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Validity of single-item parental ratings of child oral health

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Objective. The aim of this study was to assess the validity of single-item parental ratings of child oral heath.

Methods. Data were collected during a study to assess the impacts of dental injury. Clinical examinations of children aged 11–14 years were undertaken that included measures of trauma, decay, treatment needs, and fluorosis. Children with trauma and a group of trauma-free children were followed-up. Parents were mailed a questionnaire along with a questionnaire for the child that contained a short form of the Child Perceptions Questionnaire 11–14 (CPQ11–14). Bivariate analyses examined associations between parents' ratings of their child's oral health, measures of dental disease, clinically defined treatment needs, and scores on the CPQ11–14. Logistic regression was used to see if the associations observed remained after controlling for access to dental care variables.

Results. Complete data were collected from 370 children and their parents. Parental ratings showed significant associations with most of the clinical indicators used and CPQ11–14 scores. Similar results were obtained when the data were analysed for subgroups defined by household income and mother's education. These associations remained after controlling for access to dental services.

Conclusion. The data suggest that single-item parental ratings of child oral health have adequate construct validity.

Introduction

Single-item ratings of oral health are in common use in oral health research, particularly in population oral health surveys[1]. Although wordings of the questions and response formats may differ[2], they usually ask an individual to rate their oral health on a scale ranging from 'excellent' to 'poor' or 'very poor'. As with ratings of general health, these oral health ratings are assumed to provide a summary of how individuals perceive their oral health objectively and subjectively[3]. As such, they are more efficient than multi-item, multi-dimensional scales in assessing the health status of populations and patients. The predictive validity of general health ratings has been established by many studies which have shown that they are associated with functional decline and survival[4,5] and the use of health services[6]. Such research has not been undertaken with oral health ratings, although one study did find that in older adult populations, they were predictive of declines in chewing ability over time[7].

Some research has been undertaken, however, to assess the cross-sectional construct validity of self-ratings of oral health. In a study of older adults[8], self-ratings showed significant associations with measures of tooth loss, periodontal disease, and decay experience, and with measures of the functional and psychosocial impact of oral disorders. Associations were also observed with measures of oral hygiene behaviours and access to and use of dental services. Those rating their oral health as poor had more disease experience, more impacts, poorer health behaviours, and lack of access to dental care. In a study of children aged 11–14 years[9] recruited from clinical settings, their ratings of oral health were significantly associated with scores from the oral symptoms and emotional well-being subscales of the Child Perceptions Questionnaire 11–14 (CPQ11–14), a measure of the impact of oral conditions on children of this age[10]. Such studies provide evidence of the validity of self-ratings and identify some of the dimensions or variables on which they are based[11,12].

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When research is conducted with children, it is often the case that information on children's health and well-being is collected from parents who act as proxy informants or information is collected from both parent and child. In these cases, parents are often asked to rate the oral health of their child. Little is known, however, about the validity of these parental ratings. Unpublished data from the study used to develop the Child Oral Health Quality of Life Questionnaires[10,13] indicated that the correlations between parent and child ratings of the child's oral health were positive but weak ($r = 0.34$; $P < 0.05$), but there was no association between parental ratings and scores on the CPQ11–14. The sample size, however, was small ($n = 42$ child–parent pairs), the children were recruited from clinical settings, and little clinical information was collected. Consequently, the study provided only a limited opportunity for examining the criterion and construct validity of single-item parental ratings of child oral health.

Consequently, when undertaking a population-based study of the functional and psychosocial impact of traumatic dental injuries in children aged 11–14 years[14], parental ratings of the child participants' oral health were collected. The aims and objectives were to determine if: (i) if single-item parental ratings of a child's oral health are valid by examining their associations with clinical measures of oral health, clinically defined treatment needs and scores on a measure of child oral-health-related quality of life completed by the children themselves; (ii) to determine if validity differs among subgroups defined by household income and mother's educational attainment; and (iii) to determine whether the associations between parental ratings and clinical and child self-report measures were explained by access to dental care variables.

Methods

The study was conducted in two phases: a clinical examination phase of a large sample of children and a follow-up phase in which selected children and their parents were asked to complete questionnaires concerning oral health and its psychosocial impacts. The study and its processes and procedures were approved by the Research Ethics Office of the University of Toronto.

Data collection procedures

The target population for the clinical examination phase was all grade 6 (aged 11/12 years) and grade 8 (aged 13/14 years) children attending a random sample of schools in areas served by two of Ontario's Public Health Departments, namely York Region and Brant County. York Region is situated north of Toronto and comprises nine municipalities containing urban, small town, and rural communities. It has a multi-ethnic population of 895 000 and is served by 230 elementary schools. Brant County is a small predominantly rural area in south-west Ontario with a population of 35 000 largely of European origin. It is served by 33 elementary schools. These two areas were chosen because they have participated in previous population-based studies of child oral health and demonstrated their capacity to manage the data collection process necessary for the study.

