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ORIGINAL ARTICLE



# Validity and reliability of the Swedish versions of the short-form Child Perceptions Questionnaire 11–14 and Parental Perceptions Questionnaire

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**ABSTRACT**

**Objective:** To examine the validity and reliability of the Swedish versions of the short-form Child Perceptions Questionnaire 11–14 ($CPQ_{11–14}$) and Parental Perceptions Questionnaire (P-CPQ) for measuring children's oral health-related quality of life (OHRQoL).

**Material and methods:** The sample comprised 247 children and parents. OHRQoL was assessed by asking each child and their accompanying parent to complete the relevant questionnaire. To allow test–retest analysis, 30 children and 32 parents were asked to complete the instrument a second time within 2–4 weeks.

**Results:** In terms of construct validity, significant correlations were observed between CPQ scale scores and the global ratings of oral health and overall well-being for both the $CPQ_{11–14}$ and the P-CPQ. Regarding internal consistency, Cronbach's alphas for the total scales were 0.81 and 0.77, respectively, indicating good reliability, and internal consistency for the subscales (two or four dimensions) was acceptable. Test–retest reliability was good for the $CPQ_{11–14}$ total scale (ICC 0.77) and acceptable for the P-CPQ total scale (ICC 0.63).

**Conclusions:** The Swedish versions of the short-form $CPQ_{11–14}$ and P-CPQ are both valid and reliable, and can be recommended for use among Swedish children aged 11–14 years for evaluation of OHRQoL.

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OHRQoL; children; parents; validation

## Introduction

Oral health-related quality of life (OHRQoL) measures have been developed and validated for use in a number of languages and cultures. One such instrument for use among children is the Child Perceptions Questionnaire 11–14 ($CPQ_{11–14}$) [1]. The original version of the $CPQ_{11–14}$ contains two global items measuring general perception of oral health and overall well-being and 35 items representing four domains of OHRQoL: oral symptoms (e.g. pain and discomfort), functional limitations (e.g. eating difficulty), emotional well-being (e.g. avoiding smiling), and social well-being (e.g. being teased by other children) [1]. This instrument is also available for parental ratings as the Parental Perceptions Questionnaire (P-CPQ), the original version of which contains the same two global items and 31 items representing the four domains [2]. In 2006, four short forms of the $CPQ_{11–14}$ instrument for self-ratings were constructed (two containing 8 items and two containing 16 items), and a comparative study showed that the psychometric properties of all four were in good agreement with those of the 35-item version [3,4]. However, the two 16-item versions were developed from an item impact method with face-to-face interviews (16-item impact short form) and from a regression model with no impact from interviews (16-regression short form), respectively. It has been suggested that the 16-item impact short form is preferable, since it includes those items of most importance to the people interviewed, who may be considered to be the ultimate experts concerning the impact of a given condition on their quality of life [4]. The ISF version is the one, which everyone uses, and so the RSF is redundant. In the following, the 16-item impact short form will be referred to as the short-form $CPQ_{11–14}$.

The $CPQ_{11–14}$ and P-CPQ were both originally developed in English, and the initial validation showed satisfactory psychometric properties [1,4]. However, the questionnaires have also been translated into several other languages including Arabic, Brazilian, Chinese, Danish, German, Korean, Spanish, and Thai. Evaluation of the psychometric properties of these translations has shown that the subscales for oral symptoms and functional limitations have low internal consistency and low ICC value in test–retest analyses [5–12]. A recent investigation of the factor structure of the $CPQ_{11–14}$ used datasets from Oceania, Asia, Europe (not including Sweden), and Latin America. The factor analysis indicated that there are actually two subscales rather than four, with oral symptoms and functional limitations forming one subscale

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(symptoms/function) and emotional well-being and social well-being the other (well-being) [13].

