Published in final edited form as:
J Public Health Dent. 2011 ; 71(3): 185–193.

Development and validation of a measure of pediatric oral health-related quality of life: the POQL

Noelle L Huntington, PhD[1], **Dante Spetter, PhD**[2,3], **Judith A. Jones, DDS**[3], **Sharon E. Rich, MPH**[3], **Raul I. Garcia, DMD**[3], and **Avron Spiro III, PhD**[3,4]

[1] Harvard Medical School and Children's Hospital Boston

[2] Harvard University Division of Continuing Education

[3] Boston University Henry M. Goldman School of Dental Medicine

[4] Boston University School of Public Health

Abstract

Objective—To develop a brief measure of oral health-related quality of life in children and demonstrate its reliability and validity in a diverse population.

Methods—We administered the initial 20-item POQL to children (Child Self-Report) and parents (Parent Report on Child) from diverse populations in both school-based and clinic-based settings. Clinical oral health status was measured on a subset of children. We used factor analysis to determine the underlying scales and then reduced the measure to 10 items based on several considerations. Multitrait analysis on the resulting 10-item POQL was used to reaffirm the discrimination of scales and assess the measure's internal consistency and interscale correlations. We established discriminant and convergent validity with clinical status, perceived oral health and responses on the PedsQL and determined sensitivity to change with children undergoing ECC surgical repair.

Results—Factor analysis returned a four-scale solution for the initial items – Physical Functioning, Role Functioning, Social Functioning and Emotional Functioning. The reduced items represented the same four scales – two each on Physical and Role and three each on Social and Emotional. Good reliability and validity were shown for the POQL as a whole and for each of the scales.

Conclusions—The POQL is a valid and reliable measure of oral health-related quality of life for use in pre-school and school-aged children, with high utility for both clinical assessments and large-scale population studies.

Keywords

oral health; quality of life; children; diverse populations

Introduction

Dental decay in children is not evenly distributed across the population. Though 80% of adolescents have experienced some level of decay(1), 80% of the decay occurring in permanent teeth exists in only 25% of all children and adolescents(2). Children from low-income households have twice as much unmet dental need as children from higher-income

For correspondence, please contact: Noelle L. Huntington, Ph.D., Division of General Pediatrics, Wolbach 2, Children's Hospital Boston, Boston, MA 02115, Noelle.huntington@childrens.harvard.edu.

households(3). Compared with their higher-income counterparts, children from low-income families are less likely to have visited a dentist in the past year (49% *v* 62%), received sealants (4% *v* 11%) or to have private dental insurance (8% *v* 44%)(4). Though children from low-income households qualify for dental care under state-funded insurance programs, only 18% actually receive treatment and often the treatment is emergent(4).

Oral health disparities also exist between racial and ethnic groups. Mexican-American children and African-American children have a higher prevalence of caries and more unmet treatment needs than non-Hispanic, white children(3). According to the Healthy People 2010 report, 43% of Hispanic and 36% of African-American children, ages 6–8, had untreated caries, compared with 26% of Caucasian children(5).

Oral Health Beliefs

Though a disproportionate percentage of minority children live in low-income families, there are race- and ethnicity-based differences in oral health which exist independently of economic differences. According to the Surgeon General's Report, among *non-poor* children between the ages of two and nine, 56% of African-American and Mexican-American children had untreated decay, compared with 37% of White children(1), which suggests that income is not the only source of disparities. Studies of various health conditions have found a number of health-belief barriers to preventive care behaviors which exist at higher rates in non-White populations. These include placing importance on the role of chance in health, believing in the inevitability of health decline with age, and having lower feelings of control over your circumstances, as well as believing that it is the responsibility of professionals to cure disease *v* the responsibility of consumers to prevent disease(6).

Health beliefs can impact the care sought for dependent children. In focus groups, caregivers who did not utilize oral health services for their child discussed oral health in terms of emergency *v* preventive care, felt that oral health was less important than general health and did not believe that providing professional preventive care was an important caregiver responsibility(7). Non-utilizing caregivers were also more likely to emphasize the aesthetic *v* the medical importance of oral health. Similarly, Milgrom et al. found that children were more likely to have had a dental visit in the past year if the mother felt that dental care was important for children and were less likely if the mother believed that primary teeth should only be treated if they hurt(8). Actual clinical indications of need for care did not determine who did or did not receive care. Having a lower perceived need for the importance of oral health may influence the impact of oral conditions on subjective well-being. For example, beliefs that caries are inevitable may make the presence of caries less concerning. Functional limitations may be more accepted, though appearance limitations may be less so.

