Translation and validation of Taiwanese version of the Early Childhood Oral Health Impact Scale (ECOHIS)

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Abstract  Background/purpose: Treating and preventing dental caries in children have been major health concerns in Taiwan. However, little discussion on oral health-related quality of life in Taiwanese preschooler exists. This study aimed to construct and validate a Taiwanese version of the Early Childhood Oral Health Impact Scale (ECOHIS) for preschool children in Taiwan.

Materials and methods: A Taiwanese version of the ECOHIS was developed using the forward-backward translation method. Our study population (n = 251) comprised children aged 3–6 years old. Parents of the children signed informed consent and self-completed ECOHIS. Data were analyzed for internal reliability using Cronbach’s alpha coefficient, and item-to-total correlation was determined. Criterion validity was tested for the relationship between ECOHIS scores and caries experience (dmft). A multiple linear regression model was used to assess the independent variables of the ECOHIS.

Results: Cronbach’s alpha for the total score of the Taiwanese version of ECOHIS was 0.76. The validity of the ECOHIS was tested, and scores of both the total scale and family impact section were found to be statistically significantly related to dmft ($P < 0.005$). Multiple linear regression analysis revealed that with an increase in dmft, the total score of the ECOHIS significantly increased (95% CI = 0.22–0.63, $P < 0.001$).

Conclusion: The Taiwanese version of the ECOHIS is a valid and reliable tool to assess the oral health-related effect on 3- to 6-year-old children in Taiwan.

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Introduction

The Global Burden of Disease Study 2017 estimated that 531 million children experience caries in primary teeth. In addition to caries, young children also experience oral problems such as teething, trauma, oral clefts, and malocclusion. Poor oral health might result in malnutrition, low self-esteem, or missed school days. However, clinical parameters, such as dental caries, do not measure the impact of caries on children’s quality of life. The Early Childhood Oral Health Impact Scale (ECOHIS), developed by Pahel et al., in 2007, has been translated into many languages such as German, Chile, Arabic, Malay, Brazilian, Spanish, Turkish, Farsi, Chinese, and French. Currently, the ECOHIS is the most widely used scale for investigating the oral health-related quality of life (QoL) in children aged less than 6 years.

The ECOHIS explores how the oral health of preschool children affects their daily lives and the well-being of their family. The scale includes a child impact section (symptoms, function, psychological, and self-image/social interaction domains) and a family impact section (parent distress and family function domains).

The ECOHIS has been tested with a decent validity in the field of dental caries, dental trauma, malocclusion, general anesthesia, and oral cleft. In Asia, the ECOHIS has been validated in Malaysia, China, and India but not in Taiwan, which has one of the highest prevalences of caries. The prevalence of caries in Taiwanese children is markedly high; in 2012, 88.2% of 7-year-old children developed caries with an average deft of 5.90. Treating and preventing dental caries in children have been major health concerns in Taiwan. However, little discussion on oral health-related QoL in Taiwanese preschooler exists. The current study aimed to validate the ECOHIS in Taiwan; thus, clinicians can further investigate the influence of caries and other oral diseases on the QoL of young children and their families.

The purpose of this study is to construct and test the validity of the Taiwanese version of the ECOHIS.

Materials and methods

The ECOHIS was originally developed in English by Pahel et al. The scale contains two sections: child impact and family impact. The child impact section contains nine items divided into four domains: child symptoms, child function, child psychological, and child self-image/social interaction domains. The family impact section includes four items divided into two domains: parent distress and family function domains. The scale as scored using a five-point Likert scale with responses ranging from “never” to “very often.” The total score of the ECOHIS ranges from 0 to 52, with a higher score indicating poorer QoL.

Translation into Taiwanese Mandarin

The scale was developed using the forward-backward translation technique. The English version of the ECOHIS was first translated into Taiwanese Mandarin by individuals whose first language was Taiwanese Mandarin. Then, it was translated back into English by two independent translators whose first language was English. The two English versions of the ECOHIS were compared, and some revisions were made in the Taiwanese Mandarin version.

