



Original Article

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



Ming-Hsuan Sheen ^{a,b}, Szu-Yu Hsiao ^{a,b}, Shun-Te Huang ^{b,c*}

^a Division of Pediatric Dentistry, Department of Dentistry, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan

^b Division of Special Care Dentistry, Department of Dentistry, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan

^c Department of Oral Hygiene, College of Dental Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan

Received 23 February 2020; Final revision received 25 May 2020

Available online 24 June 2020

KEYWORDS

Dental caries;
Oral health;
Quality of life

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.

* Corresponding author. Department of Oral Hygiene, College of Dental Medicine, Kaohsiung Medical University, 100, Shih-Chuan 1st Road, Kaohsiung 80708, Taiwan.

E-mail address: shuntehuang@gmail.com (S.-T. Huang).

Introduction

The Global Burden of Disease Study 2017¹ 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,^{2,3} low self-esteem,⁴ or missed school days.⁵ 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 2007,⁶ has been translated into many languages such as German,⁷ Chile,⁸ Arabic,⁹ Malay,¹⁰ Brazilian,¹¹ Spanish,¹² Turkish,¹³ Farsi,¹⁴ Chinese,¹⁵ and French.¹⁶ 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,^{7–13,15,17} dental trauma,¹⁸ malocclusion,¹⁹ general anesthesia,^{20–25} and oral cleft.^{26,27}

In Asia, the ECOHIS has been validated in Malaysia,¹⁰ China,¹⁵ and India¹⁷ but not in Taiwan, which has one of the highest prevalence 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 dmft of 5.90.²⁸ 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 instrument

The ECOHIS was originally developed in English by Pahel et al.⁶ 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 is 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.²⁹ 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 of 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 the 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,¹⁰ Brazil,¹¹ Australia,³⁰ and Turkey,¹³ 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 2009.¹⁵ 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, $0 < \text{dmft} < 3$, and $\text{dmft} \geq 3$. 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	

Table 2 Distribution of the Early Childhood Oral Health Impact Scale (ECOHis) frequency score.

	Never	Hardly ever	Occasionally	Often or very often
	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?				
Had difficulty drinking hot or cold beverages	186 (74.40)	62 (24.80)	2 (0.80)	0 (0.00)
Had difficulty eating some foods	165 (66.00)	55 (22.00)	23 (9.20)	6 (2.40)
Had difficulty pronouncing any words	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?				
Been upset	170 (67.73)	56 (22.31)	21 (8.37)	4 (1.59)
Felt guilty	165 (66.53)	53 (21.37)	23 (9.27)	7 (2.82)
Take time off from work	165 (66.00)	54 (21.60)	29 (11.60)	2 (0.80)
How often has your child had dental problems or dental treatments that had a financial impact on your family	203 (81.20)	40 (16.00)	6 (2.40)	1 (0.40)

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 = 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,¹⁵ Quebec,¹⁶ and Iran,⁹ 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%)," which was 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 ≥ 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 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	Family impact section	Total score
Caries status			
dmft = 0	11.61 (3.26)	5.22 (1.70)	16.85 (4.35)
0 < dmft index < 3	11.85 (3.71)	5.43 (2.06)	17.32 (5.36)
dmft index ≥ 3	12.70 (3.52)	6.18 (2.56)	18.92 (5.23)
P value	0.101	0.008	0.017
Caries status^a			
dmft = 0	11.59 (0.36)	5.20 (0.22)	16.80 (0.51)
0 < dmft index < 3	11.85 (0.42)	5.42 (0.26)	17.30 (0.60)
dmft index ≥ 3	12.69 (0.38)	6.17 (0.24)	18.88 (0.55)
P value	0.098	0.009	0.016

^a Adjusted for sex and age.

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, 4.62)	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.

Acknowledgments

The authors thank the Division of Medical Statistics and Bioinformatics, Department of Medical Research, Kaohsiung Medical University Hospital for kind help. The authors received no specific funding for this Work.

