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Corresponding Author:
Asst. Prof. Dr. Pinpinut Wanichsaithong, Department of Family and Community Dentistry, Chiang Mai University, Chiang Mai 50200, Thailand.
E-mail: pinpinut.w@cmu.ac.th

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Validation of a Comprehensive Oral Health Literacy Tool for Thai Older Adults: A Multicenter Cross-sectional Study

Warangkana Vejvithee[1], Surat Mongkolnchaiarunya[1], Pinpinut Wanichsaithong[2]

[1]Dental Health Bureau, Department of Health, the Ministry of Public Health, Thailand
[2]Department of Family and Community Dentistry, Chiang Mai University, Thailand

Abstract

Objectives: This study aimed to develop and validate the Oral Health Literacy Assessment for Thai Older Adults (OHLA-OA) tool.

Methods: The study comprised two phases: tool development and data collection. The OHLA-OA consists of three sections: Reading Comprehension, Understanding Directions, and Self-evaluated OHL skills. A cross-sectional survey was conducted with 408 participants from four regions in Thailand. The average age of the participants was 66.8 years (SD=5.6). The descriptive analysis was performed to explore general information, and reliability and validity of OHLA-OA were tested using Kuder-Richardson Formula 20, Cronbach's Alpha, correlation, and logistic regression analyses.

Results: The OHLA-OA showed high reliability with a KR-20 coefficient of 0.79 and Cronbach's Alpha of 0.85. Concurrent validity demonstrated significant correlations between OHLA-OA scores and variables such as age, income, self-assessed literacy ability, and dental service utilization. Convergent validity showed a significant correlation (r=0.319, $p<0.001$) between OHLA-OA and the Thai Rapid Estimate of Adult Literacy in Dentistry (Th-REALD). Predictive validity indicated that higher OHLA-OA scores were associated with better oral health outcomes, including fewer decayed teeth (r= -0.166, $p=0.01$) and more filled teeth (r=0.184, $p<0.01$). The study proposed cut-off scores for 3 levels: Inadequate, Sufficient, and Excellent OHL.

Conclusions: The OHLA-OA tool demonstrated good psychometric properties, making it suitable for assessing oral health literacy among Thai older adults. It highlights the necessity of integrating literacy assessments into dental care and public health interventions to improve oral health outcomes in aging populations.

Keywords: assessment, older adults, oral health literacy, validation

Introduction

Thailand, like many other countries is experiencing a significant demographic shift with an increasing aging population.[1] This demographic change brings forth unique challenges in oral health care, as older adults face a higher prevalence of oral diseases in consequence of decelerating oral health-related quality of life.[2] The oral health prevention and promotion for older adults is required because good oral health affects overall well-being, and it maintains all significance meaning of oral health until the end of the life.[3]

The significance of oral health was previously described in the qualitative study that in older adults concerning only 3 aspects of oral health; comfort, hygiene, and heath, which are very challenging to achieve all in this group.[4] Older adults often encounter unique challenges related to oral health, including increased risk of dental diseases, tooth loss, and impaired oral function. To address these challenges, it is crucial to promote oral health literacy (OHL), in which it means ability to obtain, process, understand, and use health information to make a decision related to oral health[5], in order to strengthen this population's ability in self-care in against the oral health related problems and promote a quality of life.[6]

OHL is associated with good oral health status and oral health behaviours.[7-9] People with adequate OHL will be able to take care of their health, maintain optimal health, leading to happiness in daily life or quality of life. Health literacy in older adults has been studied in many places all over the world.[10-12] In the previous study in Thai older adults, it was found that poor oral health literacy associated with the fewer of number of natural functional teeth, the more teeth with active decay, and the less posterior occluding pairs.[13,14] Therefore, it is essential to promote oral health literacy in older adults to prevent the consequence of the poor oral health.

The Test of Functional Health Literacy in Dentistry in Older Adults (OA-TOFHLiD) was developed in 2019. It presents a good ability to assess oral health literacy in older adults.[15] However, since it is a pilot development, there were some complains about difficulty of the tools that may be too difficult and too complex for rural elderly people. In addition, the tool was pilot studied only one area in Thailand. Therefore, there is a need to further development of an OHL tool, so that it can be used with Thai older adults across the country. The objective of this study was to develop a comprehensive tool to assess oral health literacy for general Thai older adults and to test the validity and reliability of the instrument.