A pilot test was performed to examine the comprehensibility of the Taiwanese Mandarin ECOHIS, and after some minor adjustments, the final version of the Taiwanese ECOHIS was generated.

The sample

The convenient study population comprised 251 children from a kindergarten in Kaohsiung City. Children with developmental delay, disabilities, and major systematic diseases were excluded. Parents of all recruited children signed informed consent before filling in the ECOHIS. A trained and calibrated dentist (intra-rater reliability: 0.8) performed the oral examination based on the World Health Organization criteria for visual assessment of caries. Caries status was recorded using a dmft index. The study was approved by the Institutional Review Board of the Kaohsiung Medical University Hospital (KMUHIRB-SV (I)-20170066).

A multiple linear regression model was used to assess the independent variables of the ECOHIS. Validity of the scale was tested by comparing the extent to which ECOHIS scores discriminated between children with and without caries experience. We hypothesized that ECOHIS scores can discriminate between children with and without caries experience. Furthermore, alternative hypothesis was that ECOHIS scores are related to different caries status, with a higher ECOHIS score indicating a higher dmft. We divided participants into three subgroups: dmft = 0, 0 < dmft < 3, and dmft ≥ 3. The participants of this study were from a convenient sample. The three subgroups were not sex and age matched. Therefore, we further adjust the validity of the ECOHIS scale with sex and age.

The reliability of the Taiwanese ECOHIS was assessed by testing the internal consistency using Cronbach’s alpha. Cronbach’s alpha was calculated for the child impact section, family impact section, and the total scale of the study population. All data analyses were performed using JMP 14.0 software (SAS Institute Inc., Cary, NC, USA).
Results

Our study population comprised 251 preschool children with a mean dmft of 2.31 (±3.11). Table 1 presents the socio-demographic characteristics of our study group. The distribution of ECOHIS responses is presented in Table 2. Parents mostly reported pain in the teeth, mouth, or jaws (29.88%).

In the family impact section, items "take time off from work" and "feel guilty" were reported with a high frequency of 12.4% and 12.09%, respectively. No participants responded "very often" to any question.

Validity

The validity of the ECOHIS scale was tested, and scores of both the total scale and family section were found to be statistically significantly related to the caries status (P = 0.017 and P = 0.008, respectively). A higher CIS score in the child section was related to a higher dmft score, without statistical significance (P = 0.101) (see Table 3).

Reliability

Cronbach’s alpha for internal consistency reliability for both the whole scale and child section was 0.76 and for the family section was 0.79. The corrected item-total correlation coefficient ranged from 0.34 to 0.75. Multiple linear regression analysis revealed that an increase in dmft scores resulted in significantly higher total scores of the ECOHIS (95% CI = 0.22–0.63, P < 0.001) (see Table 4).

Discussion

A scale must be tested for reliability and validity before implementing in areas with different culture, environment, and population. The ECOHIS has been translated into several languages and been validated. In the original English version, Cronbach’s alpha values for the child section and the family section were 0.91 and 0.95, respectively. In Malaysia, Brazil, Australia, and Turkey, Cronbach’s alpha values for the whole scale were 0.83, 0.86, 0.87, and 0.93, respectively.

A Chinese version of the ECOHIS was validated by Hong Kong scholars in 2009. It was translated based on the Cantonese dialect, which is spoken by the people of Hong Kong, Macau and the Guangdong province. The major languages of Taiwan are Mandarin, Taiwanese Hokkien and Hakka. The national language of Taiwan is Taiwanese Mandarin. Mandarin and Cantonese are both dialects of the Chinese language and they share the same base alphabet. However, the two dialects are distinct and not mutually intelligible. Besides difference in languages, the culture and ethnic groups between Hong Kong and Taiwan are distinct. This is why we need to validate the ECOHIS in Taiwanese version.

In our study, Cronbach’s alpha was 0.76 for both the whole scale and child section and 0.79 for the family section, indicating that the ECOHIS demonstrated an acceptable validity in Taiwan.