Oral Health-Related Quality of Life

Oral health-related quality of life (OHQL) assesses the subjective impact of oral health status on social and psychological well-being and daily functioning. Although disparities in clinical oral health status have been found in children, disparities in oral health-related quality of life have not been studied, nor is it known whether any such disparities parallel disparities in clinical status. However, while some measures of oral health-related quality of life in children have been developed in recent years(9,10,11), none were developed with an emphasis on the experiences and views of children and parents from low-income or minority populations. Given the existence of economically- and culturally-based differences in oral health attitudes and beliefs, and the fact that oral health-related quality of life is a subjective condition, it is critical that measures of OHQL represent domains of impact that are

important to the full population, particularly low-income or minority populations where the rates of oral disease are highest.

To address this need, we developed a measure of OHQL, the Pediatric Oral health-related Quality of Life (POQL), with a particular focus on input from parents and children from low-income or minority populations at the stages of item development, item reduction and validation. This paper describes the development and validation of the POQL.

Methods

Initial item generation

In generating the first set of items, our decisions were guided by existing measures of OHQL for use in adults (no child measures existed at the time) and by the underlying conceptualization of those measures. Our initial set of 14 items was developed separately for three age groups: pre-school, school-age and pre-teen. While many items overlapped across versions, some items were specific to a particular developmental stage. For each item we asked how often the event occurred and how bothered the parent or child was by its occurrence, with responses on a Likert-type scale. For the pre-school version, only a parent report on child version (PRC) was developed. For the school-age and pre-teen versions we developed both a parent report and child self report (CSR) version for children ages 8 and above (~3rd grade).

Item revision

Our initial items were revised through two means: 1) administering the items to individual parents and children followed by a debriefing session on the clarity and completeness of the items; and 2) focus groups with parents and children to talk about the impact of oral health on their quality of life. For both procedures, we recruited parents and children from the Boston Medical Center pediatric clinic and a neighborhood school, both of which serve predominantly low-income, minority populations. As a result of the debriefing interviews and focus groups, one item was dropped (“felt physically uncomfortable), four new items were added (“not smile/laugh”, “worry less attractive”, “teased”, and “say certain words”), wording was changed significantly on six items (for example, replacing “troubled” with “worried”, or changing “appearance of teeth” to just “appearance”) and the layout was changed. In addition, we added a third set of questions to determine whether the event occurred because of oral health problems or because of typical development (e.g. mixed dentition). Full information on the item development process will be published elsewhere.

Item reduction

We administered the resulting 20-item version to a wide sample of children and parents. The data were analyzed in multiple steps for the purposes of item reduction. In step one, we conducted a factor analysis to determine if the theoretical domains of OHQL were reflected in actual data. We performed factor analyses on the items’ impact scores, which were calculated by multiplying the “how often” response by the “how bothered” response. On both scales, a lower value indicated a lower impact (i.e., lower frequency of occurrence or a lower degree of bother). Therefore, an event that occurred infrequently but was very bothersome when it did occur would be calculated as having a similar degree of impact as an item that occurred frequently but was only slightly bothersome. Items that did not occur at all received an impact score of zero.

The goal of step two was to choose at least two of the best items from each domain identified in the factor analysis for the final version. As recommended by Juniper et al(12),

we considered several pieces of information about each item to determine which were most representative of each domain.

Reliability and Validity

We evaluated reliability of the final version of the POQL using the Multitrait Analysis Program (MAP) to calculate the internal consistency reliability (Cronbach's alpha), scale correlations(13), and item-scale correlations corrected for overlap. These allowed us to determine how well the reduced-item version fit the domains identified in the factor analysis. We further examined reliability through a test-retest of a subset of participants at two sessions between two and four weeks apart.

We assessed convergent validity by comparing the response on the POQL to responses on the OH1, a single-item global self-assessment of current oral health status which ranges from "poor" to "excellent". In addition, we assessed discriminant validity by comparing scale and total scores for children with caries to children who were caries free. For 52% of the sample, dental professionals recorded the presence of untreated caries, previous caries experience and the current degree of treatment urgency. We defined caries presence primarily as current untreated caries but also included any other current dental need requiring immediate treatment, such as periodontal issues.