Materials and Methods

The study was divided into 2 phases: The tool development phase and the data collection phase

Phase I: Tool development

A tool was partially modified from the Test of Functional Health Literacy in Dentistry in Older Adults (OA-TOFHLiD).[15] The original OA-TOFHLiD composed of 4 parts of a closed test and 2 parts of a prompt. The newly developed tool was developed according to the suggestions from previous studies[13,16] that the instrument was too long and too difficult for community-living older adults. Researchers also worked together with the experts' comments. Therefore, the meeting for considering the content and further development of the tool was arranged in June 2021, consisting of 5 dental public health specialists from different sectors (University, Ministry of Public Health, and Hospitals). The panel decided to delete some content of the OA-TOFHLiD, but still use the template (a modified closed test and a prompt) and add the new part (subjective assessment of the set of OHL skills) to evaluate OHL in older adults comprehensively.

The Optimized Oral Health Literacy Tool for Thai Older Adults (OHLA-OA)

The newly optimized ***Oral Health Literacy Assessment for Thai Older Adults (OHLA-OA)*** comprises three distinct sections:

Section 1: Reading Comprehension (17 points)

This section includes two subtopics in the final version: 1) Basic knowledge regarding dental caries and its prevention. 2) Knowledge about gum disease and oral hygiene care. In this part, several words within the passages are omitted at intervals of 5-10 words. Respondents must select the appropriate word from four provided alternatives to complete the sentence correctly.

Section 2: Understanding Directions (10 points)

This section involves interpreting a medicine label. Respondents are required to read the provided label and answer questions related to the information on that label (Figure 1).

Section 3: Self-evaluation of Oral Health Literacy Skills (12 points)

This section consists of 12 topics assessing the respondents' ability to obtain, access, and understand oral health information, as well as their capacity to apply this information in daily life or situations related to oral health. The maximum score for the Reading Comprehension section is 17 points (1 point per each item), for the Understanding Directions section is 10 points (2 points per each item), and for the Self-evaluation section is 12 points (Likert scale 0-4).The raw scores in the Self-evaluation have a maximum of 48 points. However, to ensure a balanced representation across all sections, we rescaled these scores to a maximum of 12 in this section. This adjustment was made to prevent an overemphasis on Section 4 relative to Sections 1-3. By dividing the raw scores by 4, we maintained the relative performance of participants while ensuring that no single section disproportionately influenced the overall score.

Additionally, a socio-demographic questionnaire developed in the previous study[15], which includes age, gender, educational level, socio-economic status, oral health care behaviours and dental service utilisation was distributed together with the OHLA-OA to provide data for validity analyses.

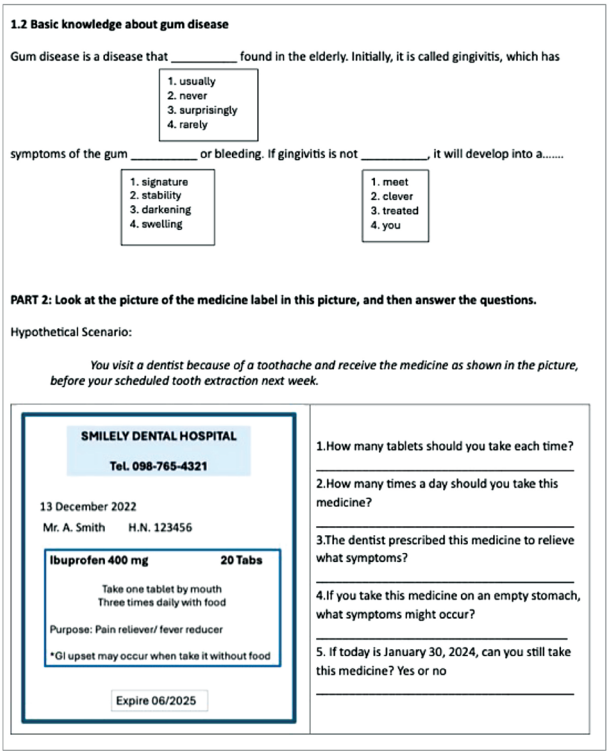

Figure 1: Example of a reading comprehension section and an understanding direction section excerpted from the OHLA-OA and translated to English

Phase II: Data collection

Study design and settings

This study was a cross-sectional survey conducted in April to October 2022, purposively selected a research center from 4 different settings in Thailand including Tak, Nakhon Ratchasima, Yala, Saraburi and Nonthaburi. These centers were the representatives of 4 major regions of Thailand (North, Northeast, South, and Central respectively). The ethical approval for conducting a study was obtained from the ethical committee of Faculty of Dentistry, Chiang Mai University, Thailand (Reference number 37/2021)

