. Is modelling dental caries a 'normal' thing to do? Community Dent Health 2000;17:212–7.
22. Cohen J. Quantitative methods in psychology: a power primer. Psychol Bull 1992;112:155–9.
23. Reisine ST, Psoter W. Socioeconomic status and selected behavioral determinants as risk factors for dental caries. J Dent Educ 2001;65:1009–16.
24. Hallett KB, O'Rourke, PK. Social and behavioural determinants of early childhood caries. Aust Dent J 2003;48:27–33.
25. Chen M. Oral health of disadvantaged populations. In: Cohen L, Gift H, editors. Disease prevention and oral health promotion. Copenhagen: Munksgaard; 1995.
26. Harrison R. Oral health promotion for high-risk children: case studies from British Columbia. J Can Dent Assoc 2003;69:292–6.
27. Dye BA, Shenkin JD, Ogden CL, Marshall TA, Levy SM, Kanellis MJ. The relationship between healthful eating practices and dental caries in children aged 2–5 years in the United States, 1988–1994. J Am Dent Assoc 2004;135:55–66.
28. Abidin R. Parenting Stress Index: Professional Manual. 3rd edn. Odessa, FL: Psychological Assessment Resources, Inc.; 1995. p. 55.
29. Kristiansen CM, Harding CM. The social desirability of preventive health behavior. Public Health Rep 1984;99:384–8.