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Translation and validation of a Chinese language version of the Early Childhood Oral Health Impact Scale (ECOHIS)

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Objective. This study aimed to adapt the *Early Childhood Oral Health Impact Scale* (ECOHIS) for pre-school children in a Chinese speaking community and to investigate its psychometric properties (validity and reliability).

Methods. A Chinese language version of the ECOHIS was derived through a forward–backward translation and tested for face and content validity among a focus group. A convenient sample of pre-school children ($n = 111$) was recruited (including a sub-sample with early childhood caries and caries-free children). Parents of the children self-completed the derived Chinese-ECOHIS measure. Validity of the measure was assessed by investigating the relationship between dental caries status and Chinese-ECOHIS scores (construct and criterion validity). A sub-sample of the parents repeated the ratings of the measure to enable reliability assessments. Both internal and test–retest reliability were determined.

Results. A Chinese version of ECOHIS was derived with minor modification to the original version. Chinese-ECOHIS scores were associated with children's caries experience (dmft) ($r = 0.66$, $P < 0.05$) supporting convergent validity. In addition, variations in ECOHIS scores were apparent with respect to caries and caries-free groups ($P < 0.001$), supporting the ability to distinguish between patient groups. Cronbach's alpha values (internal reliability) for total ECOHIS score were 0.91 and intraclass correlation coefficient value (test–retest reliability) was 0.64.

Conclusions. A Chinese version of the ECOHIS was developed and demonstrated acceptable validity and reliability. These findings can enable assessments of pre-school child oral health-related quality of life in Chinese speaking communities.

Introduction

Traditional clinical parameters, such as assessment of dental caries status, represent only one dimension of the complex nature of oral health status[1]. Although clinical parameters are undoubtedly important, it is acknowledged that the many physical and psychosocial consequences of oral diseases cannot be determined by these parameters alone[2]. Thus, in assessing oral health status there is a need to consider subjective assessments of oral health. This has led to the development of a number of measures to assess the impact of oral health problems on individual's physical, social, and psychological well-being (what has been referred as 'oral health-related quality of life': OHRQoL)[2].

Assessments of OHRQoL among adults has been a long standing area of research and has proved valuable in assessing oral health needs and evaluating outcomes from oral health care initiatives[3]. Nevertheless, assessment of OHRQoL among children has lagged behind the research developments in adult population[3,4]. This in part relates to the fact that assessing children's OHRQoL is complex particularly for younger children because of linguistic ability as well as varying cognitive and psychosocial development issues. To date, the only measure for use among pre-school children is the Early Childhood Oral Health Impact Scale (ECOHIS)[5]. A French version of ECOHIS has been recently validated[6].

Pre-school children encounter many oral health problems, such as teething pain, eruption disturbances, early childhood caries

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(ECC), and dental trauma[6]. There is a need to understand the consequences of these oral health states to pre-school children's lives (and that of their families) in prioritizing oral health care for younger children and in evaluating outcomes from oral health care activities among younger children to inform evidence-based dental practice[4,7,8].

Unlike clinical indices which have adapted easily for the global use, OHRQoL measures need to be adapted for use in other cultures; not just because of obvious linguistics differences but also because of cross-culture issues. It is imperative that different language version of the same measure be evaluated as they should exhibit similar psychometric properties to the original versions, if they are to be supported for cross-cultural and cross-national activities[9–11]. This study aimed to develop a Chinese version of the pre-school ECOHIS and to evaluate its psychometric properties (validity and reliability).

Material and methods

The ECOHIS is an English-language OHRQoL measure, which assesses the burden (negative impact) of oral health on quality of life among pre-school children (age range: 0- to 5-year-old) and was developed and validated in the United States of America[5]. It relies on parental ratings of 13 items grouped into two scales, namely, *Child Impact Section* (CIS) and *Family Impact Section* (FIS). The CIS has four sub-domains: child symptom, child function, child psychology, and child self-image and social interaction. The FIS has two domains: parental distress and family function. Response categories for each question is rated on a 5-point *Likert* scale to record how often an event has occurred during the life of the child: 0 = never; 1 = hardly ever; 2 = occasionally; 3 = often; 4 = very often; 5 = don't know. Summary ECOHIS scores can be derived by summating responses to all 13 items (total scores can range from 0 to 52). *CIS* and *FIS* scores can range from 0 to 36 and 0 to 16, respectively. A high ECOHIS score indicates greater oral health impact (more oral health problems) and poorer OHRQoL.