A subset of respondents also complete the PedsQL, a well-validated test of health-related quality of life (HQL)(14), to test the relationship between OHQL and general HQL. In addition, POQL data were collected on a separate sample of young children with severe early childhood caries before surgical treatment and at three and six months post-treatment to assess the POQL's sensitivity to change in oral health status.

Sample

We collected data from parents and children between 2005 and 2008 through a heterogeneous sample of schools and dental clinics in the Greater Boston area. Schools and clinics were purposefully selected to insure a diverse sample. Race/ethnicity data were collected on the clinic sample, but not economic data. Data from schools were collected as a part of "dental day" activities, where entire grades received a free screening and completed the POQL. Demographics for the school-based data was based on report by school districts on their individual schools. Because data was collected on an entire grade, we had no reason to believe that the demographics for one grade would differ significantly from the demographics for the school as a whole.

Table 1 presents demographics for type of site and for the sample as a whole. Age and gender were reported by all participants. Of the 16 schools from which data was collected, the African-American population was higher than the state average in four schools, the Hispanic population was higher than the state average in nine schools, and the White population was higher than the state average in seven schools.

We did not use every measurement tool with every participant, therefore each analysis was conducted on the subset of participants providing all the necessary data for that analysis. IRB approval was given for all data collection at every collection site.

Results

Factor Analysis

We conducted an exploratory iterated principal factor analysis on the initial set of 20 POQL items. We used both a varimax (orthogonal) and promax (oblique) rotation and explored 3-,

4-, and 5-factor solutions to determine which factor structure best fit the data. We looked at child self-report (CSR; n=1835) and parent report on child (PRC; n=1140) data separately and together and applied the general rule of interpreting as significant only those factor loadings greater than 30(15). Missing data occurred for 1% of cases per item for the CSR and 8% of cases per item for the PRC.

Based on the varimax rotation, four factors yielded eigenvalues greater than 1 for the CSR only, the PRC only and the CSR/PRC combined datasets. For each data set, the variance was distributed very similarly across the four factors and individual items clustered almost identically on all datasets with a coherent theme to each factor: Physical Functioning, Role Functioning, Social Functioning and Emotional Functioning. The primary difference between datasets was the ordering of the factors in terms of variance explained.

The promax oblique rotation did not change the factor structure for any of the datasets. However, because all the factors were intercorrelated on all data sets (ranging from .25 to . 56), the promax rotation was chosen as the final solution. Table 2 presents the factor loadings from the CSR/PRC combined dataset. Factor loadings greater than 30 are in bold. Three items (angry/upset, not talk with others, and trouble sleeping) loaded on more than one factor and one item (difficulty saying words) did not load on any factor.

Item Selection

To increase the utility of the POQL for clinical applications and large-scale studies, we sought to reduce the number of items while retaining the underlying domain structure identified in the factor analysis. We determined item importance based on multiple criteria: experienced by at least 15% of respondents; a significant (≤0.05) difference in rates of experiencing the item between participants with caries and those without; a factor loading greater than 50; a concordance between the responses of parents and their children of at least 85%; and the reason for occurrence being due to dental disease more than 50% of the time. These criteria were set by the research team based on what we felt were the most important or likely future uses of the POQL.

Table 3 shows the results of these analyses and highlights when criteria were met. We first identified all items which had a high occurrence rate (% affected) and a significant difference by caries status (caries effect). Six items met both criteria (worry less attractive, pain, eat hard food, eat hot/cold food, angry/upset, worry). Five items met one of the two criteria (not smile/laugh, unhappy with looks, miss school, sleep, cry). For these five items, we evaluated whether they met criteria on the other three dimensions (factor loadings, Parent-Child concordance and % due to disease) and selected them if they met two out of those three criteria. By this method, we kept “not smile/laugh,” “unhappy with looks” and “cry” but dropped “miss school” and “sleep”.

