Linguistic adaptation and psychometric evaluation of original oral health literacy-adult questionnaire (OHL-AQ)

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Abstract

Introduction: Linguistically adapted oral health literacy tools are helpful to assess oral health literacy among local population with clarity and understandability. The original oral health literacy adult questionnaire, Oral Health Literacy Adult Questionnaire, was given in English (2013), consisting of 17 items under 4 domains. The present study rationalizes to culturally adapt and validate Oral Health Literacy Adult Questionnaire into Hindi language. Thus, we objectified to translate Oral Health Literacy Adult Questionnaire into Hindi and test its psychometric properties like reliability and validity among primary school teachers.

Methods: The Oral Health Literacy Adult Questionnaire was translated into Oral Health Literacy Adult Questionnaire – Hindi Version using the World Health Organization recommended translation back-translation protocol. During pre-testing, an expert panel assessed content validity of the questionnaire. Face validity was assessed on a small sample of 10 individuals. A cross-sectional study was conducted (June-July 2015) and OHL-AQ-H was administered on a convenient sample of 170 primary school teachers. Internal consistency and test-retest reliability were assessed using Cronbach's alpha and Intra-class correlation coefficient (ICC), respectively, with 2 weeks interval to ascertain adherence to the questionnaire response. Predictive validity was tested by comparing OHL-AQ-H scores with clinical indicators like oral hygiene scores and dental caries scores. The concurrent and discriminant validity was assessed through self-reported oral health and through negative association with sociodemographic variables. The data was analyzed by descriptive tests using chi-square and bivariate logistic regression in SPSS software, version 20 and p<0.05 was considered as the significance level.

Results: The mean OHL-AQ-H score was 13.58±2.82. ICC and Cronbach's alpha for Oral Health Literacy Adult Questionnaire – Hindi Version were 0.94 and 0.70, respectively. Comparisons of varying levels of oral health literacy with self-reported oral health established significant concurrent validity (p=0.01). Significant predictive validity was observed between OHL-AQ-H scores and clinical parameters like oral hygiene status (p=0.005) and dentition status (p=0.001).

Conclusion: The translated and culturally adapted Oral Health Literacy Adult Questionnaire – Hindi Version indicated good reliability and validity among primary school teachers to assess oral health literacy among Hindi speaking population. Hence, improving OHL levels and implementing education oriented policies can improve the quality of life.

Keywords: Oral health; Health literacy; Validation studies; Reproducibility of results; Translating

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Introduction

Health literacy was defined in 1998 by World Health Organization as ''the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health''(1). Oral Health Literacy, has emerged since late 90's and defined as "degree to which individuals have the capacity to obtain, process and understand basic oral health information and services needed to make appropriate health decisions"(2).

There is a strong association between the level of health literacy and its impact on general health as evident from previous literature (3, 4). Oral health literacy has been an issue of concern both at the ground level as well as policy making criterion. In accordance with the *Disease Control Priorities in Developing Countries, "*What gets measured gets done", to promote good oral health outcomes, various tools have been implemented to first measure oral health literacy and then strategically employ prevention and promotion plans (5).

The majority of early oral health literacy tools were adapted from the Medical-health literacy counterpart scales. Tools like Rapid Estimate of Adult Literacy in Dentistry, REALD-30 (6), Test of Functional Health Literacy in Dentistry, TOFHLiD (7), Oral Health Literacy Instrument, OHIL, Comprehensive Measure of Oral Health Knowledge, CMOHK (8), Oral Health Literacy Assessment-Spanish, and Hong Kong Oral Health Literacy Assessment Task for Pediatric Dentistry were few of the most commonly used oral health literacy instruments. A chronological overview of oral health literacy tools from 2007-2014 magnifies a list of 14 such tools (9). Most of the tools measured oral health literacy in terms of specific domains expanded from word recognition ability to reading comprehension capacity. These domains provided scales with a limited objective to assess oral health literacy. The existing functional oral health literacy instruments are long and difficult considering the comprehension of general population. Recently developed oral health literacy – adult questionnaire (OHL-AQ) stands amidst the preexisting tools as a more stable and comprehensive assessment instrument. Beside reading comprehension and numeracy sections, this questionnaire-based instrument also encompasses listening and decision making as other two domains (10).