Translation process and validation of quality of the translation

The ECOHIS was translated into Chinese (based on the Cantonese dialect) using the forward–backward process[12]. The process consisted of several stages. First, the measure was translated from English to Chinese by bilingual Chinese and English speakers. Then, it was translated back from Chinese to English by independent translators. Translators rated the difficulty of translating for each item and made comments as appropriate. The quality of the translation was rated for: (i) clarity of translation (use of simple and understandable expressions); (ii) common language use (avoidance of technical terms); and (iii) semantic equivalence (representation of the content of the original source). Following reconciliation of problematic items among the questionnaire (which arose as a result of different Chinese characters being suggested for the similar English language words) a focus group of primary caregivers of pre-school children rated the proposed Chinese version for: (i) comprehensibility; (ii) readability and clarity; and (iii) relevance to assess face validity.

Psychometric testing of the measure

Recruitment of children and their primary caregiver took place in the Paediatric Dentistry and Orthodontics screening clinics of the Prince Philip Dental Hospital, University of Hong Kong over a 6-month period. To be included in the study, the children had to be aged 5 or younger, having no underlying serious medical conditions, not taking long-term medication, no physical or learning disabilities, and were accompanied by a Chinese speaking primary caregiver (who had been living with the child concerned for 50% or more of the time).

Primary caregivers of the children who met the inclusion criteria were invited to self-complete the ECOHIS and provide socio-demographic information. Subjects with missing responses to one or more items were excluded from the analysis. For all 'don't know' responses mean values were imputed

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so as to derive overall and sub-domain scores. Within 3 weeks of their child attending the screening clinic and prior to their child receiving any dental treatment, 20% (26) of the caregivers were sent the ECOHIS to self-complete and return by post.

The children underwent a clinical oral examination by a trained and calibrated examiner based on recommended WHO criteria for visual assessment of dental caries[13]. Caries experience of the children was recorded using dmft and dmfs indices.

The study was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (HKU/HA HKW IRB). Parents/primary caregivers provided their informed and written consent before their child was recruited for the study. Each child also gave verbal assent, which was documented, for their participation.

A power analysis was undertaken by Sample Power 2.0 (SPSS Inc., Chicago, IL, USA). Based on the assumption, there will be a difference of at least 2.0 in the ECOHIS scores between those with and without caries[5], and allowing for a similar standard deviation of about 3.5. Then for the given effect size (ES; a population mean difference of 2.0, SD 3.5), a sample size of at least 100, with 50 subjects in each group, is required to have 80% statistical power in identifying a significant difference in ECOHIS scores between those with and without caries.

Construct validity of the Chinese version of ECOHIS was examined through correlating ECOHIS scores with dmft and dmfs scores (*Spearman's rank correlation*). The priori assumption was that dmft and dmfs scores have a moderate-to-high correlation with ECOHIS scores. In assessing the discriminant validity, differences in ECOHIS between children with caries and caries-free children was assessed using Mann–Whitney *U*-test (non-parametric test equivalence to *t*-test). The magnitude of the statistical difference was assessed by calculating *Effect Size* [ES = $(l_1-l_2)/r$, where l_1 is the mean for one study group, l_2 is the mean for the other study group, and r is the standard deviation pooled from the two groups]. The priori hypothesis was that ECOHIS would be higher among children with caries compared with caries-free children and that the magnitude of the statistical difference would be moderate or larger.

Reliability was assessed in two ways: *internal consistency reliability* and *test–retest reliability*. *Internal consistency reliability* was determined by assessing the mean item correlation of items within ECOHIS using *Cronbach's alpha* statistics. *Test–retest reliability* was assessed by determining the level of agreement between initial and repeat assessments of the ECOHIS by calculating *Intraclass Correlation Coefficients* (ICC) in a one-way random effect parallel model.