Validity of the scale was tested by comparing the extent to which ECOHIS scores discriminated between children with and without caries experience. Participants were divided into three subgroups: dmft = 0, 0 < dmft < 3, and dmft ≥3. Results shows that both the total scale and family section were found to be statistically significantly related to the caries status (P = 0.017 and P = 0.008, respectively). In each section (child impact section, family impact section and total score), higher ECOHIS score was related to a higher dmft score. The data support our research hypothesis that ECOHIS scores can discriminate between children with and without caries experience; a higher ECOHIS score indicates a higher dmft.

| Table 1 | The distribution of the socio-demographic variables among pre-school children. |
|---------|-----------------------------------------------------------------------------|
| Variables                        | Senior class | Middle class | P-value |
|                                  | N  | %       | N  | %       |
| Gender                           |    |         |    |         |
| Boy                              | 55  | 42.31   | 67  | 55.37   | 0.039 |
| Girl                             | 75  | 57.69   | 54  | 44.63   |
| Education level of father        |    |         |    |         |
| Under junior high school         | 0   | 0       | 2   | 1.65    | 0.411 |
| High/Vocational school           | 32  | 24.62   | 25  | 20.66   |
| Junior college/University        | 74  | 56.92   | 68  | 56.20   |
| Master’s or Doctoral degree      | 24  | 18.46   | 26  | 21.49   |
| Education level of mother        |    |         |    |         |
| Under junior high school         | 0   | 0       | 0   | 0       | 0.803 |
| High/Vocational school           | 23  | 17.69   | 25  | 20.66   |
| Junior college/University        | 91  | 70.00   | 83  | 68.60   |
| Master’s or Doctoral degree      | 16  | 12.31   | 13  | 10.74   |
| Monthly income                   |    |         |    |         |
| Below 20000 NT                   | 4   | 3.08    | 1   | 0.83    | 0.381 |
| 20001-60000 NT                   | 67  | 51.54   | 68  | 56.20   |
| Above 60000 NT                   | 59  | 45.38   | 52  | 44.22   |
A multiple linear regression model was used to assess the independent variables of the ECOHIS. Its results revealed that with an increase in dmft, the total score of the ECOHIS significantly increased (95% CI \( Z = 0.22 \), 0.63, \( P < 0.001 \)).

Overall, the scale demonstrated an acceptable validity and reliability for assessing the effect of early childhood caries among Taiwanese preschool children.

In the present study, 29.88% of children had experienced toothache. Similar to studies conducted in Hong Kong, Quebec, and Iran, the item "trouble eating" had the highest frequency in the child impact section in our study. Furthermore, in parallel to the findings of the study conducted with English version, the item "take time off job" had the highest frequency (12.40%), followed by the item "feeling guilty," in the family impact section in our study.

This study has some limitations. A convenient study population was recruited from a kindergarten; therefore, none of the children were less than 3 years old. Furthermore, all participants were from the same kindergarten with relatively high socioeconomic status (more than 50% participants' parents had a monthly income of \( \geq 60000 \) NT). Further investigation with children from lower socioeconomic status is recommended. Another limitation is that the current study design was cross-sectional; therefore, the cause-effect relationship between caries and oral health-related QoL was not investigated.

This study revealed that the Taiwanese version of the ECOHIS is a valid and reliable tool for assessing the oral health-related effect on children (3–6 years old) in Taiwan. Further research is recommended to investigate the ECOHIS for evaluating and predicting treatment outcomes.

