

Original Article

Cross-Cultural Validation of the Scale of Oral Health-Related Outcomes for 5-Year-Old-Children with a Low-Income Sample from the Dominican Republic

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ABSTRACT

Aims and Objectives: To conduct a thorough psychometric assessment and validation of a Spanish-adapted version of the Scale of Oral Health-Related Outcomes for 5-Year-Old-Children (SOHO-5).

Materials and Methods: The sample consisted of 69 children aged 6 and 7 years attending a public school from a low-income community in the Dominican Republic. Outcomes consisted of SOHO-5 test scores and caries lesion severity scores, with the latter measured according to the International Caries Detection and Assessment System criteria. The IBM SPSS Statistics 20 and Mplus 7.4 programs were used for the statistical analyses.

Results: A confirmatory factor analysis revealed an excellent fit for the theoretical one-factor structure of the SOHO-5, with all the items having high loadings on this latent factor. In addition, the SOHO-5 was able to significantly explain a large amount of variance (37%) in caries lesion severity ($P < 0.001$), while its scale scores had good internal consistency reliability (Cronbach's alpha [α] = 0.85, 95% confidence interval [CI] 0.79–0.90). Further, the SOHO-5 could identify children with moderate and extensive caries lesions (area under the receiver operating characteristic curve = 0.82, 95% CI 0.70–0.94, $P < 0.001$).

Conclusions: The current findings highlight the good psychometric properties and criterion-related validity of the Spanish-adapted SOHO-5 for young children who come from impoverished backgrounds.

KEYWORDS: *Dental caries, oral health, psychometric properties, quality of life, reliability, validity*

Received : 22-12-16.
Accepted : 15-04-17.
Published : 22-05-17.

INTRODUCTION

Dental caries is an oral health problem that affects 60%–90% of children of all ages and regions of the world,^[1,2] in particular those who come from developing countries. It has a negative impact in the feeding habits, education, recreation, and other social and emotional events that are important for the healthy development of a child.^[3,4] In addition, dental caries in children can result in substantial treatment costs to both their family and the government as a result of expensive restorative procedures and because of the need of advanced behavior management strategies such as sedation and general anesthesia.^[5]

In the last decade, there has been an increased awareness and understanding regarding the impact of children's oral

health in their daily lives. This has led to the development of numerous measurement instruments intended to evaluate how oral health may be affecting children's day-to-day activities such as eating, sleeping, or playing.^[4,6-8] These instruments attempt to measure what is known as oral health-related quality of life (OHRQoL), a construct that encompasses functional, psychosocial, and social factors, as well as the experience of pain,^[3] all of which have an impact in the performance of the daily activities

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How to cite this article: Abreu-Placeres N, Garrido LE, Félix-Matos LE. Cross-cultural validation of the scale of oral health-related outcomes for 5-year-old-children with a low-income sample from the Dominican Republic. J Int Soc Prevent Communit Dent 2017;7:84-9.

Access this article online

Quick Response Code:



Website: www.jispcd.org

DOI: 10.4103/jispcd.JISPCD_513_16

of the child. In addition, they have become essential when evaluating caries interventions and dental services as these measures can serve as effective screening tools for dental lesions.^[7] Aside from their cost-effective nature, these instruments can be administered to different types of informants, such as the child's parents or guardians, and the child himself, further augmenting their usefulness.

The Self-Reported Scale of Oral-Health Outcomes for 5-year-old Children (SOHO-5)^[8] was originally developed to evaluate the effectiveness of an intervention designed to improve the oral health of Scottish children. Because it can be administered to younger children, the SOHO-5 can provide valuable information of the OHRQoL of children at a critical age in their dental development. The research showed that even children of this age could provide valuable perceptions of the impact of their oral health on different aspects of their lives.^[8] Overall, the SOHO-5 is an easy-to-administer instrument that includes seven short questions intended to measure a unitary construct [Table 1].