A Swedish translation of the full version of the $CPQ_{11–14}$ and P- CPQ were developed in 2007 by Talvilahti et al. [14]. The translation process used the technique of linguistic validation as recommended by the MAPI Research Institute (Lyon, France), which involved adapting the instrument both linguistically and culturally to Swedish conditions. The Swedish versions were then compared, differences were evaluated, and final Swedish versions of the full $CPQ_{11–14}$ and P- CPQ were determined from the comparisons [14]. The Swedish short forms were then constructed from the translation by Talvilahti et al. [14] and the selected items from the study by Foster Page et al. [4]. We have presented clinical measures in relation to the short-form $CPQ_{11–14}$ in an earlier article [15]. However, the validity and reliability of the Swedish short forms have not yet been thoroughly evaluated. Therefore, the aim of this study was to evaluate the validity and reliability of the Swedish short-form $CPQ_{11–14}$, to construct and evaluate a Swedish short form for parents (P-CPQ), and to examine the validity and reliability of the P-CPQ.

## Materials and methods

### Participants and procedure

This convenience sample ($n = 277$; 46% boys and 54% girls; mean age 11.5 years, SD 0.8) was sourced from three Swedish Public Dental Service clinics, all located in a small rural community of about 22,000 inhabitants. The material in this cross-sectional study was derived from a longitudinal study aiming to determine the prevalence and change of malocclusion [16,17]. The children also had to have been born in Scandinavia and to have at least one Scandinavian parent. Children with functional disabilities or syndromes, such as cleft lip and palate, were excluded from the original sampling and hence also from the present sample. Data collection for the present study took place from October 2012 to September 2013. Of the 277 children initially sampled for the study, 13 were excluded due to ongoing orthodontic treatment with a fixed appliance. Thus, the sample consisted of 264 child dental patients and their accompanying parents. The children with and without malocclusions underwent a routine dental clinical examination as part of a longitudinal study [17].

Children and their parents independently filled in the questionnaires in connection with a clinical examination and with the opportunity to ask questions about the questionnaires. The children answered the questions without help from their parents in a separate room at the clinic, and both children and parents could, if needed, get support from two of the authors (B.L. and L.D.). All parents and all children understood Swedish. For test–retest analyses, 30 children and 32 parents were asked to answer the questionnaires a second time within 2–4 weeks after the first time.

### Ethics approval and consent to participate

The study protocol and informed consent form were approved by the Regional Ethical Review Board in Uppsala, Sweden (ref: 2012/273). Children and their parents were invited to attend, and were asked to give their informed consent before entering the study.

### Questionnaire measures

Children's OHRQoL was assessed by the children on the Swedish version [14] of the short-form $CPQ_{11–14}$ [3,4] and by the parents on a parallel short form, P-CPQ [2], constructed by extracting those items from the original version of the P-CPQ that matched those in the short form $CPQ_{11–14}$. For the Swedish version, we used the translation by Talvilahti et al [14].

The 16 items of the short-form $CPQ_{11–14}$ and P-CPQ were initially grouped into four subscales (oral symptoms, functional limitations, emotional well-being, and social well-being) of four items each, and also summed into the two subscales symptoms/function and well-being [14] as well as a total scale score. Each item is related to symptoms from the teeth, lips, jaws, and mouth during the last 3 months. Response alternatives are on a 5-point frequency scale range from 0 ('never') to 4 ('every day'), with a total score range of 0–64 (subscale scores range from 0 to 16, and 0 to 32, respectively). Higher scores correspond to poorer status. The questionnaires also contained two global self-ratings, which were the same as those in the original versions of $CPQ_{11–14}$ [2] and P-CPQ [2]: one measuring oral health on a 5-point scale ranging from 'excellent' to 'poor' and the other measuring overall well-being on a 5-point scale ranging from 'not affected at all' to 'very much affected'. If there was more than one item missing in any of the initial four-item subscales (>25%), the questionnaire was excluded from the analyses.

### Statistical analysis

All data were analyzed using version 22.0 of the IBM SPSS Statistics software package (SPSS, Chicago, IL, USA). Descriptive statistics included frequencies and means. Psychometric analyses were performed, and Cronbach's alpha was used to evaluate internal consistency. Alpha values of $\geq 0.70$ were considered adequate [18]. For test–retest reliability, the intraclass correlation coefficient (ICC) was computed [19,20]. An ICC $> 0.75$ represented excellent reliability, an ICC between 0.60 and 0.75 good, 0.40–0.59 fair, and $<$ 0.40 poor reliability [20]. Construct validity was evaluated using Spearman's correlation coefficient to correlate CPQ scale scores with the global ratings of oral health and overall well-being. Factor analysis (by principal components analysis with varimax rotation) was used to explore the factor structure of the $CPQ_{11–14}$ and the P-CPQ. As a rule of thumb to access significance of factor loadings, factor loadings of 0.3 to 0.4 are minimally accepted [21].