| Table 2 | Distribution of the Early Childhood Oral Health Impact Scale (ECOHIS) frequency score. |
|---------|------------------------------------------------------------------------------------------|
| N (%) | N (%) | N (%) | N (%) |
| **Child impact** | | | |
| How often has your child had pain in the teeth, mouth or jaws | 78 (31.00) | 98 (39.04) | 75 (29.88) | 0 (0.00) |
| How often has your child ... because of dental problems or dental treatments? | 165 (66.00) | 55 (22.00) | 23 (9.20) | 6 (2.40) |
| Had difficulty drinking hot or cold beverages | 186 (74.40) | 62 (24.80) | 2 (0.80) | 0 (0.00) |
| Had difficulty eating some foods | 183 (73.20) | 52 (20.80) | 13 (5.20) | 2 (0.80) |
| Missed preschool, daycare or school | 217 (86.45) | 34 (13.55) | 0 (0.00) | 0 (0.00) |
| Had trouble sleeping | 204 (81.60) | 41 (16.40) | 5 (2.00) | 0 (0.00) |
| Been irritable or frustrated | 202 (80.80) | 40 (16.00) | 8 (3.20) | 0 (0.00) |
| Avoid smiling or laughing | 211 (84.74) | 34 (13.66) | 3 (1.21) | 1 (0.40) |
| Avoid talking | 211 (84.68) | 35 (14.11) | 2 (0.81) | 0 (0.00) |
| **Family impact** | | | |
| How often have you or another family member because of your child’s dental problems or dental treatments? | 170 (67.73) | 56 (22.31) | 21 (8.37) | 4 (1.59) |
| Been upset | 165 (66.53) | 53 (21.37) | 23 (9.27) | 7 (2.82) |
| Felt guilty | 165 (66.00) | 54 (21.60) | 29 (11.60) | 2 (0.80) |
| Take time off from work | 203 (81.20) | 40 (16.00) | 6 (2.40) | 1 (0.40) |

| Table 3 | Validity: comparison of mean Early Childhood Oral Health Impact Scale (ECOHIS) scores and sub-scales with respect to the caries status. |
|---------|-------------------------------------------------------------------------------------------------------------------------------------|
| **Child impact section** | | |
| Caries status | 11.61 (3.26) | 5.22 (1.70) | 16.85 (4.35) |
| \( dmft = 0 \) | 11.85 (3.71) | 5.43 (2.06) | 17.32 (5.36) |
| \( 0 < dmft \) index < 3 | 12.70 (3.52) | 6.18 (2.56) | 18.92 (5.23) |
| \( dmft \) index \( \geq 3 \) | 0.101 | 0.008 | 0.017 |
| \( P \) value | | | |
| **Family impact section** | | |
| Caries status | 11.59 (0.36) | 5.20 (0.22) | 16.80 (0.51) |
| \( dmft = 0 \) | 11.85 (0.42) | 5.42 (0.26) | 17.30 (0.60) |
| \( 0 < dmft \) index < 3 | 12.69 (0.38) | 6.17 (0.24) | 18.88 (0.55) |
| \( dmft \) index \( \geq 3 \) | 0.098 | 0.009 | 0.016 |
| \( P \) value | | | |

\(^{a}\) Adjusted for sex and age.
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| Table 4  | Summary of multiple linear regression for effects and interactions of Early Childhood Oral health Impact Scale (ECOHIS) scores and dmft. |
|----------|-------------------------------------------------------------------------------------------------------------------------------------|
| Term                                             | Parameter Estimate | 95% Confidence Interval | P-value |
| Intercept (estimated ECOHIS score for girl, junior class, educational level of father below junior college or university, educational level of mother below junior college or university and average monthly income below 60000 NT) | 14.21 | (12.34, 16.08) | <0.001 |
| Sex                                              | 0.91 | (−0.33, 2.15) | 0.151 |
| Class                                            | 0.70 | (−0.54, 1.93) | 0.268 |
| Father with educational level of junior college or university degree | 0.67 | (−0.95, 2.28) | 0.418 |
| Father with Master’s or Doctoral degree           | −0.83 | (−0.35, 1.40) | 0.465 |
| Mother with educational level of junior college or university degree | 1.32 | (−0.43, 3.06) | 0.138 |
| Mother with Master’s or Doctoral degree           | 1.88 | (−0.86, 6.62) | 0.178 |
| Above 60000 NT                                   | 0.73 | (−0.57, 2.04) | 0.270 |
| dmft                                             | 0.42 | (0.22, 0.63) | <0.001 |

R-square = 0.11.
Adjusted for sex, education level of father and mother, monthly income.

Declaration of Competing Interest

The authors have no conflicts of interest relevant to this article.

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