Even though the responses to the SOHO-5 have produced satisfactory levels of reliability and criterion-related validity, more validation studies are needed. For example, it is not known if the good properties of the SOHO-5 would be maintained if it were administered to children from impoverished backgrounds, which often have low educational levels. In this regard, initial adaptations to the Brazilian culture have provided encouraging results.^[9] In addition, as with any psychological tool intended to measure latent dimensions (such as OHRQoL), appropriate statistical

techniques such as factor analysis are needed to establish the construct validity of the scores derived from the instrument. As far as the authors are aware, no studies to date have examined the factor structure of the SOHO-5 items. Therefore, the current study examined the factorial validity of the SOHO-5 self-reports provided by Spanish-speaking children from a low-income community from the Dominican Republic. In addition, an explanatory factor model was also tested to determine the capacity of the SOHO-5 latent scores to explain the variance in caries lesions as suggested by the International Caries Detection and Assessment System (ICDAS), a widely used coding system that quantifies the extent of dental lesions on an ordinal scale of seven points.^[10]

MATERIALS AND METHODS

PARTICIPANTS AND PROCEDURE

The sample of this study comprised 69 children with ages between 6 (55.1%) and 7 (44.9%) years. The distribution in relation to gender was approximately equal (50.7% girls, 49.3% boys), with the majority of the children attending first grade (68.1%) and the rest second grade (31.9%). At the time of the study, all the children were attending the same public school from a low-income area belonging to the National District in Santo Domingo, Dominican Republic.

The SOHO-5 was linguistically and culturally adapted to the Dominican population by a team of dental and psychology researchers following recommended guidelines.^[11] First, the items of the instrument were translated using the parallel-blind technique. This approach involved the participation of two bilingual

Table 1: Prevalence (%) of oral impacts by scale of oral health-related outcomes for 5-year-old-children item and overall impact

Number	Item	No (%)	A little (%)	A lot (%)
1	Has it ever been hard for you to eat because of your teeth? <i>¿Alguna vez se te ha hecho difícil comer porque te dolían tus dientes o muelas?</i>	42.0	34.8	23.2
2	Has it ever been hard for you to drink because of your teeth? <i>¿Alguna vez se te ha hecho difícil beber porque te dolían tus dientes o muelas?</i>	60.9	17.4	21.7
3	Has it ever been hard for you to speak because of your teeth? <i>¿Alguna vez se te ha hecho difícil hablar porque te dolían tus dientes o muelas?</i>	60.3	27.9	11.8
4	Has it ever been hard for you to play because of your teeth? <i>¿Alguna vez se te ha hecho difícil jugar porque te dolían tus dientes o muelas?</i>	63.8	14.5	21.7
5	Have you ever not smiled because your teeth were hurting? <i>¿Alguna vez se te ha hecho difícil sonreír porque te dolían tus dientes o muelas?</i>	63.8	18.8	17.4
6	Have you ever not smiled because of how your teeth look? <i>¿Alguna vez se te ha hecho difícil sonreír por como se ven tus dientes o muelas?</i>	57.4	23.5	19.1
7	Has it ever been hard for you to sleep because of your teeth? <i>¿Alguna vez se te ha hecho difícil dormir porque te dolían tus dientes o muelas?</i>	56.6	18.8	24.6
Overall oral impact		26.1	73.9	

Sample size was 69 for items 1, 2, 4, 5, 7, and 68 for items 3 and 6; the Spanish adapted items appear in italics; the overall impact score indicates that 73.9% of the children reported at least one oral impact in their daily life

researchers who were proficient in English and Spanish who translated the items from the source (English) to the target language (Spanish). Second, the two translations were compared and the discrepancies were resolved to arrive at the optimal versions of the items. Third, a pilot study was conducted with ten children aged 6 and 7 years with similar characteristics to those of the target sample. As a result of this pilot study, some minor modifications were made to improve the understanding of the items (e.g., instead of referring only to "teeth," the adapted items included the phrasing of "teeth or molars" as many people make that distinction in the Dominican culture). In addition, the word "hurt" (originally only included in item 5) was added to items one to four and seven because it was determined that it helped the children to understand the meaning of the questions.

Prior to the data collection phase, the study was approved by the Ethics Committee of the author's university (approval no. CEI:2015-04) and by the National Council of Bioethics in Health of the Dominican Republic (CONABIOS; approval no. 004-2015). Next, informed consents were sent to the parents, and of those who accepted, their children were approached at their school. At this time, the study was explained to the children in terms that they could understand, and a verbal assent was obtained from those who wanted to participate.