Our literature search revealed no previous study to navigate the reliability and validity of Oral Health Literacy Adult Questionnaire (OHL-AQ) for Hindi speaking inhabitants. Despite the presence of certain modified tools to assess oral health literacy, the need to configure a reliable, valid and comprehensive instrument for Hindi speaking individuals still persists (11, 12). According to a critical appraisal, there is limited empirical evidence on reliability and psychometric properties specially the construct validity of oral health literacy tools and great variation also exists in item content across the domain distribution; thus, this study aimed to compensate for this psychometric gap (13).

We aimed to translate Oral Health Literacy – Adult Questionnaire (OHL-AQ) into Hindi and make the necessary cultural adaptation so that the instrument can be used with utmost reliability and validity to assess the oral health literacy of Hindi speaking population.

Methods

A cross-sectional study was conducted among primary school teacher community for a period of two months from June to July 2015. A list of registered primary schools was obtained from the office of Director of education department, Indore city. A total of 15 primary schools including both government and private schools were randomly approached. A detailed description of the study methodology and significance of the study was provided to the school authorities. The primary schools that provided written permission were enrolled as a part of the study.

The study sample of primary school teachers was selected using a simple random sampling technique. The sample size was derived based on the concept of N/p ratio, i.e. item to participant ratio of at least 1:10; indicative of 10 responders for each question in the scale (14). The 17-item questionnaire enabled us to compute a sample size of 170 participants.

Hindi translation of oral health literacy adult questionnaire (OHL-AQ)

The translation of OHL-AQ was done as per four sequential stages of translation back-translation recommended by World Health Organization (15). Primary instructions emphasized conceptual rather than literal translation as well as the need to use natural and acceptable linguistic approach for the majority of Hindi speaking audience while avoiding technical terms and jargons.

A bilingual expert panel consisting of the original translator, experts in public health and experts with experience in translation and development of questionnaires reached a consensus regarding the translated version of OHL-AQ and sorted out discrepancies.

The initial forward translated Hindi version was back-translated into English by a native single independent translator who was blind to the questionnaire. The back-translated English version was cross-matched with original OHL-AQ.

Pre-testing phase was carried out on 10 participants from the same sampling frame but not a part of the main study. The instrument was administered to participants with small de-briefing of the content. Face to face interview sessions were carried out by the primary investigator. The answers obtained from this session were matched with actual responses marked by the respondents in the questionnaire. The respondents were also interviewed regarding the content and ease of understanding the questionnaire.

Psychometric assessment of oral health literacy adult questionnaire Hindi (OHL-AQ-H)

Four main aspects of validity considered in the study were face validity, content validity, criterion validity and construct validity (16). Content validity was undertaken to ascertain whether the content was appropriate and relevant. Complete ranges of attributes under the study were subjected to appointed expert panel to assess all intrinsic aspects of the questionnaire. The panel analyzed the stability of the questionnaire despite cultural or linguistic reframing.

Face validity assessment of the translated scale indicated that the questionnaire appeared appropriate for the study purpose and content area. The target population was made a part of the assessment protocol to ensure the feasibility, readability, consistency, formatting, and clarity of language. Iterations were made based on the difficulty encountered by the participants.

In the present study, construct validity was assessed by examining the predictive and discriminant validity. Clinical parameters like oral hygiene status and dentition status were compared with the OHL-AQ-H scores to determine predictive validity while discriminant validity was assessed by negative/insignificant association of OHL-AQ-H scores with socio-demographic variables like gender, education and socioeconomic status. Criterion validity was assessed through concurrent validity by examining the correlation between self-reported oral health and oral health literacy levels.

Internal consistency or homogeneity of the translated OHL-AQ scale was determined by subjecting the participant's responses for all 17-items of the scale to alpha reliability analysis. Cronbach's alpha values above 0.70 were considered to establish acceptable consistency.

The reliability of the translated questionnaire was evaluated through "test-retest" approach. OHL-AQ-H was randomly re-administered to one-half of the participants. Although there is no definite evidence on the duration between the two tests, in the present study, the questionnaire was re-administered after 2 weeks to minimize the chances of either deterioration or improvement in individual's literacy levels.