## Results

### Sample characteristics

Of the 264 children in this validation study, 7 were excluded due to missing data on the short-form $CPQ_{11–14}$, giving a final sample of 257 children: 121 (47%) boys and 136 (53%) girls. Of the 257 adults accompanying these children, two were excluded since they were not the child's parent and eight were excluded due to missing data in the P-CPQ, giving a final sample of 247 parents: 166 (67%) mothers and 81 (33%) fathers. The test–retest analysis of the short-form $CPQ_{11–14}$ was based on 27 children (three did not respond a second time), and that of the short-form P-CPQ was based on 32 parents.

### Descriptive data on the $CPQ_{11–14}$ and P-CPQ

The mean total score on the short-form $CPQ_{11–14}$ was 9.3 with no difference between genders and higher than the mean total score for the short-form P-CPQ, 5.2 (Table 1). Mean subscale scores for the 4-item subscales varied from 1.3 to 3.9 for $CPQ_{11–14}$ and from 0.5 to 2.8 for P-CPQ. Equal patterns were seen between $CPQ_{11–14}$ and P-CPQ, with the lowest value for the social well-being subscale and the highest value for the oral symptoms subscale. Consequently, mean scores for the two-item subscales were higher for the symptoms/function subscale and lower for the well-being subscale (Table 1). The floor effects (proportion of answers scoring the lowest) were 2.3% ($CPQ_{11–14}$) and 8.1% (P-CPQ), while no ceiling effects (proportion of answers scoring the lowest) were found.

### Internal consistency

The internal consistency of the $CPQ_{11–14}$ was sufficient, with a Cronbach's alpha of 0.81 for the total scale. However, the alpha value was lower for the initial four-item subscales (0.53–0.77), with the lowest values found for oral symptoms and functional limitations. When examining the eight-item subscales (symptoms/function and well-being), the alpha value increased (Table 3). The internal consistency of the P-CPQ was again sufficient, with a Cronbach's alpha of 0.77 for the total scale. Both the four-item and eight-item subscales showed slightly lower values for the P-CPQ than for the $CPQ_{11–14}$ scales (Table 3).

### Validity

Validity was tested by correlating the $CPQ_{11–14}$ and P-CPQ total scores with the respective global ratings of oral health ($r_{cpq} = 0.41$; $p < .01$; $r_{p\text{-}cpq} = 0.32$; $p < .01$) and overall well-being ($r_{cpq} = 0.37$; $p < .001$; $r_{p\text{-}cpq} = 0.36$; $p < .01$). There were also weak to moderate significant correlations between all subscale scores and the global ratings of oral health and overall well-being, with the only exception being the functional limitations subscale of the P-CPQ (Table 4). An ascending gradient was observed in mean scale scores across the ordinal categories of the two global items covering oral health and overall well-being, with only one deviation (Table 2), this gives strength to the validity of the scales.

We did an exploratory factor analysis of the children's and the parents answers, respectively, with an eigenvalue above 1 and a scree plot. For the $CPQ_{11–14}$ we found 2–5 factors and for P-CPQ we found 2–4 factors. The scree plots and evaluation of interpretability pointed to a dimensionality of two factors (Table 5).

### Test–retest reliability

The test–retest reliability was excellent for the total $CPQ_{11–14}$ scale (ICC 0.77), and good for the subscales (ICC 0.62–0.74; Table 3). The P-CPQ scale showed a moderate test–retest reliability for the total scale (ICC 0.63), while the subscales had ICCs ranging from 0.14 to 0.85, indicating poor to excellent test–retest reliability (Table 3).

## Discussion

This study evaluated the validity and reliability of the Swedish versions of the short-form $CPQ_{11–14}$ and P-CPQ for self-assessment and parental assessment of children's OHRQoL. The validation showed that these versions are both suitable for use among children aged 11–14 when using the total score as an overall measure, and that they may also be used as two-dimensional but not four-dimensional scales.

The questionnaires were applied in a sample of ordinary child dental patients who took part in a longitudinal study and, together with a parent, entered a follow-up examination at about 12 years of age. The questionnaire was tested for cross-sectional validity and reliability, and compared with the original instrument and the original validation.