This list of nine items gave us three items each on the Social Functioning, Physical Functioning and Emotional Functioning scales, but no items on the Role Functioning scale. To meet our requirement of having at least two representative items for each scale, we loosened the criteria for the Role Functioning scale and selected “miss school” as it had the highest occurrence rate of items on that scale and differentiated between children with and without caries. We also added “pay attention” because it had the second highest occurrence rate and loaded well on the factor. The final list of selected items is indicated with highlighting on Table 3. Our final adjustment to the scale was to combine the wording of the two eating questions into one question – “difficulty eating food (such as hard food, hot or cold food)” – resulting in a final 10-item POQL.

Reliability

In the next step, we conducted a Multitrait Analysis on the POQL to confirm if the reduced items fit the same scale (factor) structure and to evaluate the tool's reliability(13). The CSR data (n=1821) and PRC data (n=1158) were analyzed separately. We calculated item scores by multiplying the 'how often' response (0–3) by the 'how bothered' response (0–4). These 'impact scores' were then summed and converted to a percent of the maximum possible score which ranged from 0 to 100. If fewer than 2/3 of the items in a scale were completed, we set the scale score to missing; otherwise, if there were missing responses, we substituted the person mean for that particular item and the scale score computed as described above.

Table 4 shows the correlations of each item with each scale score and the total score. A scale shows good discrimination from the other scales if its items correlate significantly higher (more than two standard errors) on that scale compared to the other scales. The CSR data had better scale discrimination overall. The Role Functioning scale did not show good discrimination on either dataset. Many cases of non-discrimination occurred between the Social and Emotional scales, which may underscore the social nature of emotion and the emotional nature of social experiences.

The internal consistency reliability (Cronbach's alpha) for the total score was .83 for the CSR data and .86 for the PRC. The internal consistency reliability for the individual scales, the inter-scale correlations and the scale-total correlations are shown in Table 5. All scales except for Role Functioning showed good reliability and strong correlations with the total POQL for both datasets. The scales were moderately inter-correlated, as expected, with the strongest relationship seen between the Social and Emotional scales.

There were 102 older school-age children and preteens who completed the POQL twice at a 2–4 week interval. Test-retest reliability was calculated for the 68 children and preteens who did not indicate any change in their perceived oral health status (OH1) between testing points (Table 6). There were strong intraclass correlations for the total score and the Social and Emotional scales and moderate correlations for the Role and Physical scales. There were no significant changes in mean scores on any scales or the total POQL between the first and second measurements, indicating that there was no upward or downward shift in the values.

Validity

We examined discriminant validity of the scales and total scores by comparing children with caries with those known to be caries free and convergent validity by relating POQL scores with perceptions of oral health status (the OH1) and scores on the PedsQL. Table 7 shows the average scale and total scores by caries status and by perceived oral health. For total POQL scores and for every scale except Role Functioning, there was a significant difference by caries status and by perceived oral health for both the CSR and the PRC. Role Functioning did not show a significant difference by caries status for the CSR. As further evidence of convergent validity, total scores on the POQL correlated significantly with total scores on the PedsQL for both the CSR ($r=-0.52$; $p<0.001$; $n=545$) and the PRC ($r=-0.25$; $p<0.001$; $n=508$).

Sensitivity to Change

A separate sample of 218 parents of young children with severe ECC completed the PRC before their child underwent surgical treatment of their ECC and then again three and six months later. A control sample of 325 parents of healthy same-age children completed the POQL at the same timepoints (further description of this study will be published elsewhere). Because of developmental differences between preschool-age children and school-age children, the POQL for preschoolers contains only six items on three scales: Role

Functioning (miss school/daycare); Physical Functioning (pain, eat food); and Emotional Functioning (angry/upset, worry, cry).

For the total score and all three scales, there was a significant group (ECC *v* Control) by timepoint interaction (e.g. $F=91.5$; $p<0.001$) for the total score. At baseline, ECC children scored significantly worse than controls on the POQL (total score = 14.6 *v* 0.7). Significant improvements were seen for the ECC group at the three-month follow-up (3.0 *v* 0.7), and by six months they were indistinguishable from the controls (1.4 *v* 1.0).

Discussion

The POQL is a valid and reliable measure of oral health-related quality of life for use in pre-school, school-age and pre-teen children. Equivalent parent report and child self-report versions were validated for older children and pre-teens, and the items on the pre-school version, adjusted for developmental differences, showed strong sensitivity to change. With only 10 items, the POQL has high utility for use in both clinical assessments and large-scale population studies.