A single trained and calibrated investigator (Kappa value = 0.84 for intra-rater examination) conducted the clinical examination by recording Oral Hygiene Index – simplified (OHI-S) and caries experience in terms of DMFT scores. The socioeconomic status of the participants was evaluated using modified Kuppuswamy's socioeconomic scale via reframing the socioeconomic classes as per Ministry of Labor and Employment, Consumer Price Index, May 2015 (17, 18). Self reported oral health responses were also documented.

Measurement tools used in the study

Type III oral examination was carried out under natural light and illumination using mouth mirror, explorer and CPI probe to record clinical data. A strict sterilization protocol was followed during clinical examination.

Ethical approval

This study was approved by the ethics committee of Sri Aurobindo College of dentistry and informed consent was taken from all participants. At the beginning of the interview, the participants were acquainted with the purpose of the study, method of questionnaire filling, privacy and confidentiality of the study. The study sessions were carried out in the respective primary school premises either in classrooms or staff-room at convenience of the participating teachers. The participants were allowed to leave the study at any possible time.

The data collected was entered into Microsoft Excel data sheet and analyzed using Statistical Package for Social Sciences (SPSS, IBM Version 20.0). The statistical analysis consisted of Cronbach's alpha, Intra-class Correlation Coefficient, Kappa statistics, Chi-square tests and binary logistic regression analysis to assess the reliability and validity of the translated questionnaire at 95% confidence interval and 5% significance level ($p < 0.05$).

Results

Among the various sociodemographic variables, age ($p = 0.014$) and gender ($p = 0.005$) were found to be significant factors for oral health literacy. No significant differences in

literacy score was observed in relation to varying education level and socioeconomic status (see Table 1). Both the aforementioned results suggested partial fulfillment of discriminant validity for OHL-AQ-H.

The mean oral health literacy score 14.56±2.16 for younger age group (18–30 years) was significantly higher (p=0.014) than middle and post-middle age groups. These findings suggest that younger participants were more concerned and aware regarding oral health care. Female respondents also had significant higher mean oral health literacy scores (13.94±2.45) than males (12.57±2.87) (p=0.005). The results suggested that female respondents had more proficiency in reading comprehension on oral health, listening oral health advices and making appropriate decisions for better oral health. Non-normal distribution of the data enabled us to evaluate the statistical significance using non-parametric test like Krushkal Wallis and Mann Whitney U test.

The mean total score of 17-item OHL-AQ-H indicated a shift towards high oral health literacy levels (Table 2). The maximum percentage difficulty (29.50%) was encountered in responding to questions pertaining to listening domain followed by difficulty in appropriate decision making (25.00%) regarding oral health.

Internal consistency of the OHL-AQ-H was acceptable with alpha value of 0.70. The "Test-retest reliability" assessment, using bivariate correlation analysis, showed significant results with almost perfect agreement (ICC=0.93, CI=0.88-0.96) indicating highly reliable translated scale (p<0.001). No drastic increment in alpha values was encountered upon item-deletion. So it was decided to have all the 17 items on the final questionnaire with overall internal consistency score of 0.70. Inter-item correlation matrix revealed a significant but weak correlation with maximal correlation between items from numeracy section (0.48).

Table 1: Frequency distribution of sociodemographic variables in contrast to differing levels of oral health literacy – a measure of discriminant validity

Variables	n (%)	Oral Health Literacy – Adult Questionnaire (OHL-AQ-H)			p (Chi-square)
		Low OHL (0-9) n (%)	Moderate OHL (10-11) n (%)	High OHL (12-17) n (%)	
Age					
18–30 years	41 (24.13%)	1 (2.43)	4 (9.75)	36 (87.80)	0.03
31–45 years	66 (38.82%)	10 (15.15)	4 (6.06)	52 (78.78)	
Above 46 years	6 (37.05%)	11 (17.46)	11 (17.46)	41 (65.07)	
Gender					
Male	52 (30.59%)	12 (23.07)	10 (19.23)	30 (57.69)	<0.001
Female	118 (69.41%)	10 (8.47)	9 (7.62)	99 (83.89)	
Education					
Higher sec.	8 (4.72%)	1 (12.50)	3 (37.50)	4 (50.00)	0.18
Graduate	64 (37.64%)	9 (14.06)	7 (10.93)	48 (75.00)	
Post graduate	98 (57.64%)	12 (12.24)	9 (09.18)	77 (78.57)	
SES					
Lower	8 (4.72%)	2 (25.92)	0 (00)	6 (75.00)	0.45
Middle	54 (31.76%)	4 (7.42)	7 (12.95)	43 (79.62)	
Upper	108 (63.52%)	16 (14.81)	12 (11.11)	80 (74.07)	
Tooth brushing behavior					
Twice or more	118 (69.41%)	17 (14.40)	10 (8.47)	91 (77.11)	0.38
Once daily	52 (30.59%)	5 (9.60)	9 (17.30)	38 (73.07)	