A stratified random sample of 15 schools was drawn in each location; five designated low caries risk, five medium risk, and five high risk. These caries risk designations are made by the Public Health Departments using data on caries prevalence collected during their annual school dental screening programmes. This approach was employed to ensure inclusion of children from the full range of disease risk and socioeconomic strata. All grade 6 (aged 11/12 years) and 8 (aged 13/14 years) students in sampled schools were included in the study if they were present at the time of the clinical examinations.

Clinical data were collected during the dental screening programme conducted by the two participating Public Health Departments. The screening examinations were undertaken by experienced dental hygienists who were trained and calibrated in the use of a common screening protocol and diagnostic criteria.

Each child's caries experience was recorded using the decayed, missing, or filled permanent teeth (DMFT) index. Caries was scored at the D3 level. Each child was also assessed for the

following treatment needs: urgent restorative need, non-urgent restorative need, need for sealants, need for topical fluoride, and need for scaling. The examination procedures, diagnostic classifications, and criteria for determining treatment needs were derived from protocols developed by the Public Health Branch of the Ontario Ministry of Health in consultation with the Ontario Association of Public Health Dentistry, for use in the screening programmes and Dental Indices Surveys conducted by all Public Health Departments in Ontario.

The appearance of the anterior teeth of each child was scored by the examining hygienist using the Aesthetic Component of the Index of Orthodontic Treatment Need (AC-IOTN)[15]. This is a 10-point scale based on photographs that are ranked according to the arrangement of the anterior dentition, where 1 is the most and 10 the least attractive. The Dental Trauma Index[16] was used to record evidence of injury to the upper and lower incisors. A score of 0 indicates a tooth that is present and sound, whereas a score of 1 indicates unrestored enamel fractures, and scores of 2–5 indicate more severe levels of trauma, such as a fracture involving dentine, pulp involvement, or tooth loss, either treated or untreated. The upper incisors and canines were examined for fluorosis using the Tooth Surface Index of Fluorosis[17], and each child was assigned to one of the following fluorosis categories: none, very mild, mild, moderate, and severe.

The target population for the questionnaire phase of the study was all children showing clinical evidence of injury, along with a comparison group consisting of the next two non-injured children of the same gender and in the same class to be clinically examined. This approach was taken to facilitate the main aim of the study, that is, to compare the oral-health-related quality of life of children with and without traumatic dental injury while controlling for other oral conditions likely to impact on quality of life. It meant, however, that this subsample was not representative of the children taking part in the clinical examination phase.

The parents of this subsample of children were sent a letter informing them of the study and asking them to complete a short questionnaire concerning the child's dental history and family characteristics. Also included was a questionnaire to be completed by the child. The parents were asked to allow their children to complete their questionnaire independently. Two mailings were used along with telephone follow-ups of non-responders to these mailings.

The parental questionnaire asked whether or not the child had a regular source of dental care and at least one dental visit in the last year. Parents were asked: 'Would you say that the health of this child's teeth and mouth is ... excellent, good, fair, or poor?' Questions were asked on whether or not the family had dental insurance, total annual household income, and mother's educational attainment. The child questionnaire contained a ten-item short form of the CPQ11–14[18] which was specifically designed to assess the oral-health-related quality of life of children. Each item asked about the frequency of functional and psychosocial problems experienced over the previous 3 months as a result of the condition of the teeth and mouth. The response format was Likert-type with the following categories and codes: never = 0, once or twice = 1, sometimes = 2, often = 3, every day or almost every day = 4. The numerical codes of these ten items were summed to give a CPQ11–14 score. The validity and reliability of this short form have been demonstrated in a previous study[18].

Data analysis

The data for children with and without evidence of dental injury were pooled. Prior to all analyses, data were weighted to adjust for non-response. Simple descriptive statistics were generated and bivariate analyses were undertaken to assess the associations between parent ratings of the child's oral health and the clinical measures of oral diseases/disorders. Because the parental rating was an ordinal variable, Kendall's tau was used to assess the statistical significance of differences in proportions, and one-way analysis of variance was used to assess the association between the parental rating and continuous variables such as the number of decayed teeth and the score on the short form CPQ11–14. The analyses were repeated for groups defined by household

income (low = $39 000 or less per annum; high = $40 000 or more per annum) and mother's education (low = high school or less; high = more than high school).