The development of the items on the POQL, and tests of its psychometric properties, involved oversampling from low-income and minority communities so that the voices and opinions of traditionally underserved populations were not overshadowed by the majority population. This resulted is an instrument that contains items of greater importance or relevance to the majority population as well as items of greater importance or relevance to some minority populations. Future uses of the POQL will be less biased towards capturing accurately only the perspective of the majority group, thus increasing the measure's external validity for use in the general population. Appropriate translation of the POQL into other languages, as well as large-scale studies of the general population and its specific sub-groups, are important next steps in testing the POQL.

The POQL clustered best into four dimensions – Physical Functioning, Role Functioning, Social Functioning and Emotional Functioning. The individual items on these dimensions had good face validity in terms of their representation of the underlying domain. In addition, there was consistency in the way the data clustered, with the same four factors appearing in both the CSR data and PRC data. The difference in dimensions between the POQL and earlier measures of OHQL in adults may reflect the difference between what is important to adults about their oral health and what is important to children.

The POQL had a number of items in common with other measures of OHQL in children(9,10,11), particularly items about Physical and Role Functioning. However, for socio-emotional impacts, the POQL is unique in two respects: a greater proportion of the items (60%) focus on socio-emotional impacts (other measures are between 29% and 44%) and the social items focus more on concerns about appearance (unhappy with looks, worry less attractive) while the social items on other measures focus more on interactions with others, such as feeling shy or not talking to others. During our initial item development, we conducted focus groups with children to listen to their concerns and beliefs about oral health, which was an item-development technique unique to the POQL. In contrast to what parents told us about their children, the children in our focus groups shared primary concerns about their appearance, whether it had to do with disease, misaligned teeth or mixed dentition. The salience of this dimension for children is reflected in our Social Functioning items and our overall emphasis on socio-emotional factors.

One scale on the POQL, Role Functioning, did not show consistently strong psychometric properties. It was the only scale whose items did not meet any of our initial criteria for inclusion, and instead the relatively best two items from that scale were chosen. One issue

was the low occurrence rate for the scale's items, even in a sample with a full range of oral health conditions. The chosen items, "miss school" and "pay attention in school", occurred for only about 10% of our sample and occurred due to dental disease less than half of the time. However, from a public health perspective it seems important to capture the impact of oral disease on school attendance and function, no matter how small the effect. Even then, small effects found in a representative sample translate to large numbers at the population level. By the July 2007 U.S. Census estimates(16), there are 40,163,937 children between the ages of 5 and 14 in the U.S. If 5.1% of children (10.1% occurrence * 49.4% due to disease) have missed school in the past three months because of dental problems, at the population level that equals over two million elementary- and middle-school children missing school because of a preventable disease.

When we looked at POQL scores by caries status, we found that scores for children with caries were about 50% greater than scores for children without caries. However, when we looked at POQL scores by OH1 status, we found that the scores for children with self-reported fair/poor health were more than twice as large as scores for children with excellent/very good/good oral health. This is consistent with previous studies which have found discrepancies between clinical oral health status and perceived oral health quality(17,18) and further suggests that a poor perception of oral health may contribute more to OHQL than does poor clinical oral health.

Clearly, caries prevalence and incidence rates are far from sufficient for describing the state of children's oral health in this country. To have a complete picture, we need to examine the triumvirate of clinical status, perception of overall oral health, and oral health-related quality of life. The POQL is uniquely suited to capture the impact of oral conditions in both the general population of children and at-risk populations to better characterize the general state of oral health in the pediatric population or to better understand oral health disparities.

Acknowledgments

We would like to acknowledge the contributions of the children and parents who contributed to this project, as well as the Chelsea Schools and School Dental Clinic, Billerica Schools, Framingham Schools, Natick Schools and the Boston Health Net (South Boston and South End Community Health Centers) and the Cambridge Health Alliance (Windsor Street and East Cambridge Health Centers). We also acknowledge the valuable data collection assistance of Joan Bohlke, Carolyn Wehler, Ludmila Reategui-Sharpe, Janis Johnson, Raffi Miller, Moira Sinnott, Adam Swenson, Erika Kullberg, Jonathan Shenkin, Catherine Hayes, Wanda Wright, Juliana Novis, Corinna Culler and Miguel Tabares.

