

Can Oral Health-Related Quality of Life Measures Substitute for Normative Needs Assessments in 11 to 12-year-old Children?

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Abstract

Objectives: 1) assess the relationship between a measure of condition-specific oral health-related quality of life (OHRQoL) and the related normative need for dental treatments, and 2) test the diagnostic validity of the condition-specific OHRQoL measure for specific dental conditions in a group of primary school children.

Methods: A cross-sectional study of all 11 to 12 year-olds carried out in a municipal area of Suphanburi province, Thailand. 1034 children (91.8%) were dentally examined to assess their normative needs for 6 types of treatment (dental caries, traumatic dental injuries, enamel defects, periodontal, orthodontic and prosthodontic treatment). OHRQoL was assessed using the Child-OIDP index and its Condition-Specific impacts measure for the 6 treatment types. **Results:** The prevalence of specific types of normative needs ranged from 3.2% (prosthodontic) to 97.0% (periodontal) and for Condition-Specific oral impacts from 0.7% (prosthodontic) to 50.6% (dental caries). Despite their statistically significant relationship for every treatment type except for periodontal treatment when need was indicated by a CPI score of 1, there were large differences between measures of normative need and oral impacts. High proportions of children had normative need without impacts and vice versa. The biggest differences were for appearance-related conditions (e.g. enamel defects and orthodontic treatment). For every type of treatment, oral impacts poorly predicted the normative needs of individuals. **Conclusions:** Although normative needs and OHRQoL are associated, when assessed appropriately, there was considerable discrepancy between them. OHRQoL measures cannot replace normative needs. Instead, both should be used in combination in order to cover different dimensions of oral health.

Key Words: Needs assessment, oral health, quality of life, relationship, diagnostic tests, child health

Introduction

The traditional normative approach using clinical measures alone to assess oral health and oral health needs has serious inadequacies (1). The normative approach mainly considers the values of dental professionals and attributes relatively scant importance to patient's subjective perceptions about their own oral health and needs (2). The relative neglect of subjective measures is certain considering that disruptions in normal physical, psychological and social functioning are important in assessing oral health. Since then, research

has focussed on the measurement of multiple dimensions of oral health impacts on quality of life including perceived needs, particularly in relation to patients' perceptions regarding oral appearance where gender differences were expected (3, 4). A number of sociodental indicators or, as they have more recently been named, oral health related quality of life (OHRQoL) measures, were developed to assess subjective aspects of oral health (5). Since subjective perceptions about health are central to the assessment of oral health and needs, some OHRQoL measures have

been incorporated into systems for assessing oral health and dental needs (2, 6).

Subjective needs or perceived oral impacts are considered as consequences of oral conditions (1). Therefore, the relationship between clinical oral conditions and patients' perceptions of their conditions has been investigated. Results were equivocal. Strong, questionable and even no associations were reported. Studies using a simple or single-item questionnaire to assess individual's perceptions tended to report strong relationship between clinical and subjective assessments (3, 7-8), while results varied when using a systematically developed general OHRQoL indicator (9-12). It is unclear whether people with subjective oral impacts are likely to have clinical oral health needs or not. In addition to that relationship, the diagnostic validity of subjective against clinical measures has been tested. All studies found that subjective measures were poor predictors of oral conditions and concluded that individuals' perceptions were not precise enough to deduce their oral status. Therefore, subjective measures could not be used as a screening tool for clinical oral examinations (13-14). However, the interpretation of the findings from those studies, both on the relationships and the diagnostic tests, should be viewed with caution because, while clinical indicators refer to specific oral conditions, all studies that used systematically developed OHRQoL indicators obtained

their impact outcomes in terms of overall oral impacts attributed to oral problems in general and not to specific oral conditions. It is obviously incorrect to compare general OHRQoL indicator outcomes with specific oral conditions or treatment needs. No study has assessed the relationship and diagnostic agreement between subjectively assessed oral impacts attributed to specific oral conditions and the related normative needs for specific treatments. Such a methodologically correct comparison would provide better information about the relationship of condition-specific OHRQoL measures to clinical measures and would more precisely determine the usefulness of OHRQoL measures in oral health service planning. A study was planned to fill the aforementioned gap in knowledge. The objectives were: 1) to assess the relationship between a measure of condition-specific OHRQoL and the related normative need for dental treatments, and 2) to test the diagnostic validity of the condition-specific OHRQoL measure for specific dental conditions in a group of 11 to 12 year-old Thai primary school children. For each type of dental treatment, the relationship and diagnostic agreement between outcomes of the two measures were examined.