**Table 1.** Descriptive data including scale range, mean score, standard deviation (SD), and range for the short forms of the $CPQ_{11–14}$ ($n = 257$) and P-CPQ ($n = 247$).

| | Children's self-ratings on $CPQ_{11–14}$ | | | | Parental ratings on P-$CPQ_{11–14}$ | | | |
|---|---|---|---|---|---|---|---|---|
| | Scale range | Mean | SD | Range | Scale range | Mean | SD | Range |
| Total scale | 0–64 | 9.3 | 6.2 | 0–33 | 0–64 | 5.2 | 4.3 | 0–26 |
| Four subscales | | | | | | | | |
| Oral symptoms | 0–16 | 3.9 | 2.1 | 0–11 | 0–16 | 2.8 | 1.9 | 0–8 |
| Functional limitations | 0–16 | 2.2 | 2.2 | 0–10 | 0–16 | 1.2 | 1.6 | 0–9 |
| Emotional well-being | 0–16 | 1.9 | 2.3 | 0–11 | 0–16 | 0.7 | 1.4 | 0–9 |
| Social well-being | 0–16 | 1.3 | 1.7 | 0–10 | 0–16 | 0.5 | 0.9 | 0–5 |
| Two subscales[a] | | | | | | | | |
| Symptoms/function | 0–32 | 6.1 | 3.5 | 0–16 | 0–32 | 3.9 | 2.9 | 0–16 |
| Well-being | 0–32 | 3.2 | 3.7 | 0–21 | 0–32 | 1.2 | 2.1 | 0–11 |

[a]Two-subscales analysis as recommended by Thomson et al. [13].

**Table 2.** Concurrent validity of the short forms of the $CPQ_{11-14}$ ($n = 255$[a]) and P-CPQ ($n = 247$).

| | Response alternatives and response distributions on the global questions | | | | |
|---|---|---|---|---|---|
| Children's self-ratings on $CPQ_{11-14}$ | | | | | |
| Global item 1 – Oral health. Would you say the health of your teeth, lips, jaws, and mouth is as follows: | Excellent ($n = 49$) | Very good ($n = 91$) | Good ($n = 95$) | Fair ($n = 20$) | Poor ($n = 0$) |
| Mean (SD) | 5.5 (4.3) | 8.6 (6.1) | 10.8 (5.6) | 14.1 (7.9) | – |
| Global item 2 – Overall well-being. How much does the condition of your teeth, lips, jaws, and mouth affect your life overall? | Not at all ($n = 110$) | Very little ($n = 66$) | Some ($n = 51$) | A lot ($n = 18$) | Very much ($n = 10$) |
| Mean (SD) | 6.9 (5.4) | 10.3 (5.8) | 12.0 (6.7) | 12.6 (6.0) | 8.9 (6.6) |
| Parental ratings on P-CPQ | | | | | |
| Global item 1 – Oral health. Would you say the health of your child's teeth, lips, jaws, and mouth is as follows: | Excellent ($n = 42$) | Very good ($n = 115$) | Good ($n = 75$) | Fair ($n = 15$) | Poor ($n = 0$) |
| Mean (SD) | 2.4 (2.0) | 5.2 (4.0) | 6.1 (5.2) | 7.8 (3.2) | – |
| Global item 2 – Overall well-being. How much does the condition of your child's teeth, lips, jaws, and mouth affect your life overall? | Not at all ($n = 91$) | Very little ($n = 69$) | Some ($n = 45$) | A lot ($n = 38$) | Very much ($n = 4$)) |
| Mean (SD) | 3.2 (2.9) | 5.3 (3.9) | 7.2 (4.4) | 6.8 (7.2) | 8.5 (7.2) |

[a]Two participants had missing data.