Table 2: Mean total scores of OHL-AQ-H and its four domains with percentage of difficulty encountered in respective domains

OHL-AQ-H scale and domains (no. of items pertaining to each domain)	OHL-AQ-H (N=170) Mean±SD	Percentage difficulty (%)
Reading comprehension (6)	5.15±1.10	14.16
Numeracy (4)	3.21±1.06	19.75
Listening (2)	1.41±0.56	29.50
Decision making (5)	3.75±1.07	25.00
OHL-AQ-H total (17)	13.58±2.62	20.11

Oral hygiene status and DMFT values were found to be significantly associated with oral health literacy levels. Respondents having high oral health literacy had good to fair oral hygiene status (p<0.005) and DMFT values <5 (p<0.001). The results indicated a good predictive validity for the translated scale. Self-rated oral health was also found to be significantly associated with OHL levels (see Table 3). Participants having high OHL reported good self-rated oral health, indicating OHL-AQ-H to have good concurrent validity.

A bivariate logistic regression analysis implemented to analyze the determinants of poor self-rated oral health concluded that males belonging to middle age group, having at least

moderate oral health literacy, and brushing twice daily were more likely to have poor self-rated oral health (see Table 4). Although insignificant, our findings ascertained the correlation between the impact of oral health literacy level and self-reported oral health status further strengthening the evidence for concurrent validity.

Discussion

The purpose of our study was to translate the original English version of OHL-AQ into Hindi and evaluate its psychometric properties. Sufficient evidence for scientific basis of our study was provided by systematic sample size determination through the existing literature (14).

Table 3: Comparison of levels of literacy with clinical parameters and self-reported oral health as a measure of predictive and concurrent validity respectively

Clinical parameters	OHL-AQ-H			p (Chi-Square)
	Low OHL (0-9) n (%)	Moderate OHL (10-11) n (%)	High OHL (12-17) n (%)	
OHI-simplified				
Good	0 (0)	7 (20)	28 (80)	<0.005
Fair	11 (12.22)	6 (6.67)	73 (81.11)	
Poor	11 (24.44)	6 (13.34)	28 (62.22)	
Dentition status				
DMFT <5	7 (5.03)	16 (11.52)	116 (83.45)	<0.001
DMFT >5	15 (48.38)	3 (9.69)	13 (41.93)	
Self reported oral health				
Poor	6 (7.79)	14 (18.19)	57 (74.02)	0.01
Good	16 (17.22)	5 (5.37)	72 (77.41)	

Table 4: Determinants of poor self-rated oral health based on binary logistic analysis among primary school teachers (N=170)

Variables	OR (95% CI)	p
Age		
18–30 years	1.00 (ref.)	
31–45 years	1.93 (0.77–4.80)	0.15
Above 46	1.67 (0.77–3.65)	0.19
Gender		
Female	1.00 (ref.)	0.89
Male	1.05 (0.49–2.26)	
SES		
Lower	1.00 (ref.)	
Middle	0.41 (0.07–2.44)	0.33
Upper	0.90 (0.43–1.86)	0.77
Education		
Higher secondary	1.00 (ref.)	
Graduate	0.17 (0.01–1.58)	0.12
Post graduate	0.58 (0.29–1.17)	0.13
Tooth brushing behavior		
Once daily	1.00 (ref.)	0.45
Twice or more	3.02 (0.16–54.42)	
OHL-AQ-H		
High knowledge	1.00 (ref.)	
Moderate knowledge	1.52 (0.55–4.47)	0.38
Low knowledge	0.56 (0.17–1.87)	0.33

In contrast to the majority of studies conducted using conveniently selected sample population, the present study adopted a random sampling procedure to obtain the sample population. Supportive evidence enabled us to derive the sample size using item to participant ratio, N/p ratio. As a rule of thumb, the number of subjects per variable may vary from 4 to 10, with a minimum of 100 subjects to ensure the stability of the variance–covariance matrix. The results of a systematic review on the quality of factor analysis of Medical Outcome Short Form (SF-36) scale identified 3 out of 22 studies on cross-validation, justifying the use of a similar method for sample size estimation. Another systematic review considered a range from 2 to 20 subjects per item, with an absolute minimum of 100 to 250 subjects for cross-validation research (14, 19).