Calibration of the examiners

In March 2022, a total of 10 examiners (dentists and dental nurses) and 10 research assistants from 4 centers received training and calibration from the researcher. The training session featured a lecture outlining the data collection procedures and protocol. Additionally, examiners from the 4 centers participated in oral examination training and calibration with the gold standard (PW) on 10 older adults. The inter-rater reliability was found to be 0.81, demonstrating very good consistency.[17]

Sample selection

The sample size was based on a previous validation study of TOFHLiD.[18] In this study, we incorporated a minimum of 100 participants from each of the four centers, aiming for a total participant count of no fewer than 400. Utilizing convenience sampling, we targeted individuals over the age of 55 who were present at the centers on the designated data collection days. To recruit participants, we disseminated infographic advertisements on the social media platform (Line) two weeks prior to the commencement of data collection. Each potential participant was provided with a patient information sheet, which was also verbally explained by a research assistant. Written informed consent was obtained from those who agreed to participate. The study excluded individuals who were unable to read or write in Thai or those with significant medical conditions that would hinder their ability

to independently complete the test (e.g., severe vision impairments or cognitive disabilities).

Questionnaires administration and oral examination

On the data collection day, participants were provided with two self-administered questionnaires: the OHLA-OA and the demographic questionnaire. Upon completion of these questionnaires, participants' pronunciation skills were assessed using the Thai Rapid Estimate of Adult Literacy in Dentistry (Thai REALD-30)[19] which served as the reference oral health literacy (OHL) tool.

The oral examination aimed to assess dental caries status and treatment needs, utilizing only a mouth mirror for the examination. The protocol and diagnostic criteria adhered to adaptations from the 7th Thai National Oral Health Survey.[20] Dental caries were evaluated according to the World Health Organization (WHO) criteria using the Decayed, Missing, and Filled Teeth (DMFT) index.[21] In addition, the prostheses status and prosthesis needs, and the number of natural functional teeth were assessed. Additionally, the examination included an assessment of prosthesis status and needs, as well as the number of natural functional teeth.

Statistical analysis

Descriptive statistics were utilized to depict the characteristics of the respondents in this study, encompassing oral health status, treatment needs, and the scores from the OHLA-OA and Th REALD-30 assessments. For the evaluation of concurrent validity, it was posited that oral health literacy would be associated with age, educational attainment, monthly income, frequency of dental service utilization within the past year, and self-assessed literacy skills. This hypothesis was examined using Spearman's rank correlation.

For the assessment of convergent validity, both Spearman's rank correlation and linear regression analysis were employed to determine the correlation between OHLA-OA scores and Th REALD-30 scores. Predictive validity was assessed by examining the ability of OHLA-OA scores to predict oral health status through Spearman's rank correlation and binary logistic regression.

The internal consistency reliability of the questionnaire was assessed using the Kuder-Richardson-20 (KR-20) coefficient for parts 1 and 2, and Cronbach's Alpha for part 3. The scoring ranges for the new tool were defined based on Sorensen's Health Literacy levels and were categorized into four quartiles: inadequate, marginal, sufficient, and excellent.

Data analysis was conducted using SPSS software for Mac version 23 (IBM Corp, 2015). For multivariate analysis, participants were categorized by age, gender, educational level, residential area, income, dental service usage in the past year, and the number of caries, fillings, or missing teeth. All statistical analyses were two-tailed, with a significance level set at 0.05. To enhance the utility of the new tool for older adults who cannot read or write, a statistical analysis was performed to create a shortened version of OHLA-OA using scores from part 3, which involves a self-rated OHL skill suitable for interview-based administration. This was analyzed alongside the full version.

Results

Descriptive results

The demographic details of the participants in this study are presented in Table 1. A total of 408 individuals participated, with a majority being female. Participants' ages ranged from 55 to 86 years, with a mean age of 66.8 years (SD=5.6). Nearly half (42.6%) of the respondents had an educational level of primary school or lower. Monthly income among participants varied from 0 to 100,000 Thai Baht, with a mean income of 13,282.6 Baht (SD=16,901.5 Baht).

In terms of dental service utilization, only 39.5% of the participants had accessed dental services within the previous year. The majority of these individuals (50.5%) sought dental services for symptomatic reasons, while 27.6% attended for regular check-ups.