The work presented in this original research report is supported by NIDCR Grants # U54 DE014264, K24 DE018211, K24 DE00419 and F32 DE05742

References

1. U.S. Department of Health and Human Services. Oral health in America: A report of the Surgeon General. Rockville, MD: USDHHS, NIDCR, NIH; 2000.
2. Kaste LM, Selwitz RH, Oldakowski RJ, Brunelle JA, Winn DM, Brown LJ. Coronal caries in the primary and permanent dentition of children and adolescents 1–17 years of age: United States, 1988–1991. J Dent Res. 1996; 75:631–41. [PubMed: 8594087]
3. Beltran-Aguilar ED, Barker LK, Canto MT, Dye BA, Gooch BF, Griffin SO, et al. Surveillance for dental caries, dental sealants, tooth retention, edentulism, and enamel fluorosis – United States, 1988–1994 and 1999–2002. MMWR. 2005; 54:1–44. [PubMed: 16121123]
4. Casmassimo, P. Oral health in maternal and child health. In: Wallace, HM.; Green, G.; Jaros, KJ.; Paine, LL.; Story, editors. Health and welfare for families in the 21st century. Sudbury MA: Jones and Bartlett; 1999. p. 441-453.

5. U.S. Department of Health and Human Services. Healthy People 2010: With understanding and improving health and objectives for improving health. 2. Washington, DC: U.S. Government Printing Office; November. 2000
6. Garcia A. Is health promotion relevant across cultures and the socioeconomic spectrum? Fam Community Health. 2006; 29(1S):20S–27S. [PubMed: 16344633]
7. Kelly SE, Binkley CJ, Neace WP, Gale BS. Barriers to care-seeking for children's oral health among low-income caregivers. Am J Public Health. 2005; 95:1345–1351. [PubMed: 16043666]
8. Milgrom P, Mancl L, King B, Weinstein P, Wells N, Jeffcott E. An explanatory model of the dental care utilization of low-income children. Med Care. 1998; 36:554–66. [PubMed: 9544595]
9. Jokovic A, Locker D, Stephens M, Kenny D, Tompson B, Guyatt G. Validity and reliability of a questionnaire for measuring child oral-health-related quality of life. J Dent Res. 2002; 81:459–63. [PubMed: 12161456]
10. Broder HL, Wilson-Genderson M. Reliability and convergent and discriminant validity of the Child Oral Health Impact Profile (COHIP child's version). Community Dent Oral Epidemiol. 2007; 35(suppl 1):20–31. [PubMed: 17615047]
11. Pahel BT, Rozier RG, Slade GD. Parental perceptions of children's oral health: the Early Childhood Oral Health Impact Scale (ECOHIS). Health and Quality of Life Outcomes. 2007; 5:6. [PubMed: 17263880]
12. Juniper, EF.; Guyatt, GH.; Jaeschke, R. How to develop and validate a new health-related quality of life instrument. In: Spilker, B., editor. Quality of life and pharmacoeconomics in clinical trials. 2. Lippincott-Raven; Philadelphia: 1996. p. 49-56.
13. Hays RD, Hayashi T. Beyond internal consistency reliability: rationale and user's guide for Multitrait Analysis Program on the microcomputer. Behavior Research Methods Instruments and Computers. 1990; 22:167–75.
14. Varni JW, Seid M, Rode CA. The PedsQL: Measurement model for the pediatric quality of life inventory. Med Care. 1999; 37:126–39. [PubMed: 10024117]
15. Nunnally, JC.; Bernstein, IH. Psychometric theory. 3. McGraw-Hill; New York: 1994.
16. U.S. Census. 2000 [Retrieved Feb 26, 2009]. http://www.census.gov/popest/national/asrh/NC-EST2007-sa.html
17. Atchison KA, Matthias RE, Dolan TA, Lubben JE, DeJong F, Schweitzer SO, Mayer-Oakes SA. Comparison of oral health ratings by dentists and dentate elders. J Public Health Dent. 1993; 53:223–30. [PubMed: 8258784]
18. Nagarajan S, Pushpanjali K. Self-assessed and clinically diagnosed periodontal health status among patients visiting the outpatient department of a dental school in Bangalore, India. Indian J Dent Res. 2008; 19:243–46. [PubMed: 18797102]