We focused on implementing WHO proposed methodology for translation back-translation procedure which was in contrast to similar studies on linguistic adaptation of OHLI (6). The OHL-AQ-H was found to have an acceptable internal consistency (0.70), which was comparable to pre-validated OHL-AQ (0.72) and OHLI (>0.70) (6, 10). The translated scale illustrated an inter-item correlation of 0.15, which is acceptable for scales measuring diverse characteristic domains (20).

Higher test-retest reliability (0.93) was comparable to similar oral health literacy scales, indicating the understandability and reproducibility of the responses (9, 10, 21-23). The high test-retest reliability could be attributed to the acceptable face and content validity of the translated questionnaire. Despite the cross-sectional nature of the data, computation of test-retest reproducibility was an added advantage. Another advantage of OHL-AQ-H scale was a limited number of questions, which the respondents found less time consuming and easy to respond. In order to avoid discrepancies pertaining to literacy level of the language used in Hindi translated questionnaire, the study was conducted on primary school teachers.

The comparison of sociodemographic variables highlighted an insignificant association between education and socioeconomic status but revealed significant results for age and gender categories. The evidence to support divergent validity of our study was partially favored by the results. The study findings were in agreement to the NAAL (National assessment of adult literacy) instrument survey conducted by Ian M. Bennett et al. 2009 (24). The influence of socioeconomic status on the level of oral health literacy was not significant in the present study; this can be illustrated by the fact that the majority

of participants belonged to either upper or middle socioeconomic class, disabling us to ascertain whether socioeconomic status did actually influence oral health literacy outcome.

The significant association between poor self-rated oral health and oral health literacy levels was in line with similar studies and represented acceptable concurrent validity (11, 12, 21).

The clinical parameters like oral hygiene status and dentition status were highly correlated with the scale scores. This significant association ascertained the predictive validity of OHL-AQ-H scale. The participants having poor oral hygiene status and higher DMFT scores had a low level of oral health literacy as compared to respondents having good oral hygiene status and lower DMFT scores. The majority of the studies conducted on translation and validation of literacy scales confirmed a significant association with clinical parameters (9-12, 21, 22).

The rationale behind conducting the present study on primary school teachers was to reconsider the concept of "*Dental socialization*" and "*significant others*" in contribution to better OHL (23, 24). The scientific layout behind selecting our study population was a key factor differentiating the present study from other similar studies.

The limited sample size for the study was a major concern, meaning that psychometric properties of the scale may vary in a larger subset of population. The participants brushing twice daily had poor oral hygiene and caries status. The same participants reported of having good self-rated oral health. This enabled us to suspect the probability of social desirability bias in the study. The study results can be generalized to school teachers but external validation on a larger sample consisting of local population with limited educational level and differing levels of literacy on language used in OHL-AQ-H should be done cautiously.

We recommend conducting similar studies on a larger sample consisting of local population so as to have a more comprehensive assessment of psychometric properties of the OHL-AQ-H like discriminant and convergent validities. Comparative trials should be conducted in future using OHL-AQ-H and similar other scales to evaluate the effectiveness of different OHL assessment tools

Conclusion

The initial testing of Oral Health Literacy Adult Questionnaire Hindi (OHL-AQ-H) demonstrated a valid and reliable instrument to assess oral health literacy levels among primary school teachers. Although OHL-AQ-H is an oral

health literacy tool which is easy to administer and use, studies are needed to be conducted on local, tribal and rural communities to ascertain its external validity. OHL-AQ-H can effectively be used to conduct researches to assess the literacy levels and implement preventive programs. Thus the Hindi version has enabled its use at both epidemiological and clinical levels.

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