Methods

Measures. Clinical normative needs for six dental conditions were assessed, for permanent dentition only. For dental caries, the criteria in the WHO (15) survey manual were used. The Community Periodontal Index (CPI) was used for periodontal needs assessments. The Index of Orthodontic Treatment Need (IOTN) (16), the most commonly used orthodontic index in the United Kingdom (17), was used for assessing orthodontic need. There is no clear standard normative criterion for traumatic dental injuries, enamel defects/dental anomalies and prosthodontic conditions. Thus, the authors developed criteria and guidelines based on recommendations from professional bodies, international dental associations

and expert opinions (18-21). For trauma, the criteria ranged from no treatment through grinding, filling, crown, pulp treatment to extraction. For enamel defects the criteria ranged from no treatment through polishing, bleaching, filling, veneer to crown. For prosthodontic, no need, need a new denture or repairing was recorded (detailed clinical criteria are available from the authors). The developed criteria and guidelines were independently reviewed by 30 public health or academic Thai dentists.

The Child-OIDP index (22) was used to assess OHRQoL, because it is the only systematically developed OHRQoL indicator for children that can be used for assessing treatment need and it allows for the calculation of Condition-Specific Child-OIDP scores (CS-COIDP). Thus it associates oral impacts to specific oral conditions. The index assesses oral impacts on daily life in relation to 8 daily performances: a) eating, b) speaking, c) cleaning teeth, d) relaxing (including sleeping), e) smiling, laughing and showing teeth without embarrassment, f) maintaining usual emotional state, g) study (including going to school and doing homework), and h) contact with other people. For each performance, if the child reported an impact then, the severity and frequency of the impact was recorded using 3-scale answers. Moreover, the child was further asked to identify the main clinical causes of impacts on that performance. Consequently, impacts can be attributed to specific types of dental treatment such as periodontal disease (impacts caused by 'bleeding gum, swollen gum, calculus, bad breath'), malocclusion (impacts caused by 'position of teeth such as crooked, projecting, gap between teeth'). Full explanations regarding the use and psychometric properties of the Child-OIDP can be found elsewhere (22-23).

Population and procedure. The population of this study was all 1126 final year primary school children in a municipal area of Suphanburi province, Thailand. The Ethics Committee of Thailand Ministry of Public Health approved the study protocol. Primary

education and local health authorities as well as all primary schools in study areas gave permission. Informed consent was obtained from the parents by their signing and returning the relevant form, sent to them via their children as school mail. Prior to the main survey, pilot studies were carried out to validate all questionnaires and improve the practicality of their application in fieldwork; the back-translation method was used to check the validity of translation from English to Thai (22).

Data were collected through questionnaires and clinical examination on separate days for practical reason. One trained interviewer used the Child-OIDP questionnaires and self-administered questionnaires (for demographic data) on the same day. Then, clinical examinations were undertaken by 4 calibrated dentists on another day. Reliability of data was tested through ten percent random duplication. Results were between good to excellent (weighted kappa score for the Child-OIDP was 0.91, kappa scores for the self-administered questionnaires, intra- and inter-examiner variability were 0.7-1.0, 0.7-1.0 and 0.6-1.0 respectively).

Data analysis. Condition-specific Child-OIDP scores (CS-COIDP) relating to 6 types of treatment were calculated; treatment of dental caries, traumatic dental injuries, enamel defects, periodontal, orthodontic and prosthodontic treatment (5, 23). In addition, the aforementioned CS-COIDP variables were also dichotomised (0, non-0), thus indicating the presence of condition-specific impacts (CS-impacts) for each of those conditions. The relationship between normative needs and CS-COIDP was tested with non-parametric tests (Mann-Whitney, Kruskal-Wallis), due to the skewed distribution of CS-COIDP. The differences between sexes in the normative need assessments, as well as in the presence of CS-impacts, were tested by Chi-square. Differences between normative need and CS-impacts for each dental condition were assessed through the McNemar's test. The diagnostic validity of the Child-OIDP was tested through the analysis of

sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the CS-impacts, using the respective normative needs as gold-standard. Data were analyzed using the SPSS software.

Results

One thousand, one hundred and twenty-six children were invited to participate and 1101 returned positive consent forms, 1100 (97.7%) were interviewed and 1034 (91.8%) were thereafter clinically examined, and constituted the study sample of which 52.4% were male and 47.6% female. The mean age was 11.3 years.