Table 1

Income and race/ethnicity data for data collection sites

Demographic Variables	Total	School-based Sample	Clinic-based Sample	ECC Intervention Sample
Total n	3400	2319	274	807
Gender (n)	3357	2280	270	806
Female (%)	53.3	54.5	55.6	49.2
Male (%)	46.7	45.5	44.4	50.8
Age in Years (n)	3333	2254	272	806
Mean (range)	8.6 (2–16)	10.5 (3–16)	7.0 (3–14)	3.6 (2–6)
Race/Ethnicity (n)	*	*	254	797
Asian (%)	2.1	2.8	0	0.9
Black (%)	13.8	3.6	4.7	46.8
Hispanic (%)	25.5	30.4	40.2	6.3
White (%)	56.2	61.7	54.7	40.5
Other/mixed (%)	2.4	1.5	0.4	5.5
Income (n)	†	†		716
Low income (%)	40.7	33.9	n/a	62.7
Oral Health (n)	2153	1073	273	807
Caries (%)	36.3	22.3	59.7	47.1
Caries Free (%)	63.7	77.7	40.3	52.9

*Race/ethnicity data for school-based sample is based on a weighted average of the distributions of state-reported data for each school where data was collected and a weighted estimate for the total sample.

†Low-income determined in school-based sample by a weighted average of percent of children qualifying for free or reduced lunch in each school where data was collected. Income for ECC intervention sample is based on parent report; low income = household income <$25K. No income data is available for clinics. Total low income is a weighted estimate between school sample estimates and ECC intervention data.

Table 2

Factors and item loadings

	Social Functioning	Role Functioning	Physical Functioning	Emotional Functioning
Not smile/laugh	**79**	6	0	−5
Worry less attractive	**73**	1	1	5
Unhappy with looks	**71**	−19	4	25
Teased	**37**	14	−1	18
Angry/upset	**39**	9	6	**36**
Not talk with others	**50**	**34**	−3	−8
Pay attention	−7	**63**	5	6
Do homework	−2	**68**	−2	6
Miss school	−4	**49**	10	10
Not speak aloud	30	**50**	11	−22
Not be with friends	25	**47**	−5	8
Miss activities	3	**54**	−6	8
Not be with family	7	**33**	−11	28
Sleep	−7	**31**	**34**	19
Pain	−3	1	**71**	8
Eat hard food	0	0	**81**	−5
Eat hot/cold food	16	−3	**49**	−3
Worry	30	0	3	**53**
Cry	1	11	4	**66**
Say words	17	26	12	2

Table 3

Item evaluation matrix

	% Affected*	Caries Effect†	Factor loadings	P-C Concordance‡	% Disease¶
Not smile/laugh	17.6	0.14	79	75.4	50.4
Worry less attractive	14.6	0.05	73	78.4	47.6
Unhappy with looks	17.1	0.08	71	77.2	56.7
Teased	10.0	0.84	37	85.4	43.8
Not talk with others	8.9	0.57	50	87.6	50.0
Pay attention	9.9	0.26	63	85.5	43.2
Do homework	6.4	0.19	68	89.8	50.0
Miss school	10.4	0.02	49	85.4	49.4
Not speak aloud	9.3	0.27	50	88.2	56.3
Not be with friends	6.5	0.10	47	91.2	59.5
Miss activities	5.3	0.10	54	93.1	50.0
Not be with family	2.3	0.26	33	96.4	56.3
Sleep	12.0	0.002	34	84.9	32.7
Pain	37.3	0.003	71	64.6	42.2
Eat hard food	32.6	0.01	81	66.8	40.6
Eat hot/cold food	27.6	0.02	49	65.4	67.9
Angry/upset	17.5	0.01	36	73.3	52.9
Worry	20.8	<0.001	53	66.0	64.5
Cry	11.9	<0.001	66	80.5	59.5
Say words	12.7	0.91	--	85.5	33.9

*The percent of respondents (parents or children) who said that the event occurred at all (n=2593 CSR and PRC)

†p-values from chi-square analyses of event occurring (yes/no) by presence/absence of caries (n=1972 CSR and PRC)

‡Percent of parent-child pairs giving the same response on the item – either both reporting that it did not happen or reporting a positive impact score within one impact value of each other (n=679 parent-child pairs)

¶Percent of respondents (parents or children) where the event occurred who reported that it occurred because of a disease-related issue (e.g. caries, dental trauma) *v* an expected developmental issue (e.g. mixed dentition) (n=165)

J Public Health Dent. Author manuscript; available in PMC 2012 July 1.