The scores for the OHLA-OA full version ranged up to 39, with a mean score of 31.7 (SD=4.5), a maximum score of 39, and a minimum score of 8. In the shortened OHLA-OA, scores ranged from 0 to 12, with a mean score of 7.9 (SD=1.9). For the reference measure, the Thai REALD-30, the scores ranged from 0 to 30, with a mean score of 27.3 (SD=5.4).

Reliability

Two essential metrics were used to evaluate the instrument's reliability. Firstly, the combined parts 1.1, 1.2, and 2, which include a total of 22 items of objective

Table 1: Demographic data

Data		n	%
Gender	Male	115	28.2
	Female	293	71.8
Age	55-65	180	44.1
	Older than 65	228	55.9
Education	Primary school or lower	174	42.6
	Middle to high school	80	19.6
	Diploma, bachelor's degree or higher	154	37.7
Occupation	Current/retired government officer	101	34.1
	Business owner	36	8.8
	Agricultures, or self-employment	73	17.9
	Not working, or others	160	39.2
Utilisation of dental services within 1 year	Use	161	39.5
	Not use	247	60.5
Monthly Income	0-5,000 THB	219	53.7
	More than 5,001THB	189	46.3

measurements, were calculated using the Kuder-Richardson Formula 20 (KR-20). It was discovered that the KR-20 coefficient was 0.79, indicating good reliability. Additionally, Cronbach's Alpha was calculated for part 3, which consists of 12 items. The resulting Cronbach's Alpha was 0.85, signifying very good reliability. These measures show that there is a high degree of internal consistency throughout the instrument's different sections.

Validities

Concurrent validity

Table 2 in Part1 presents the results of concurrent validity. Concurrent validity identified the properties of the newly developed tool is associated with the criterion that it was established the correlation in the previous studies, for example age, income, number of dental services utilizations. The results found that the OHLA-OA scores negatively correlated with age (r=-0.103, p=0.037), positively correlated with monthly income (r=0.336, p<0.001), self-assessment literacy ability (r= 0.430, p<0.001), and the number of dental service utilisation in the previous year (r=0.110, p=0.0026).

For the short form, the correlation was found the same as the full form, except the correlation between the tool and the age.

Convergent validity

This property defines that the ability of the newly developed tool presents correlation with the selected gold standard. In this study, we selected the Th-READ 30 as the gold standard tool. It was found the correlation between the OHLA-OA full and short form were 0.319 (p<0.001) and 0.157 (p<0.001) consecutively.

Predictive validity

It was assessed by examining the ability of oral health literacy scores to predict oral health status. Initially, it was found that the Decayed, Missing, and Filled Teeth (DMFT) index was not significantly correlated with the OHLA-OA scores. However, when analyzing each component of DMFT separately, it was found that the total number of decayed (D) teeth was negatively correlated with oral health literacy scores in both the full and shortened versions (r=-0.166 and r=-0.126, p<0.001, respectively). Conversely, the total number of filled (F) teeth was positively correlated in both the full and shortened versions (r=0.146 and r=0.235, p<0.001). (Table 2.)

To further assess the predictive validity of the Oral Health Literacy Assessment for Older Adults (OHLA-OA), "good oral health status" was defined as a composite variable. This variable comprised two criteria: having no active decay and possessing more than 20 functional teeth. Participants meeting both criteria were categorized

as having "good" oral health status (coded as 1), while those not meeting these criteria were categorized as "not good" (coded as 0). Logistic regression analysis results, as reported in Table 3, demonstrated that both the full and shortened versions of OHLA-OA were significant predictors of good oral health status, with *p*-values of 0.030 and 0.029, respectively. These findings support the utility of OHLA-OA in predicting oral health outcomes among older adults.

Cut-of scores of the Oral Health Literacy Assessment for Older Adults (OHLA-OA)

To measure Oral Health Literacy (OHL) effectively, we employed standard methods to establish index thresholds and create distinct OHL levels. In this study, we proposed cut-off scores for the OHLA-OA, categorized into four groups-Inadequate, Marginal, Adequate, and Excellent-based on the threshold assessment of the HLS-EU indices by Sørensen *et al.,*[22]