A series of logistic regression analyses were undertaken to see if the associations between parental ratings and the clinical and oral-health-related quality of life outcome variables remained after controlling for the access to dental care variables. For these analyses, the parental rating was reduced to a binary variable (excellent/good = 0; fair/poor = 1). Individual clinical variables and short form CPQ11–14 scores were entered as continuous variables, and treatment need variables as binary predictors (yes = 1; no = 0). Having a regular dental care provider and having at least one dental visit in the last year were also entered as binary variables (yes = 0; no = 1).

Results

A total of 2422 children were clinically examined and 808 children were selected for questionnaire follow-up. Complete clinical and patient and child questionnaires data were obtained for 370 children, 208 boys and 162 girls. One hundred and fifty-two were in grade 6 (aged 11/12 years) and 218 were in grade 8 (aged 13/14 years). Caries rates were relatively low: although 43.7% had a DMFT of one or more, the mean was 0.79 [standard deviation (SD) = 1.21]. Just over a tenth, 13.3%, had one or more decayed teeth and 7.1% had one or more teeth missing because of caries. Almost a quarter, 22.6%, were judged to have one or more treatment needs: urgent restorative – 5.9%, non-urgent restorative – 3.7%, sealants – 5.5%, topical fluoride – 2.2%, and scaling – 9.7%.

Just over a quarter, 27.3%, was classified as having very mild fluorosis or mild fluorosis. Based on the AC-IOTN ratings, 19.1% had moderate/borderline need for orthodontic treatment, and 9.8% had a definite need for treatment. Because of the way the subjects were selected, dental injury rates were high. Just over one-third, 37.5%, showed evidence of injury to the anterior dentition with 15.3% having one or more teeth with severe injury. CPQ11–14 short form scores ranged from 0 to 22 with a mean of 2.9 (SD = 4.2).

Parental ratings of the children's oral health were excellent – 36.1%, good – 45.9%, fair – 16.0%, and poor – 2.0%. There were no differences in the oral health ratings according to the child's age as indicated by school grade or by gender. More favourable ratings, however, were given where the child had a regular source of dental care ($P < 0.001$) and if the child had at least one dental visit in the last year ($P < 0.001$).

Table 1 shows the associations between the parental ratings and measures of the child's caries experience, treatment needs, and other oral conditions. Significant associations were observed for 11 of 18 clinical variables denoting decayed and missing teeth, need for sealants and urgent restorative care, orthodontic treatment need, and injured incisors. Ten indicated worse clinically defined oral health for those children rated as only fair or poor. There was also a significant association between scores on the CPQ11–14 with children rated as only fair or poor reporting more functional and psychosocial impacts.

Table 2 shows the results of the same analyses for subgroups defined by household income and mother's education. For the low-income group, significant associations were observed between the parental rating and eight of the clinical indicators; for the high-income groups, significant associations were observed for six. In both, the parental rating was associated with scores on the CPQ11–14. Where the mother's education was 'high school or less', associations were observed for eight clinical indicators; where the mother's education was 'more than high school', associations were observed for four. For both groups, the parental rating was associated with scores on the CPQ11–14.

In the logistic regression analyses, the following variables retained their significant association with the parental rating after controlling for the two access to care variables: number of decayed teeth ($P < 0.05$), number of missing teeth (< 0.01), number of filled teeth (< 0.05), urgent treatment needs (< 0.05), AC-IOTN score (< 0.01), number of injured incisors (< 0.05), and the CPQ11–14 score (< 0.001). The two access to care variables were significant in all models.

Table 1. Association between parental ratings of the child's oral health and clinical and subjective indicators of the child's oral health.

Parental rating	Excellent (*n* = 116)	Good (*n* = 147)	Fair/Poor (*n* = 57)	*P* value
Caries experience				
With one or more decayed teeth (%)	8.8	12.9	16.0	0.034
Mean decayed teeth	0.14	0.15	0.28	0.038
With one or more missing teeth (%)	4.4	7.5	12.8	0.007
Mean missing teeth	0.04	0.08	0.11	0.040
With one or more filled teeth (%)	31.7	29.7	21.6	0.675
Mean filled teeth	0.79	0.80	0.81	0.982
Treatment needs				
Needing sealants (%)	2.4	6.3	11.1	< 0.001
Needing topical fluoride (%)	0.8	2.2	0.1	0.978
Needing scaling (%)	12.0	9.4	5.6	0.044
With urgent restorative needs (%)	2.8	7.2	9.6	0.044
With non-urgent restorative needs (%)	2.4	2.2	2.4	0.949
Other clinical conditions				
With fluorosis (%)	23.1	26.9	30.4	0.118
With orthodontic treatment need (%)	19.4	32.6	38.4	0.001
Mean AC-IOTN score	3.1	3.1	4.2	< 0.001
With one or more injured incisors (%)	24.7	28.2	35.2	0.044
Mean number of injured incisors	0.31	0.37	0.50	0.023
With one or more severely injured incisors (%)	13.5	10.0	12.7	0.522
Mean number of severely injured incisors	0.15	0.14	0.20	0.426
Functional and psychosocial outcomes				
Mean CPQ11–14 score	1.6	2.6	6.0	0.001