Results

Translation process and validation of quality of the translation

All 13 items of ECOHIS were feasible to translate. Nevertheless, some difficulties were encountered regarding the clarity of the Chinese translation. This was in part due to colloquial differences in the Chinese language used by the different translators. There were some concerns about the conceptual equivalence of certain items assessing socio-emotional issues. The item *'been irritable or frustrated'* was considered inappropriate to use because this was not a common phrase in Chinese. The phrase *'been impatient or frustrated'* was agreed upon to provide conceptual equivalence of the item rather than a direct verbal equivalence. The item *'been upset'* was also substituted with *'been troubled'*, a conceptual equivalence of the phrase. In addition, as the term *'pre-school'* is not a common term in Hong Kong this was replaced by the terms '*kindergarten, day-care or school*'. Through focus group discussion, all items of the ECOHIS were considered comprehensible, clear and relevant, although some suggestions were provided on Chinese characters used.

Psychometric testing

Over a 6-month period a convenient sample of 111 children and their primary caregivers

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Table 1. Comparison of parent and children characteristics between the caries and caries-free groups.

Parent & children characteristics	Patient group: Entire sample *n* = 111 (100%)	Caries *n* = 64 (57.7%)	Caries-free *n* = 47 (42.3%)	*P*-value
Parent demographics				
Relationship to the child, *n* (%)				
Mother	79 (71.2)	45 (70.3)	34 (72.3)	0.35
Father	24 (21.6)	16 (25.0)	8 (17.0)	
Other	8 (7.2)	3 (4.7)	5 (10.6)	
Education level, *n* (%)				
Secondary or below	66 (59.5)	36 (56.3)	30 (63.8)	0.60
Post-secondary	20 (18.0)	12 (18.8)	8 (17.0)	
Tertiary or above	25 (22.5)	16 (25.0)	9 (19.1)	
Children demographics				
Age (months), Mean (SD)	49 (12)	53 (11)	44 (10)	<0.01*
Gender, *n* (%)				
Male	60 (54.1)	36 (56.3)	24 (51.1)	0.32
Female	51 (45.9)	28 (43.8)	23 (48.9)	

*Statistically significant ($P < 0.05$), independent samples *t*-test.

were recruited. The profile of the group is presented in Table 1. Most had evidence of caries (58%, $n = 64$). Caries status was associated with age ($P < 0.01$) but no other socio-demographic variable ($P > 0.05$).

The responses to the ECOHIS items are presented in Table 2. No missing response to items was found. For the child impact section of the ECOHIS, 'pain in the teeth, mouth or jaws' was the most frequently reported item by the parents (47.7%). The items related to 'difficulty in eating (33.3%) and drinking (25.2%)', 'pronunciation (23.4%)', 'trouble in sleeping (21.6%)', and 'irritation or frustration (25.2%)' were also reported often in the children impact section of the scale. Items related to 'feeling upset or guilty', 'taking time off from work', and 'financial impact to the family' were reported frequently in the family impact section of the ECOHIS. The responses to the questions were skewed because most participants responded 'never'.

Table 3 provides a summary of descriptive statistics: range, floor effect (% with score of 0), mean and standard deviation values, as well as median and interquartile range values. Approximately one-fifth (18.9%) had an ECOHIS score of zero. Floor effects (% scoring zero) were evident particularly for the

Table 2. Distribution of Early Childhood Oral Health Impact Scale response.

Impacts	Never or hardly ever *n* (%)	Occasionally, often, or very often *n* (%)	Don't know *n* (%)
Child impact			
How often has your child had pain in the teeth, mouth or jaws	57 (51.3)	53 (47.7)	1 (0.9)
How often has your child …… because of dental problems or dental treatments?			
Had difficulty drinking hot or cold beverages	82 (73.9)	28 (25.2)	1 (0.9)
Had difficulty eating some foods	74 (66.7)	37 (33.3)	0 (0)
Had difficulty pronouncing any words	83 (74.8)	26 (23.4)	2 (1.8)
Missed pre-school, daycare or school	104 (93.7)	5 (4.5)	2 (1.8)
Had trouble sleeping	86 (77.5)	24 (21.6)	1 (0.9)
Been irritable or frustrated	82 (73.9)	28 (25.2)	1 (0.9)
Avoided smiling or laughing	103 (92.8)	8 (7.2)	0 (0)
Avoided talking	106 (95.5)	4 (3.6)	1 (0.9)
Family impact			
How often have you or another family member …… because of your child's dental problems or dental treatments?			
Been upset	66 (59.5)	45 (40.5)	0 (0)
Felt guilty	66 (59.5)	45 (40.5)	0 (0)
Taken time off from work	80 (72.1)	31 (27.9)	0 (0)
How often has your child had dental problems or dental treatments that had a financial impact on your family	91 (82.0)	20 (18.0)	0 (0)

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Table 3. Descriptive distribution of Early Childhood Oral Health Impact Scale for different domains.