The first step in the evaluation process consisted of a professional dental cleaning that was performed to each child at the dental community clinic within the school. After this cleaning, a calibrated ICDAS examiner evaluated the children's teeth, and a score from zero (no lesions) to six (extensive lesions) was assigned to each surface. To establish the reliability of these scores, a second calibrated ICDAS examiner re-assessed 238 surfaces without knowledge of the scores provided by the first examiner. Due to the ordinal nature of the ICDAS scores, the intraclass correlation coefficient (ICC) was used as a measure of agreement between the two examiners. According to the ICC, the absolute agreement between the two ICDAS examiners was 0.791, which suggests an excellent level of inter-rater reliability.^[12]

After the children's teeth were evaluated by the examiners, and on a different day, the SOHO-5 was administered separately to each child at their school. The protocol for the administration of the instrument required that the interviewers read aloud each of the SOHO-5 items and collected the verbal responses of the participants. Throughout this process, the children also had in their hands a large paper with the response option labels in large fonts. In total, the duration of the study was 6 weeks.

Measures

The SOHO-5^[8] was adapted to Spanish and administered to the children participating in this study. The SOHO-5 consists of seven short items, each evaluating the impact of the child's oral health on different areas of their daily lives [Table 1]. The responses to the SOHO-5 are coded through a three-point Likert scale with options of "no" (0 points), "a little" (1 point), and "a lot" (2 points). A global score is obtained by summing the scores on the seven items. Previous research has indicated adequate reliability levels for this total scale score (Cronbach's alpha >0.70).^[8,13] In addition, the instrument has shown significant associations with subjective oral health outcomes as well as capability to discriminate between different clinical groups in relation to active caries lesions.^[8] To aid the responding process for the young children, corresponding faces were added to each response option of the SOHO-5.^[13]

STATISTICAL METHODS

The factor structure of the SOHO-5 was examined through confirmatory factor analysis (CFA). Because the items of the SOHO-5 provide measurements at an ordinal level, the model was analyzed using a robust weighted least squares estimator with mean- and variance-adjusted standard errors over polychoric correlations. Item factor loadings ≥ 0.70 were considered high, ≥ 0.55 and < 0.70 medium, ≥ 0.40 and < 0.55 low, and < 0.40 nonsalient.^[14] Next, and to evaluate the capacity of the SOHO-5 latent scores to explain the variance in the ICDAS severity scores, a factor model was estimated where the ICDAS scores were regressed on the SOHO-5 factor scores [Figure 1]. Standardized regression coefficients with absolute values ≥ 0.50 were considered large, between ≥ 0.30 and < 0.50 medium, and < 0.30 small.^[14] The fit of these factor models to the observed data was assessed

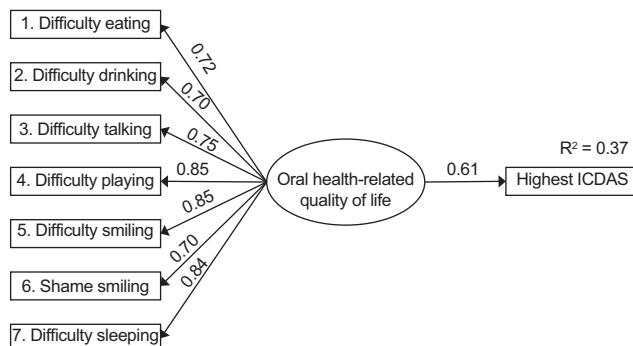


Figure 1: Explanatory factor model with the Highest International Caries Detection and Assessment System Score Regressed on the Scale of Oral Health-Related Outcomes for 5-year-old-Children Latent Dimension. R^2 = variance explained. The values next to the arrows indicate the size of the standardized factor loadings or regression coefficients. The rectangles represent observed variables, while the oval represents a latent dimension. $P < 0.001$ for all parameter estimates

using three widely recommended fit indices, the root mean square error of approximation (RMSEA) index, the comparative fit index (CFI), and the Tucker-Lewis index (TLI). Values of RMSEA <0.05, CFI ≥0.95, and TLI ≥0.95 were considered to indicate a good fit to the observed data.^[14]

The reliability of the SOHO-5 scores was assessed with Cronbach's alpha coefficient of internal consistency (α). A rule of thumb for interpreting alpha coefficients is that values ≥0.90 are considered excellent, ≥0.80 and <0.90 good, ≥0.70 and <0.80 acceptable, and <0.70 questionable. Furthermore, a 95% confidence interval (CI) for the point estimate of the alpha coefficient was constructed according to alpha's standard error statistic.^[15] Regarding the ICDAS criteria, a total caries lesion score was computed by selecting the worst ICDAS score for each child. ICDAS original scores of zero, one, and two were recoded as sound or initial lesions (new code zero), codes three and four as moderate lesions (new code one), and codes five and six as extensive lesions (new code two). These new code groups were expected to better reflect differences in perceived levels of pain by the children.