AC-IOTN, Aesthetic Component of the Index of Orthodontic Treatment Need; CPQ11–14, Child Perceptions Questionnaire 11–14.
P values for proportions: Kendall's tau tests; *P* values for mean scores: one-way analysis of variance.

Table 2. Association (*P* values) between parental ratings of the child's oral health and clinical and subjective indicators of the child's oral health by household income and mother's education.

	Household income		Mother's education	
	Low (*n* = 87)	High (*n* = 238)	Low (*n* = 101)	High (*n* = 211)
Caries experience				
With one or more decayed teeth (%)	0.001	0.284	0.032	0.548
Mean decayed teeth	0.012	0.535	0.040	0.553
With one or more missing teeth (%)	0.004	0.332	0.002	0.202
Mean missing teeth	0.030	0.817	0.020	0.343
With one or more filled teeth (%)	0.012	0.240	0.927	0.002
Mean filled teeth	0.093	0.149	0.276	0.001
Treatment needs				
Needing sealants (%)	0.143	0.050	0.001	0.389
Needing topical fluoride (%)	–	0.397	–	0.652
Needing scaling (%)	0.503	0.396	0.137	0.362
With urgent restorative needs (%)	0.178	0.006	0.006	0.211
With non-urgent restorative needs (%)	0.076	0.415	0.061	0.129
Other clinical conditions				
With fluorosis (%)	0.250	0.003	0.671	0.182
With orthodontic treatment need (%)	0.027	0.001	0.286	0.001
Mean AC-IOTN score	0.025	0.001	0.105	< 0.001
With one or more injured incisors (%)	0.896	0.015	0.001	0.688
Mean number of injured incisors	0.003	0.003	0.025	0.216
With one or more severe injuries (%)	0.378	0.393	0.876	0.581
Mean number of severely injured incisors	0.151	0.151	0.976	0.950
Functional and psychosocial outcomes				
Mean CPQ11–14 score	< 0.001	< 0.001	< 0.001	< 0.001

AC-IOTN, Aesthetic Component of the Index of Orthodontic Treatment Need; CPQ11–14, Child Perceptions Questionnaire 11–14.
P values for proportions: Kendall's tau tests; *P* values for mean scores: one-way analysis of variance.

Because the contact letter to parents of children with one or more injured anterior incisors indicated that evidence of such injury had been found during the screening examination, this may have biased the oral health ratings that the parents of this group gave. To see if this was the case, the parental ratings for children with and without injury were compared. The distribution for the former was as follows: excellent – 31.6%, good – 45.9%, fair/poor – 16.2%. For the latter, the distribution was: excellent – 37.9%, good – 45.9%, fair/poor – 22.4%. Although this suggests no substantial bias, all analyses were repeated for children without evidence of injury to the anterior dentition. The results were very similar to those when all children were included. For example, in the logistic regression analyses, significant associations were found between the parental ratings and the following clinical variables after controlling for access to dental care variables: mean number of decayed teeth, mean missing teeth and mean filled teeth, need for scaling, urgent restorative need, the Tooth Surface Index of Fluorosis score, and the AC-IOTN score. The association with the CPQ11–14 scores was also significant.

Discussion

A recent review of oral health research involving children[20] noted the changing social position of children in society; the specification of children's rights; and increasing emphasis placed on obtaining information on children's wishes, desires, and perspectives when making decisions concerning their health and welfare. Most research conducted to date, however, has treated children as research subjects with little effort to involve children as active participants. In this research, termed 'research *on* children', information on their subjective experiences is either not collected or derived from proxies such as parents. By contrast, 'research *with* children' requires that their views are obtained directly by means of questionnaires developed with input from children, qualitative interviews, or focus groups. Such research is consistent with prevailing social and legal ideologies concerning children.