The prevalence of normative needs ranged from 3.2% for prosthodontic to 97.0% for periodontal treatment. By comparison, the rates of Condition-Specific impacts (CS-impacts) ranged from 0.7% for prosthodontic treatment to 50.6% for treatment of dental caries (Table 1). The frequency distribution of Condition-Specific Child-OIDP (CS-COIDP) scores was skewed. Ranges of scores were between 0.0-6.9 for periodontal treatment to 0.0-38.9 for orthodontic treatment. Quartiles were 0, 1.4, 5.6 for treatment of dental caries; 0.0, 0.0, 1.4 for periodontal treatment and 0.0, 0.0, 0.0 for the other four types of treatment. Boys were more likely to have normative needs for traumatic dental injuries ($p<0.01$) and orthodontic treatment ($p<0.05$) than girls; the normative need prevalence figures referred to 25.8% of boys compared to 18.7% of girls for the former, and 38.0% compared to 31.5% respectively for the latter. On the other hand, girls were more likely than boys to report perceived oral impacts relating to orthodontic treatment ($p<0.001$) and treatment for enamel defects and dental anomalies ($p<0.05$); 25.6% of girls compared to 15.5% of boys reported impacts for the former, and 21.7% compared to 15.9% respectively for the latter (Table 1).

Condition-Specific Child-OIDP scores and normative need were positively related (Table 2). Percentiles of CS-COIDP scores in the group with normative need were higher than those in the group without normative

Table 1
Prevalence of normative needs and Condition-Specific impacts (CS-impact) relating to specific types of dental treatment

Dental treatment	Presence of normative need			Presence of CS-impact		
	% of boys	% of girls	% of sample	% of boys	% of girls	% of sample
	Dental caries	45.0	41.3	43.2	51.7	49.4
Traumatic dental injuries	25.8	18.7 †	22.4	5.2	4.1	4.6
Enamel defect/dental anomalies	25.3	24.4	24.9	15.9	21.7*	18.7
Periodontal treatment - CPI \geq 1	97.2	96.7	97.0	28.2	25.8	27.1
Periodontal treatment - CPI \geq 2	84.7	83.9	84.3			
Orthodontic treatment	38.0	31.5*	35.0	15.5	25.6 ‡	20.3
Prosthodontic treatment	3.1	3.3	3.2	0.7	0.0*	0.7

* $p<0.05$

† $p<0.01$

‡ $p<0.0001$ (Chi-square test)

Table 2
Relationship between Condition-Specific Child-OIDP (CS-COIDP) score and normative need for specific types of dental treatment

Normative need		CS-COIDP score			Mean Rank	P value	
		Median	75th	Maximum			
Dental caries	No	0.0	2.8	18.1	474.0	<0.001 *	
	Yes	2.8	6.9	31.9	574.6		
Dental injuries	No	0.0	0.0	13.9	503.2	<0.001 *	
	Yes	0.0	0.0	22.2	567.0		
Enamel defects/dental anomalies	No	0.0	0.0	16.7	503.9	<0.001 *	
	Yes	0.0	1.4	18.1	558.5		
Periodontal treatment	No	0.0	0.0	2.8	459.5	0.158 *	
	- CPI \geq 1	Yes	0.0	1.4	6.9		519.3
	- CPI \geq 2	No	0.0	0.0	5.6		467.5
Yes	0.0	1.4	6.9	526.8			
Orthodontic treatment	No	0.0	0.0	38.9	462.5	<0.001 †	
	Borderline	0.0	0.0	25.0	523.9		
	Yes	0.0	2.8	25.0	571.1		
Prosthodontic treatment	No	0.0	0.0	12.2	515.6	<0.001 *	
	Yes	0.0	0.0	13.9	576.6		

* Mann-Whitney Test

† Kruskal-Wallis Test

need. For dental caries, the median CS-COIDP score was zero in the group without normative need and 2.8 in the normative need group. For enamel defects, periodontal and orthodontic treatment, the 75th percentiles of the group without normative need were zero, while they were 1.4, 1.4 and 2.8 respectively for the normative need groups. Due to the low prevalence and skewed distribution of CS-COIDP scores relating to dental injuries and prosthodontic treatment, the 75th percentile scores of both groups, with and without normative need, were zero. The positive relationship between CS-COIDP scores and normative need

was strongly significant for every type of dental treatment ($p<0.001$), except for periodontal treatment where the relationship was not significant at a need threshold for CPI score of 1, but significant ($p=0.003$) if the threshold was raised to a CPI score of 2.