Table 4

Item-scale correlations

	Social	Role	Physical	Emotional	Total
Child Self-Report					
Not smile/laugh	**.65**	.30	.30	.51	.60
Worry less attractive	**.71**	.32	.32	.50	.62
Unhappy with looks	**.70**	.24	.30	.58	.63
Pay attention	.29	**.39**	.28	(.37)	.41
Miss school	.26	**.39**	.26	.32	.38
Pain	.28	.29	**.55**	.37	.47
Eat food (hard/hot/cold)	.34	.28	**.55**	.34	.47
Angry	(.62)	.37	.35	**.62**	.65
Worry	.51	.32	.32	**.63**	.60
Cry	.37	.34	.31	**.55**	.51
Parent Report on Child					
Not smile/laugh	**.67**	.35	.27	(.61)	.63
Worry less attractive	**.75**	.32	.27	.56	.62
Unhappy with looks	**.68**	.32	.34	(.62)	.65
Pay attention	.27	**.37**	.28	(.41)	.40
Miss school	(.35)	**.37**	(.34)	.44	.47
Pain	.33	.34	**.51**	(.47)	.52
Eat food (hard/hot/cold)	.27	.31	**.51**	.42	.45
Angry	.55	.47	.37	**.64**	.65
Worry	(.67)	.37	.47	**.70**	.75
Cry	.52	.50	.46	**.65**	.68

Correlations between each item and its target scale are shown in bold; these were corrected for item-scale overlap. For each item, any correlation with a non-target scale that is less than 2 standard errors from the correlation with its target scale is indicated by parentheses. This means that the item has less discrimination between scales.

Table 5

Internal consistency reliability (Cronbach's alpha) and inter-scale correlations

	Social	Role	Physical	Emotional	Total
Child Self-Report					
Social	**.83**				
Role	.33	**.55**			
Physical	.35	.32	**.69**		
Emotional	.61	.42	.40	**.76**	
Total	.83	.57	.71	.83	**.83**
Parent Report on Child					
Social	**.84**				
Role	.38	**.54**			
Physical	.34	.37	**.66**		
Emotional	.69	.52	.51	**.81**	
Total	.83	.60	.72	.90	**.86**

Cronbach's alpha shown in bold.

Table 6

Test-retest of Child-Self Report version

	Intraclass Correlation	Time 1 mean (SD)	Time 2 mean (SD)	Paired t-test
Total Score	.75	5.3 (10.0)	5.3 (9.5)	t = −0.00; p = 1.00
Social	.75	6.8 (18.0)	5.9 (17.3)	t = 0.65; p = 0.52
Role	.49	1.7 (5.2)	2.0 (5.2)	t = −0.49; p = 0.63
Physical	.52	10.8 (14.8)	11.7 (16.9)	t = −0.49; p = 0.62
Emotional	.88	4.2 (13.2)	4.4 (12.2)	t = −0.26; p = 0.80

Table 7

POQL scores by caries status and reported OH1

	Caries Free (mean)	Caries (mean)	p-value	OH1 EVG* (mean)	OH1 FP* (mean)	p-value
Child Self-Report (n)	(647)	(189)		(1608)	(168)	
Total Score	6.4	9.4	0.003	6.0	13.4	<0.001
Social	5.5	8.1	0.057	4.8	15.0	<0.001
Role	3.1	3.8	0.34	2.7	4.7	0.023
Physical	12.5	16.4	0.01	13.3	21.1	<0.001
Emotional	5.3	8.8	0.007	4.2	12.4	<0.001
Parent Report on Child (n)	(605)	(232)		(705)	(126)	
Total Score	3.6	5.6	0.006	3.2	11.0	<0.001
Social	3.3	5.1	0.057	2.8	11.7	<0.001
Role	1.0	2.1	0.01	0.9	3.6	0.009
Physical	7.0	9.9	0.01	6.4	17.4	<0.001
Emotional	3.5	5.7	0.02	3.1	11.2	<0.001

*EVG=Excellent, Very Good or Good; FP=Fair or Poor