Nevertheless, there are situations in which the use of parents/caregivers as proxies may be justified; for example, with very young children, children with cognitive or communication difficulties, or other conditions that preclude direct participation in research. In these cases, the perspective of the parent/caregiver is used as a substitute for that of the child. Even when children are able and willing to participate directly, there is some benefit to obtaining the parent's perspective. Parsons *et al.*[18] have suggested that because parents are usually the principal decision-makers with respect to a child's health, their perceptions are important in that they can have a major influence on choices with respect to health care. Further, health care for children often provides for parents' needs as well as, or rather than, those of the child. Consequently, there is an emerging consensus that parent reports are valuable even if they differ from those of the child and even if they are not being used as a substitute for that of the child. Accordingly, a recently developed measure of child oral-health-related quality of life[10,13] consists of parallel questionnaires for the child and the parent. Such questionnaires can be used to obtain both child and parent opinions on the benefits of interventions such as orthodontic treatment, and to explore the extent of agreement and disagreement between children and their parents regarding oral health outcomes[21]. However, for these to function appropriately, the validity of both parent and child questionnaires needs to be established.

The study reported here is concerned with the validity of parental single-item ratings of child oral health. These ratings were judged against measures of the child's caries experience and fluorosis, dental injury, orthodontic treatment need based on aesthetic considerations, and a measure of the functional and psychosocial impact of oral disorders completed by the children themselves. Most of the associations examined were significant and in all but one case indicated that children who were rated by the parents as having poor oral health had worse scores on clinical and impact measures. These results are similar to those reported by Weyant *et al.*[22] who undertook a study of adolescents in grades 9 and 11. Single-item parental ratings of oral health were significantly associated with findings of treatment need based

on clinical examinations by dentally trained examiners. In regression analysis, parental ratings were associated with the prevalence of untreated decay, missing teeth, and orthodontic treatment need. Taken together, these results provide some evidence of the validity of the parental ratings when judged against independent clinical and child self-report criteria.

In this study, broadly similar results were obtained when the data were analysed by subgroups defined by household income and mother's education. This suggests that the validity of the parental reports of children's oral health is independent of social group membership. Interestingly, the associations were more consistent for children from low-income households and households where the mother had less than high school education. This may be because of the fact that children from such households have higher rates of oral disease so that the validity of the parental rating is easier to demonstrate.

Many of the bivariate associations observed remained significant in multivariate analyses controlling for two variables denoting access to dental care. These analyses were undertaken because it is possible that parents assume that a child's oral health is good and rate it favourably if the child has access to dental services. These results strengthen the conclusion that parental ratings are valid indicators of child oral health, and suggest that they can be used when parents must act as proxies for their children and in studies where data are collected from both parent and child. They also suggest that the ratings are based on both biomedical and behavioural referents. Qualitative approaches, however, are needed to more fully understand the reasons which underlie parent's ratings of the oral health of their children.

The study has a number of limitations. First, the recruitment letter to parents may have induced some bias in the ratings, even though the analysis of data for children without evidence of dental injury suggests that this was not the case. Second, given the way children were selected for the questionnaire phase of the study, as a subgroup they had higher rates of oral diseases/disorders than the larger group that took part in the clinical examination phase. They had higher rates of trauma to the anterior dentition, were less likely to be caries free (56.3% vs. 65.8%) and more likely to have one or more decayed teeth (13.3% vs. 7.8%). Moreover, 28.9% vs. 19.8% had AC-IOTN scores, indicating orthodontic treatment need. This agrees with an earlier study that found higher rates of decay among children who had experienced trauma to the anterior dentition[23], and with the results of other studies indicating that malocclusion, specifically an increased overjet, is a risk factor for traumatic dental injury[24]. Consequently, the subjects who completed the questionnaire phase of the study were not representative of the children taking part in the clinical phase of the study nor the target population. At this point, the main concern is with the internal validity of the study rather than its external validity. Nevertheless, because it is possible that parental ratings are only valid for populations of children with relatively high levels of oral disease, the study needs to be repeated using larger and more representative samples to confirm the findings reported here. This would allow for further exploration of the validity of parental ratings of child oral health according to the personal and family characteristics of both parents and children. A final limitation is the reliance on mail survey methodology, one weakness of which is the loss of control over the data collection process. Consequently, the study should be repeated where data are collected from parents and children by means of interviews or self-complete questionnaires in a more controlled environment.

What this paper adds

- Single-item parental ratings of the oral health of grade 6 and 8 children are valid when judged against clinical examination and child self-report criteria.
- The validity of these ratings is not influenced by social group membership.

Why this paper is important to paediatric dentists

- Single-item parental ratings of child oral health can be used in research where the children themselves cannot participate or where information is being collected to assess the extent of agreement between children and their parents. Parental ratings may also be useful in clinical contexts because parents play a prominent role in decisions regarding oral health care for children.

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