**Table 3.** Internal consistency and test–retest reliability of the short forms of the $CPQ_{11-14}$ and P-CPQ.

| | | Children's self-rating | | Parental rating | |
|---|---|---|---|---|---|
| | | Internal consistency ($n = 257$) | Test–retest ($n$=27) | Internal consistency ($n$=247) | Test–retest ($n$=30) |
| | No. of items included | Cronbach's alpha | ICC (95% CI) | Cronbach's alpha | ICC (95% CI) |
| Total scale | 16 | 0.81 | 0.77 (0.55–0.89) | 0.77 | 0.63 (0.36–0.80) |
| Four subscales | | | | | |
| Oral symptoms | 4 | 0.53 | 0.62 (0.32–0.81) | 0.53 | 0.71 (0.49–0.85) |
| Functional limitations | 4 | 0.57 | 0.65 (0.37–0.83) | 0.36 | 0.85 (0.71–0.92) |
| Emotional well-being | 4 | 0.77 | 0.66 (0.36–0.83) | 0.75 | 0.37 (0.03–0.64) |
| Social well-being | 4 | 0.57 | 0.74 (0.50–0.88) | 0.48 | 0.58 (–0.39 to –0.29) |
| Two subscales[a] | | | | | |
| Symptoms/function | 8 | 0.66 | 0.70 (0.44–0.85) | 0.62 | 0.78 (0.60–0.89) |
| Well-being | 8 | 0.81 | 0.74 (0.51–0.87) | 0.77 | 0.14 (–0.22 to –0.46) |

[a]Two-subscales analysis as recommended by Thomson et al. [13].

**Table 4.** Construct validity – rank correlation between the short forms of the $CPQ_{11-14}$ and P-CPQ and global ratings of oral health and overall well-being. $CPQ_{11-14}$ ($n = 257$) and P-CPQ ($n = 247$).

| | Global ratings by children themselves ($n = 257$) | | | | Global parental ratings ($n = 247$) | | | |
|---|---|---|---|---|---|---|---|---|
| | Oral health | | Overall well-being | | Oral health | | Overall well-being | |
| | $r_s$ | $p$-value | $r_s$ | $p$-value | $r_s$ | $p$-value | $r_s$ | $p$-value |
| Total scale | 0.41 | <.01 | 0.37 | <.01 | 0.32 | <.01 | 0.36 | <.01 |
| Four subscales | | | | | | | | |
| Oral symptoms | 0.30 | <.01 | 0.33 | <.01 | 0.33 | <.01 | 0.31 | <.01 |
| Functional limitations | 0.24 | <.01 | 0.17 | <.05 | 0.11 | NS | 0.24 | <.01 |
| Emotional well-being | 0.39 | <.01 | 0.35 | <.01 | 0.23 | <.01 | 0.33 | <.01 |
| Social well-being | 0.27 | <.01 | 0.21 | <.05 | 0.24 | <.01 | 0.21 | <.01 |
| Two subscales[a] | | | | | | | | |
| Symptoms/function | 0.31 | <.01 | 0.31 | <.01 | 0.28 | <.01 | 0.33 | <.01 |
| Well-being | 0.37 | <.01 | 0.32 | <.01 | 0.26 | <.01 | 0.32 | <.01 |

[a]Two-subscales analysis as recommended by Thomson et al. [13].

In psychometrics, validity reflects the degree to which evidence and theory support the interpretation of test scores. We tested validity by examining the correlations between the total and subscale scores on the short-form $CPQ_{11-14}$ and P-CPQ and the global ratings of oral health and overall well-being. These correlations were significant, with only one exception, and the correlation between $CPQ_{11-14}$ and oral health was higher than the correlation found in the original validation by Jokovic et al. [3]. The correlation with the global rating of overall well-being was in agreement with that reported by Jokovic et al. [3]. Further, the almost complete pattern of an ascending gradient in mean scale scores across the ordinal categories of the two global items gives strength to the validity of the scales. Floor and ceiling effects in terms of the proportion of answers scoring the lowest or highest possible scores were acceptable, although the response

**Table 5.** Outcome of exploratory factor analyses of the short forms of the $CPQ_{11–14}$ and P-CPQ (varimax rotated solutions).