Impacts	Number of items	Possible range	Range	Floor effect (% score 0)	Mean (SD)	Median (IQR)
Child impact section	9	0–36	0–19	22.6	5.93 (0.53)	5.0 (9.0)
Child symptoms	1	0–4	0–4	36.8	1.22 (0.11)	1.0 (2.0)
Child function	4	0–16	0–10	30.2	2.75 (0.25)	2.5 (4.0)
Child psychology	2	0–8	0–7	50.0	1.40 (0.16)	0.5 (2.0)
Self image and social interaction	2	0–8	0–4	74.5	0.58 (0.10)	0.0 (1.0)
Family impact section	4	0–16	0–16	33.0	3.70 (0.35)	4.0 (6.0)
Parental distress	2	0–8	0–8	39.6	2.18 (0.22)	2.0 (4.0)
Family function	2	0–8	0–8	45.3	1.52 (0.17)	1.0 (3.0)
Total score	13	0–52	0–29	18.9	9.63 (0.82)	9.0 (14.0)

SD, standard deviation; IQR, inter-quartile range.

'child psychology' (50.0%) and 'self image and social interaction' (74.5%) in CIS, and with respect family function (45.3%) in the FIS. The range of scores varied considerably and the maximum values of the total ECOHIS score and the sub-scales observed among the study group, was approximately half of the possible range of scores for the measures.

Variations in the mean ECOHIS score and the two sub-scales (the child impact and family impact sections) ($P < 0.001$) were apparent between the caries and caries-free groups (Table 4). Children with caries had higher mean ECOHIS scores than the caries-free children. The ES of the total ECOHIS scores between caries and caries-free subjects was 0.73; for CIS and FIS, it was 0.68 and 0.67, respectively.

Details of the correlation (Spearman's rank) between the ECOHIS and caries experience (dmft/dmfs) are shown in Table 5. The ECOHIS scores were significantly correlated with dmft ($r = 0.66$; $P < 0.01$) and dmfs ($r = 0.69$; $P < 0.01$). ECOHIS were significantly correlated with the dt ($r = 0.66$, $P < 0.01$) and ds ($r = 0.69$, $P < 0.01$).

The mean inter-item correlation (Cronbach's alpha values) of ECOHIS and sub-scales were above 0.85: CIS (0.87), FIS (0.85), and total score (0.91) (Table 6).

Table 5. Construct validity: Spearman's rank correlation coefficients of Early Childhood Oral Health Impact Scale and caries experience reported by the study group.

Caries prevalence	Child impact section	Family impact section	Total score
dmft	0.63**	0.60**	0.66**
dt	0.63**	0.59**	0.66**
mt	0.12	0.16	0.16
ft	0.23*	0.22*	0.24*
dmfs	0.65**	0.62**	0.69**
ds	0.65**	0.61**	0.69**
ms	0.12	0.16	0.16
fs	0.26**	0.21*	0.26**

*Statistically significant ($P < 0.05$); **Statistically significant ($P < 0.01$).

Table 4. Discriminant validity: comparison of mean Early Childhood Oral Health Impact Scale (ECOHIS) scores and sub-scales with respect to the caries status.

ECOHIS, Mean (SD)	Caries	Caries-free	Effect size (ES)	*P*-value
Child impact section	9.17 (4.89)	1.87 (2.68)	0.68	<0.001*
Family impact section	5.81 (3.37)	1.04 (1.65)	0.67	<0.001*
Total score	14.98 (6.99)	2.91 (4.05)	0.73	<0.001*

*Statistically significant ($P < 0.05$), independent samples *t*-test.