All factor models were estimated using the Mplus software version 7.4. Data handling and alpha coefficient estimation were performed with IBM SPSS Statistics 20 (IBM Corporation, 2011) and for Mplus software version 7.4: Muthén & Muthén, 2015). Alpha's standard error was computed with SPSS syntax.^[15] The two missing values (0.4% of the total responses) were imputed with the item median for the reliability and factor analyses.

RESULTS

DESCRIPTIVE ANALYSES

The frequencies (%) of endorsement for each response option of the SOHO-5 items are shown in Table 1. In total, 57.8% of the responses indicated "no" daily difficulties, 22.2% showed "a little" difficulty, and 19.9% "a lot" of difficulties in the daily lives of the children due to their oral health. The activity that showed the greatest impact was eating, with 58.0% of the children reporting difficulties (34.8% a little, 23.2% a lot). Furthermore, at the highest level of difficulty ("a lot"), the activity that was the most affected was sleeping (24.6%). In general, an overall impact score was computed showing that 73.9% of the children experienced difficulty in at least one activity of their daily lives as measured by the SOHO-5 items. In addition, 58.0% of the children reported that at least one activity highly impacted their oral health (a response of "a lot") [Table 1].

CONSTRUCT VALIDITY

The CFA one-factor model that was fitted to the seven SOHO-5 items produced a good fit to the data, with a

Chi-square value of 13.77 with 14 degrees of freedom ($P = 0.47$). This nonsignificant Chi-square indicates that there was no statistically significant difference between the observed matrix of polychoric correlations and the model-implied correlation matrix, therefore supporting the theoretical one-factor model. Further, all three fit indices indicated an excellent level of fit to the data (CFI = 1.000 > 0.95; TLI = 1.000 > 0.95; RMSEA = 0.000 < 0.05). Regarding the factor loadings of the SOHO-5 items, all obtained standardized factor loadings were in the range considered as "high" (≥ 0.70), thus evidencing the excellent quality of the OHRQoL indicators contained in the SOHO-5 [Figure 1].

CRITERION VALIDITY

The factor model estimated to evaluate the criterion validity of the SOHO-5 is presented in Figure 1. The highest ICDAS scores for the children were distributed as follows: 15.9% of the children only had sound or initial lesions, 10.1% had one or more moderate lesions, and 73.9% had one or more extensive lesions. As with the CFA model, the fit of the explanatory model was good with a nonsignificant Chi-square of 21.75 with 20° of freedom ($P = 0.35$). In addition, the fit indices indicated a good fit to the data as well (CFI = 0.995 >0.95; TLI = 0.993 >0.95; RMSEA = 0.036 <0.05). As the model in Figure 1 shows, the criterion validity of the SOHO-5 latent scores was supported with a large standardized regression coefficient of 0.61 ($P < 0.001$), which explained 36.8% of the variance in the ICDAS caries lesion scores. Further, according to receiver operating characteristic curve analysis, the observed SOHO-5 total score could identify children with moderate and extensive caries lesions from those with sound or initial lesions (area under the curve = 0.82, 95% CI 0.70–0.94, $P < 0.001$) [Figure 1].

GLOBAL SCORE RELIABILITY

According to Cronbach's alpha coefficient, the internal consistency of the SOHO-5 scale scores was good, with a point estimate of 0.848 (>0.80). In addition, the 95% CI for alpha ranged between 0.794 and 0.903, showing again a good level of reliability even at the lower level of the CI. Furthermore, as can be seen in Table 2, all items contributed positively to the reliability of global score (see "alpha if item deleted" column) [Table 2].