References

- GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the global burden of disease study 2017. *Lancet* 2018;392:1789–858.
- So M, Ellenikiotis YA, Husby HM, Paz CL, Seymour B, Sokal-Gutierrez K. Early childhood dental caries, mouth pain, and malnutrition in the ecuadorian amazon region. *Int J Environ Res Publ Health* 2017;14:550.
- Tsang C, Sokal-Gutierrez K, Patel P, et al. Early childhood oral health and nutrition in urban and rural Nepal. *Int J Environ Res Publ Health* 2019;16:2456.
- Losso EM, Tavares MC, Silva JY, Urban CA. Severe early childhood caries: an integral approach. *J Pediatr* 2009;85:295–300.
- Gift HC, Reisine ST, Larach DC. The social impact of dental problems and visits. *Am J Publ Health* 1992;82:1663–8.
- Pahel BT, Rozier RG, Slade GD. Parental perceptions of children's oral health: the early childhood oral health impact scale (ECOHIS). *Health Qual Life Outcome* 2007;5:6.
- Bekes K, Omara M, Safar S, Stamm T. The German version of early childhood oral health impact scale (ECOHIS-G): translation, reliability, and validity. *Clin Oral Invest* 2019;23:4449–54.
- Zaror C, Atala-Acevedo C, Espinoza-Espinoza G, et al. Cross-cultural adaptation and psychometric evaluation of the early childhood oral health impact scale (ECOHIS) in Chilean population. *Health Qual Life Outcome* 2018;16:232.
- Farsi NJ, El-Housseiny AA, Farsi DJ, Farsi NM. Validation of the Arabic version of the early childhood oral health impact scale (ECOHIS). *BMC Oral Health* 2017;17:60.
- Hashim AN, Yusof ZY, Esa R. The Malay version of the early childhood oral health impact scale (Malay-ECOHIS)-assessing validity and reliability. *Health Qual Life Outcome* 2015;13:190.
- Martins-Junior PA, Ramos-Jorge J, Paiva SM, Marques LS, Ramos-Jorge ML. Validations of the Brazilian version of the early childhood oral health impact scale (ECOHIS). *Cad Saúde Pública* 2012;28:367–74.
- Bordoni N, Ciaravino O, Zambrano O, et al. Early childhood oral health impact scale (ECOHIS). Translation and validation in Spanish language. *Acta Odontol Latinoam* 2012;25:270–8.
- Peker K, Uysal O, Bermek G. Cross-cultural adaptation and preliminary validation of the Turkish version of the early childhood oral health impact scale among 5-6-year-old children. *Health Qual Life Outcome* 2011;9:118.
- Jabarifar SE, Golkari A, Ijadi MH, Jafarzadeh M, Khadem P. Validation of a Farsi version of the early childhood oral health impact scale (F-ECOHIS). *BMC Oral Health* 2010;10:4.
- Lee GH, McGrath C, Yiu CK, King NM. Translation and validation of a Chinese language version of the early childhood oral health impact scale (ECOHIS). *Int J Paediatr Dent* 2009;19:399–405.
- Li S, Veronneau J, Allison PJ. Validation of a French language version of the early childhood oral health impact scale (ECOHIS). *Health Qual Life Outcome* 2008;6:9.
- Bhat SG, Sivaram R. Psychometric properties of the Malayalam version of ECOHIS. *J Indian Soc Pedod Prev Dent* 2015;33:234–8.
- Vieira-Andrade RG, Siqueira MB, Gomes GB, et al. Impact of traumatic dental injury on the quality of life of young children: a case-control study. *Int Dent J* 2015;65:261–8.
- Sousa RV, Clementino MA, Gomes MC, Martins CC, Granville-Garcia AF, Paiva SM. Malocclusion and quality of life in Brazilian preschoolers. *Eur J Oral Sci* 2014;122:223–9.
- Farsi DJ, Farsi NJ, El-Housseiny AA, Damanhour WH, Farsi NM. Responsiveness of the Arabic version of the ECOHIS to dental rehabilitation under general anaesthesia. *Int J Paediatr Dent* 2018;28:52–61.
- Ferrazzano GF, Sangianantoni S, Mitrano RL, Ingenito A, Alcidi B, Cantile T. Assessing changes in oral health-related quality of life and body growth in 3-5 years old children following dental treatment under general anaesthesia due to severe dental caries. *Eur J Paediatr Dent* 2019;20:214–8.

22. Grant CG, Daymont C, Rodd C, et al. Oral health-related quality of life of Canadian preschoolers with severe caries after dental rehabilitation under general anesthesia. *Pediatr Dent* 2019;41:221–8.
23. Hashim NA, Yusof ZYM, Saub R. Responsiveness to change of the Malay-ECOHIS following treatment of early childhood caries under general anaesthesia. *Community Dent Oral Epidemiol* 2019;47:24–31.
24. Jiang HF, Qin D, He SL, Wang JH. OHRQoL changes among Chinese preschool children following dental treatment under general anesthesia. *Clin Oral Invest* 2019. <https://doi.org/10.1007/s00784-019-03063-z>.
25. Marshman Z, Knapp R. Child oral health-related quality of life following treatment under dental general anaesthetic (DGA). *Evid Base Dent* 2019;20:46–7.
26. Rando GM, Jorge PK, Vitor LLR, et al. Oral health-related quality of life of children with oral clefts and their families. *J Appl Oral Sci* 2018;26:e20170106.
27. Zeraatkar M, Ajami S, Nadjmi N, Golkari A. Impact of oral clefts on the oral health-related quality of life of preschool children and their parents. *Niger J Clin Pract* 2018;21:1158–63.
28. Ministry of Health and Welfare, Taiwan. *National oral health promotion program*. 2017. <https://www.mohw.gov.tw/dl-48398-7a59576c-f84e-4a47-b92f-f083ecd9db72.html>.
29. World Health Organization. *Oral health surveys: basic methods*, 5th ed. Geneva, Switzerland: World Health Organization, 2013.
30. Arrow P, Klobas E. Evaluation of the early childhood oral health impact scale in an Australian preschool child population. *Aust Dent J* 2015;60:375–81.