Table 6. Reliability analysis: internal consistency (reliability) and test–retest reliability.

ECOHIS (number of items)	Internal consistency reliability (Cronbach's alpha)	Test–retest reliability [ICC (95% CI)]
Child impact section (9)	0.87	0.64 (0.11, 0.85)
Family impact section (4)	0.85	0.44 (–0.37, 0.77)
Total score (13)	0.91	0.64 (0.10, 0.85)

ICC, Intraclass Correlation Coefficients; ECOHIS, Early Childhood Oral Health Impact Scale.

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A total of 21 of 26 (80.8%) completed the Chinese ECOHIS for the second time. These 21 subjects reported no change in the child's oral health status. The ICC values were 0.64 for the total score and the CIS, and 0.44 for the FIS (Table 6).

Discussion

The translation and validation of quality of the translation process, although time consuming, are important procedures in the cross-cultural adaptation of a quality of life measure[14–16]. In this study, the ECOHIS was translated into Chinese and the issue of appropriateness of the wording of items emerged in assessing the quality of the translations, but these were easily modified so that the semantic and conceptual equivalence of items was similar to original English-language version. All of the 13 items of original ECOHIS were retained because of their universality and relevance in focus group discussion and thus the Chinese version of ECOHIS developed can be employed in cross-national comparisons because of its similarity to the English-language form. Of note, Cantonese (a dialect of the Southern Chinese) was used in the translation process and despite being somewhat different from other Chinese dialects; however, the characters of written Chinese are the same and can be understood by the reader irrespective of dialect spoken.

The participants of this study were from a convenient sample. The caries and caries-free groups were not sex and age matched. Between the two groups, no significant gender difference was observed, but a significant age difference was found ($P < 0.01$). Nevertheless, no significant association was found between age and gender of the children with the ECOHIS. Taking this into account, though there was a difference in age between the two study groups, the effect of age and gender of the children to the responses was insignificant in this study. Younger children usually have a lower level of caries experience. This is why, in the convenient sample, the children of the caries-free group were comparatively younger than those of the caries group.

The majority of primary caregivers (81%) reported that their child experienced at least one oral health impact (ECOHIS >0). More frequently, it was reported that child experiencing symptoms and functional impairments as opposed to psychological and social effects. Likewise, most (67%) reported an impact on the family as results of the child's oral health. This would suggest that among the study population, impairment of OHRQoL was common, but it should be borne in mind that this study population was a convenient sample who were seen at a university hospital and thus most likely had oral health problems. For the most part primary caregivers were able to rate the experience of their children's to the items of ECOHIS (rarely did they respond 'don't know'). This would suggest the feasibility of employing OHRQoL measures in screening clinics for pre-school children.

A significant difference in the mean scores for the summary ECOHIS the two sub-scales were found between children with caries and those without caries. Higher scores (poorer OHRQoL) was observed among the caries group. In addition, the observed ES of >0.65 for the overall scale and sub-scales could be interpreted to as a moderate-large difference[17,18]. These findings support the ability of the Chinese ECOHIS measure in distinguishing between the two groups of children.

Significant correlations were shown between dental caries experience and ECOHIS scores. The strength of the correlation between dental caries experiences at a tooth and surface level (dmft, dmfs, dt, ds) with ECOHIS scores could be interpreted as moderate (Spearman's correlation values were 0.60 and above)[19]. These findings support the construct validity of the measure.

Internal consistency examines the mean correlation between items, assessing the same concept. *Cronbach's alpha* values obtained were >0.80 for overall scale and the two subscales, suggesting excellent internal reliability and at a similar level to the English and French validation studies[5,6,20]. In test–retest reliability, ICC values were >0.60 for the overall scale and for the sub-scale of CIS, suggesting good reliability[21] but less so than

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what was reported in the English and French validation studies. Nevertheless, for the subscale of FIS, the test–retest was less reliable[21].

In conclusion, a Chinese version of the ECOHIS was created with minor modifications to some of the questions. Psychometric testing of the measure demonstrated good construct validity, discriminant validity, internal consistency as well as acceptable test–retest reliability. The Chinese version of ECOHIS is therefore appropriate to use for assessing oral health-related quality of life in pre-school children with Chinese-speaking primary caregivers. It would be useful to establish the sensitivity and responsiveness of the measure developed over a time during early childhood or in response to oral health care interventions but this will require a longitudinal study.