DISCUSSION

The SOHO-5 is a particularly useful OHRQoL measurement instrument because it can be used with younger children of just 5 years of age.^[8] So far, initial validation studies have shown the SOHO-5 to be a reliable instrument, with easy-to-understand questions and criterion-related validities with pertinent outcomes

Table 2: Internal consistency and item-total statistics of the scale of oral health-related outcomes for 5-year-old-children

Item	Corrected item-total correlation	Alpha if item deleted
Difficulty eating	0.580	0.831
Difficulty drinking	0.566	0.834
Difficulty speaking	0.594	0.830
Difficulty playing	0.636	0.823
Difficulty smiling	0.667	0.818
Shame smiling	0.573	0.832
Difficulty sleeping	0.637	0.823

Alpha for the total scale was 0.848

such as cavity lesions, traumatic dental injuries, and overall well-being.^[8,13,16-19] Despite these favorable properties of the SOHO-5 scores, however, its latent factor structure had yet to be examined with appropriate psychometric methods, an essential step in establishing the construct validity of any psychological instrument. In addition, there was limited information regarding the cross-cultural validity of the instrument with populations that do not speak English and come from developing countries where education levels are lower and oral health is a greater problem. Further, no study had evaluated the capability of the SOHO-5 scores to explain caries lesion severity according to the widely used ICDAS criteria. Due to these issues, a thorough validation procedure of the SOHO-5 was conducted in the current study with Spanish-speaking children aged 6 and 7 years from a low-income community in Santo Domingo, Dominican Republic.

The proposed one-factor latent structure of the SOHO-5 was evaluated through a CFA with appropriate methods for categorical variables. The results of this analysis showed an excellent fit to the data, thus supporting the notion that the SOHO-5 provides information of a unitary OHRQoL construct. In addition, the factor loadings were all high, indicating very good psychometric quality for the test items. In terms of the criterion-related validity of the SOHO-5 scores, an explanatory factor model was estimated where ICDAS caries severity scores were regressed on the OHRQoL factor. This model also fitted the data well and was able to explain around 37% of the variance in the ICDAS scores. This statistically significant relation with caries severity further supports the validity of the SOHO-5, which had previously been shown to correlate with caries lesions as measured by the World Health Organization criteria.^[16] In all, these results provide the first evidence supporting the theoretical latent structure of the SOHO-5 and its relation with caries severity according to the widely used ICDAS coding system.

Regarding the reliability of the SOHO-5 global scale scores, the findings from this study revealed that they had a good level of internal consistency ($\alpha = 0.85$), which was actually higher than previous reported values for the instrument that had ranged between 0.740 and 0.778.^[13] Additional analysis at the item level showed that all seven variables contributed positively to the reliability of the scale scores, thus supporting the use of all items when computing a global OHRQoL score.

It is notable that a high number of children (74%) in this study indicated that at least one aspect of their daily lives was being affected by their oral health. Even more concerning, 58% of the children reported that at least one activity was being highly impacted by the pain they experienced from their teeth. These results are much higher than those found for Scottish children^[8] but are in line with those encountered in other Latin-American communities.^[13,16] In addition, they highlight the importance of measuring the OHRQoL of young children and provide insight into the extent that their daily lives are being affected by their oral health.

There are some limitations in this study that should be noted. First, the sample collected was not probabilistic and its size fell below some recommended guidelines for factor analysis. Simulation studies have shown, however, that under some circumstances, namely, with high factor loadings such as those found in this study, a good recovery of the population structure and accurate test statistics can be obtained with samples sizes as small as 50.^[20] Second, the SOHO-5 was developed for 5-year-old children, whereas this study evaluated children of 6 and 7 years of age. Because of this, it is not known if the favorable properties found here would be maintained for the younger population of these impoverished communities. Nevertheless, this limitation does not diminish the usefulness of the instrument for 6- and 7-year-old children.

CONCLUSIONS

The findings from this study show that the SOHO-5 can be a reliable and valid instrument for the measurement of OHRQoL in Spanish-speaking children that come from low-income communities. Its ease of use and low cost of administration make it a valuable measure to evaluate the effectiveness of oral health programs, and its total score can serve as an effective proxy for epidemiology research of caries lesions. At the individual level, the precision of the global score provided by the SOHO-5 makes it possible to reliably identify children who are dealing with significant issues related to their oral health. Future studies are needed, however, to evaluate the measurement invariance of the SOHO-5 factor structure and the feasibility of cross-cultural comparability of OHRQoL levels between children of different countries.

FINANCIAL SUPPORT AND SPONSORSHIP

Colgate-Palmolive.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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