There were significant differences between the presence of condition-specific impacts (CS-impacts) and normative needs for every specific type of dental treatment ($p<0.001$) (Table 3). Furthermore, considerable proportions of children had normative need but not CS-impacts, and vice versa. CS-impacts were frequently reported without the presence of a

Table 3
Difference between and diagnostic validity of Condition-Specific impact (CS-impact) against Normative need (NN) for specific types of dental treatment

Dental treatment need	NN (Without CS-impacts)	CS-impacts (Without NN)	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Dental caries	43.2 (17.6)	50.6* (25.0)	0.59	0.56	0.51	0.64
Traumatic dental injuries	22.4 (19.2)	4.6* (1.4)	0.14	0.98	0.68	0.80
Enamel defects/dental anomalies	24.9 (18.3)	18.7* (12.1)	0.27	0.84	0.35	0.78
Periodontal treatment						
- CPI \geq 1	97.0 (70.4)	27.1* (0.5)	0.27	0.83	0.98	0.03
- CPI \geq 2	84.3 (60.1)	27.1* (2.8)	0.29	0.82	0.90	0.18
Orthodontic treatment	35.0 (24.5)	20.3* (9.8)	0.30	0.85	0.52	0.70
Prosthetic treatment	3.2 (2.8)	0.7* (0.3)	0.13	0.99	0.57	0.97

* $p < 0.001$ (McNemar Test)

normative need, particularly for treatments with an appearance-related component, such as enamel defects and orthodontic treatment. For dental caries, 43.2% had normative need but 17.6% had normative need without CS-impacts relating to caries. The level of disagreement was even higher for all other conditions. The respective figures were 22.4% and 19.2% for traumatic dental injuries, 24.9% and 18.3% for enamel defects, 97.0% and 70.4% for periodontal treatment, 35.0% and 24.5% for orthodontic treatment and 3.2% and 2.8% for prosthetic treatment. On the other hand, 50.6% of children reported CS-impacts relating to dental caries but 25.0% had CS-impacts without normative need. The respective percentages were 4.6% and 1.4% for traumatic dental injuries, 18.7% and 12.1% for enamel defects, 20.3% and 9.8% for orthodontic treatment and 0.7% and 0.3% for prosthetic treatment. The gap was very large for periodontal treatment; the respective percentages were 27.1% and 0.5%.

Tests of the diagnostic validity of CS-impacts against normative needs showed that results of the four tests were not consistent (Table 3). For dental caries, all four diagnostic values were low, ranging from 0.51 to 0.64.

The results varied greatly for other types of dental treatment. For traumatic dental injuries, sensitivity was as low as 0.14, specificity was as high as 0.98, PPV was 0.68 and NPV was 0.80. The respective values were 0.27, 0.84, 0.35 and 0.78 for enamel defects; 0.30, 0.85, 0.52 and 0.70 for orthodontic treatment; 0.13, 0.99, 0.57 and 0.97 for prosthetic treatment. For periodontal treatment, sensitivity (0.27) and NPV (0.03) were very low while specificity (0.83) and PPV (0.98) were very high. In general, sensitivity estimates were very low, while specificity was very high. PPV were low and NPV were high, except for periodontal treatment where PPV was extremely high and NPV was extremely low. Taking all results into consideration it is clear that CS-impact was a poor predictor of the presence of an individual's normative need for the specific dental treatments.

Discussion

The findings clearly reveal a large gap between normative and subjective assessments. The substantial disagreements between the two assessments is highlighted by the extremely high proportion of children normatively assessed as needing treatment that did not report CS-impacts for most

types of treatment. The relatively smaller, but still considerable, gap for dental caries may be explained by the fact that children attributed the caries related impacts to both primary and permanent teeth while the normative assessment reported here was done for permanent dentition only. On the other hand, CS-impacts were frequently reported without the presence of a normative need, particularly for treatments with an appearance-related component, such as enamel defects and orthodontic treatment. That indicates that dental appearance is a major concern in this Thai child population. Girls were more likely than boys to have CS-impacts or perceived need for these two appearance-related dental treatments.

The considerable difference between subjectively and normatively assessed needs relating to dental appearance has been highlighted by previous studies on malocclusions and teeth discolouration. Subjective needs for aesthetic-related treatment were more frequently reported by females than males (3, 4, 24). This gap between normative and subjective assessments is in line with the multi-dimensional concept of health. Normative needs assessments rely on the existence of diseases or signs that can be observed

by professionals. On the other hand, subjective perceptions are the outcomes of complex bio-psychosocial processes of individuals (25).

Despite the gap observed in this study, the analysis of relationships between normative need and OHRQoL measures revealed significant relationships for each type of dental condition. The exception was periodontal treatment when bleeding on probing (CPI score of 1) indicated normative need. This highly sensitive normative periodontal measure led to an extremely high level of normative need (97.0%) while subjective perceptions of periodontal diseases were commonly much lower than professional assessments (14).