What this paper adds

- This study describes the development and psychometric testing of a Chinese version of the ECOHIS for assessing oral health-related quality of life among pre-school children in Chinese speaking communities.

Why this paper is important to paediatric dentists

- The Chinese version of the ECOHIS may be a useful tool for assessing oral health-related quality of life of pre-school children among paediatric dentists working with Chinese speaking communities.
- The existence of a Chinese version of ECOHIS will facilitate cross-cultural and cross-national research to enhance paediatric dentists understanding of the impact of oral health on pre-school children's life quality.

References

1 Locker D. Measuring oral health: a conceptual framework. *Community Dent Health* 1988; **5**: 3–18.

2 Allen PF. Assessment of oral health-related quality of life. *Health Qual Life Outcomes* 2003; **1**: 40–43.

3 Broder HL. Children's oral health-related quality of life. *Community Dent Health* 2007; **35**(Suppl. 1): 5–7.

4 McGrath C, Broder H, Wilson-Genderson M. Assessing the impact of oral health on the life quality of children: implications for research and practice. *Community Dent Oral Epidemiol* 2004; **32**: 81–85.

5 Pahel BT, Rozier RG, Slade GD. Parental perceptions of children's oral health: The Early Childhood Oral Health Impact Scale (ECOHIS). *Health Qual Life Outcomes* 2007; **5**: 6.

6 Li S, Veronneau J, Allison PJ. Validation of a French language version of the Early Childhood Oral Health Impact Scale (ECOHIS). *Health Qual Life Outcomes* 2008; **6**: 9.

7 Broder HL, Wilson-Genderson M. Reliability and convergent and discriminant validity of the Child Oral Health Impact Profile (COHIP Child's Version). *Community Dent Oral Epidemiol* 2007; **35**(Suppl. 1): 20–31.

8 Clancy CM, Eisenberg JM. Outcomes research: measuring the end results of health care. *Science* 1998; **282**: 245–246.

9 Lawrence HP. Cross-cultural perceptions of oral health and oral-health-related quality of life. *Community Dent Health* 2001; **18**: 207–208.

10 Skevington SM. Advancing cross-cultural research on quality of life: observations drawn from the WHOQOL development. World Health Organisation Quality of Life Assessment. *Qual Life Res* 2002; **11**: 135–144.

11 McGrath C, Pang HN, Lo EC, King NM, Hägg U, Samman N. Translation and evaluation of a Chinese version of the Child Oral Health-related Quality of Life measure. *Int J Paediatr Dent* 2008; **18**: 267–274.

12 Del Greco L, Walop W, Eastridge L. Questionnaire development 3: translation. *CMAJ* 1987; **136**: 817–818.

13 World Health Organization. *Oral Health Surveys. Basic Methods*, 4th edn. Geneva: World Health Organization, 1997.

14 Sullivan M. Cross-cultural validation for quality of life. *J Clin Epidemiol* 1994; **47**: 1465–1466.

15 Corless IB, Nicholas PK, Nokes KM. Issues in cross-cultural quality-of-life research. *J Nurs Scholarsh* 2001; **33**: 15–20.

16 Herdman M, Fox-Rushby J, Badia X. A model of equivalence in the cultural adaptation of HRQoL instruments: the universalist approach. *Qual Life Res* 1998; **7**: 323–335.

17 Cohen J. *Statistical Power Analysis for the Behavioral Sciences*, 2nd edn. Hillsdale, HJ: Lawrence Erlbaum Associates, 1988.

18 Grissom RJ, Kim JJ. *Effect Sizes for Research: A Broad Practical Approach*, 1st edn. Hillsdale, HJ: Lawrence Erlbaum Associates, 2005.

19 Cohen J, Cohen P, West SG, Aiken LS. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, 2nd edn. Hillsdale, HJ: Lawrence Erlbaum Associates, 2003.

20 Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika* 1951; **16**: 297–334.

21 Shrout P, Fleiss JL. Intraclass correlation: uses in assessing rater reliability. *Psychol Bull* 1979; **86**: 420–428.

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