| | $CPQ_{11–14}$ | | $P\text{-}CPQ_{11–14}$ | |
|---|---|---|---|---|
| | Factor loadings[a] | | Factor loadings[b] | |
| Item | Factor 1 | Factor 2 | Factor 1 | Factor 2 |
| Pain in your teeth | 0.120 | 0.601 | 0.158 | 0.633 |
| Sores in your mouth | 0.114 | 0.611 | 0.162 | 0.652 |
| Bad breath | 0.070 | 0.530 | 0.088 | 0.472 |
| Food stuck in between your teeth | 0.014 | 0.553 | 0.122 | 0.459 |
| Taken longer than others to eat a meal | 0.281 | 0.384 | 0.332 | 0.357 |
| Difficulty biting or chewing food | 0.288 | 0.413 | 0.289 | 0.403 |
| Difficulty saying any words | 0.335 | 0.318 | −0.082 | 0.552 |
| Difficult to drink or eat hot or cold foods | 0.114 | 0.565 | 0.128 | 0.332 |
| Felt irritable or frustrated | 0.740 | 0.142 | 0.640 | 0.316 |
| Felt shy or embarrassed | 0.678 | 0.187 | 0.593 | 0.336 |
| Been concerned what other people think | 0.488 | 0.426 | 0.705 | 0.147 |
| Been upset | 0.821 | 0.078 | 0.720 | 0.248 |
| Avoiding smiling or laughing | 0.555 | 0.259 | 0.755 | −0.180 |
| Argued with other children or your family | 0.644 | 0.084 | 0.345 | 0.329 |
| Other children teased you or called you names | 0.564 | 0.035 | 0.519 | 0.034 |
| Other children asked questions about teeth | 0.526 | 0.154 | 0.426 | 0.254 |

[a]Factor 1 Eigenvalue = 3.6, with 22.2% of the variance explained; Factor 2 Eigenvalue = 2.4, with 15.0% of the variance explained; KMO = 0.80.
[b]Factor 1 Eigenvalue = 3.2, with 20.0% of the variance explained; Factor 2 Eigenvalue = 2.5, with 15.4% of the variance explained; KMO = 0.77.

distributions for both informant categories were skewed to low levels (i.e. there was no ceiling effect).

Reliability, in terms of stability, was assessed using a test–retest analysis. In the $CPQ_{11–14}$ the ICC for the total scale (0.77) indicated excellent reliability, while the P-CPQ had a lower ICC (0.63) indicating good reliability; this was not in agreement with the validation by Jokovic et al. [2], where the ICC for the total scale was 0.85 (95% CI: 0.74–0.91).

Reliability also provides an estimate of the correlation among items (internal consistency) in a psychometric test, reflecting whether the questions measure the same phenomena. One way to test this is to examine the expected correlation among items using Cronbach's alpha. The mean Cronbach's alpha for the total scale in the Swedish version of the short-form $CPQ_{11–14}$ was 0.81, indicating good reliability, which is in agreement (0.83) with the original validation by Jokovic et al. [3]. The P-CPQ total scale showed a slightly lower internal consistency which did not clearly match the result reported by Jokovic et al. [2]. Even lower levels of alpha values were found for the subscales for both informant categories, with particularly poor internal consistency [18] for the functional limitations and social well-being subscales of the parental ratings. The two eight-item subscales suggested by Thomson et al. [13] gave higher alpha values and, with the exception of the well-being subscale for parental ratings, also higher ICCs, indicating better internal consistency and test–retest stability than for the initial four-item subscales.

Furthermore, the factor analyses gave good support to the two eight-item subscales suggested by Thomson et al [13]. Albeit, worth to consider is that in the Swedish translation of $CPQ_{11–14}$ the two items 'Difficulty saying any words' and 'Been concerned what other people think' loaded equally high in both factor 1 and 2. This is not unreasonably, since, in our opinion, these items can be interpreted as having connections to both subscales (symptoms/function and well-being). In the P-CPQ, the two items 'Taken longer than others to eat a meal' and 'Argued with other children or your family' loaded in both subscales.

Thus, in addition to the total score as a measure of children's oral health related quality of life, the Swedish versions of the short-form $CPQ_{11–14}$ and P-CPQ can be used as an instrument to assess the two dimensions of symptoms/function and well-being. However, the four-item subscale scores should be interpreted with caution.

## Conclusions

The validity and reliability tests of the Swedish versions of the short-form $CPQ_{11–14}$ and P-CPQ indicate that these instruments are useful tools to assess children's OHRQoL. In addition to the total score as an overall measure, the scale may be used as a two-dimensional but not a four-dimensional scale. The Swedish versions of the short-form $CPQ_{11–14}$ and P-CPQ can therefore be recommended for use in Swedish populations aged 11–14 years for evaluation of OHRQoL.

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