The relationship between normative and subjective assessments has been investigated in studies on children and adolescents. The findings are inconsistent. Studies employing specific simple or single-item subjective assessments found strong relationships between such assessments and normative treatment for enamel defects or fluorosis (7), orthodontics (3-4) and dental caries (8). Other studies gave a mixed picture, with significant associations for some, but not all dental conditions (10) or even non-significant associations (9). An important reason for the variation relates to the type of measures employed. For example, overall OHRQoL outcomes are not comparable with normative need for a particular type of treatment. However, a significant positive relationship exists if overall impacts are clearly attributed to a particular normative treatment need, as was the case with orthodontics in an adolescent population where 'position of teeth' was the most frequently perceived problem causing oral impacts (4). Significant relationships were also reported when particular clinical conditions such as dental caries were likely to contribute largely to overall oral impacts (10, 12), or when both normative and subjective outcomes are assessed by related specific measures, namely early childhood caries and quality of life in terms of pain and dental appearance (8).

The present study confirms that there are generally significant relationships between normative and subjective assessments, if appropriate measures are used. However, careful interpretation of this finding is important. The statistically significant relationship indicates an association between the condition-specific Child-OIDP and normative need. However, this association presents only part of the story. At the same time, there are statistically significant differences between the presence of specific oral impacts and the respective normative need. Despite the fact that for most conditions a considerable proportion of children with normative need also reported condition-specific oral impacts, there were also considerable proportions of children with normative need but without CS-impacts, as well as children having CS-impacts without normative need. Moreover, normative need and CS-impacts may not differ much at the population level, due to a compensation of the differences of individual results. This is clearly illustrated by the results for enamel defects where the prevalence of normative and CS-impacts in the population was 24.9% and 18.7% respectively, despite the substantial disagreement between those assessments at the individual level.

Indeed, the analysis of diagnostic validity shows that CS-impacts poorly predicted the status of normative needs. Although the decision about the appropriateness of a measure cannot be made statistically using arbitrary cut-off points of diagnostic tests (26), considering the four tests in a clinical manner it seems that sensitivity together with specificity are more appropriate for high prevalence diseases and PPV together with NPV for low prevalence (<25%) diseases (27). This study has shown that the Child-OIDP could not be used as a screening tool for clinical diseases because a considerable proportion of those normatively needing treatment did not report CS-impacts. The poor ability of a subjective measure to screen clinical diseases was also previously reported (13-14). As already

mentioned, those studies did not use oral impact scores derived specifically for certain oral conditions, as happened in this study.

Generally, the index demonstrated low sensitivity in terms of identifying a clinical treatment need. This might be the result of a generally higher threshold of CS-impacts than that of normative need. Normative need exists when a condition deviating from an ideal state is detected while oral impacts would be perceived when a clinical abnormality is obvious enough, thus creating physical, psychological or social impacts on a child. On the other hand, most children not having normative need did not report CS-impacts, indicated by the generally high specificity of the index. Though some pathology may have to be present to provoke oral impacts, a child might perceive oral impacts in the absence of normative need, indicated by the generally low PPV values. This fits with a bio-psychosocial model explaining that subjective perceptions are not necessarily the direct outcome of a biological change, but a complex interaction between biological, psychological and social elements of individuals (25). However, most of the children without CS-impacts did not also have normative need; the NPV values were generally high. The exception for periodontal treatment, where PPV was extremely high and NPV was extremely low, was due to the very high prevalence of the normatively defined disease.

The implications from the findings of this study are important. First, broader OHRQoL measures can be used for descriptive purposes. However, for purposes that relate to treatment need or service provision such as planning treatment, assessing dental needs or evaluating treatment outcomes, specific relevant OHRQoL measures should be selected. The Child-OIDP and OIDP indices have the advantage that they can assess both overall and condition-specific impacts. Second, the statistically significant relationships between specific subjective measures and their

relevant clinical measures indicate association, but not necessarily agreement. Actually, there were also statistically significant differences between the two assessments. This emphasizes the fact that subjective measures cannot replace clinical measures. The presence of either subjective perceptions or clinical conditions does not accurately imply the presence of the other. Nor is either on its own adequate for assessing oral health and needs. Both measures tap into different domains of the dimensions of oral health. Thus, the assessment of oral health and treatment needs requires comprehensive measures encompassing both normative and subjective assessments used in combination. The role of either of them can be different for different dental conditions. Normative measures should be dominant for diseases that are likely to progress such as dental caries and traumatic dental injuries. On the other hand, the overreliance on normative judgement can be challenged in dental conditions that have a strong aesthetic component or are unlikely to progress or cause adverse health consequences. The use of condition-specific OHRQoL measures combined with normative assessments should be considered for such conditions.

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