Table 2: Results of validity assessment of the Thai OHLA-OA using Spearman correlation

n = 408	OHLA-OA Full version (Score =39)		OHLA-OA Shorten version (Score = 12)	
	r	*p*-value	r	*p*-value
Part 1: Concurrent validity				
Age	-0.103	0.037*	0.010	0.837
Monthly income	0.336	<0.001**	0.205	<0.001**
Self-assessment reading and writing ability scores	0.430	<0.001**	0.313	<0.001**
Number of dental service utilisation in previous year	0.110	0.026*	0.064	0.196
Part 2: Convergent validity				
Th REALD-30 (Reference tool)	0.319	<0.001**	0.157	0.001*
Part 3: Predictive validity				
DMFT	0.056	0.256	0.085	0.088
Number of Decayed teeth (DT)	-0.166	0.001*	-0.126	0.001*
Number of Missing teeth (MT)	0.037	0.460	-0.034	0.495
Number of Filled teeth (FT)	0.184	<0.001**	0.178	<0.001**
Number of functional teeth	0.023	0.640	0.038	0.443
Self-rated overall oral health	0.146	0.003*	0.235	<0.001**

OHLA-OA, Oral Health Literacy Assessment for Thai Older Adults
*Significant value: *p<0.05, ** p<0.001*

Table 3: Using OHLA-OA scores to predict good oral health status by Logistic regression analysis and controlled for confounding factors to determine the predictive validity

	Having good oral health status (Good)							
	OHLA-OA Full version				OHLA-OA Shorten version			
	Exp(B)	*p*-value	95% CI		Exp(B)	*p*-value	95% CI	
			lower	upper			lower	upper
Predictive								
OHLA-OA Scores	1.100	0.030*	1.009	1.198	1.145	0.029*	1.019	1.412
Controlling factors								
Age (years)	0.972	0.279	0.923	1.024	0.968	0.219	0.919	1.019
Monthly Income (THB)	1.000	0.544	1.000	1.000	1.000	0.610	1.000	1.000
Self-assessment reading and writing ability scores (scores 1-5)	1.078	0.716	0.720	1.621	1.022	0.913	0.693	1.506
Number of dental service utilisation in previous year (times/year)	1.007	0.117	0.998	1.015	1.007	0.100	0.999	1.015
Overall percentage	85.1%				85.1%			

OHLA-OA, Oral Health Literacy Assessment for Thai Older Adults
*Significant value: *p<0.05*

The threshold selection was conducted during the questionnaire development in Phase I, with experts unanimously agreeing that the minimum score for the Adequate OHL level should be no less than 50 percent. The expert panel also decided to use quartiles to determine four levels of OHL, with Q1 representing the Inadequate group and Q4 representing the Excellent group consecutively (Table 4).

Subsequently, the four levels of OHL were consolidated into three levels, following Sørensen's suggestion that three levels would be optimal for improving health literacy in vulnerable groups. Therefore, 'Inadequate (Q1)' and 'Problematic (Q2)' were combined into a single category, "Inadequate." Ultimately, the proposed cut-off scores for OHLA-OA are as follows: 1) Inadequate, 2) Adequate, and 3) Excellent.

The final cut-off points for each level of Oral Health Literacy (OHL) are delineated in Table 4, based on the upper and lower limit scores. For the full version of the OHLA-OA, individuals are classified as having Inadequate OHL with scores ranging from 0 to 32.50. Those achieving scores from 32.75 to 34.74 are categorized as having Sufficient OHL, while scores from 34.75 to 39.00 signify Excellent OHL. For the shortened version, the cut-off points are similarly defined: scores from 0 to 8 categorize Inadequate OHL, scores from 8.25 to 8.75 denote Sufficient OHL, and scores between 9 and 12 correspond to Excellent OHL. These thresholds facilitate precise classification of oral health literacy levels, aiding in targeted intervention and assessment.

Discussion

The validation of the Oral Health Literacy Assessment for Thai Older Adults (OHLA-OA) reveals several key findings that significantly contribute to the field of oral health promotion and public health. Firstly, our tool was designed to measure comprehensive oral health literacy skills. It assesses not only word recognition, numeracy skills, and reading abilities as previously developed tools from past decades have done[23], but also evaluates health literacy comprehensively as an outcome of health promotion actions and the perceived abilities of respondents. This approach aligns with contemporary health promotion concepts, empowering individuals to take charge of their health to modify the determinants of health.[6]

The questions in the reading comprehension passages required basic oral health knowledge. For instance, participants were asked about active ingredients in toothpaste that prevent tooth decay. These prompts evaluated participants' comprehension of numbers and label reading skills. Additionally, the self-evaluation of oral health literacy skills, such as the ability to seek, understand, and apply information for oral health care and the use of dental services—was included. This section was added to enhance the tool's properties, addressing a limitation identified in a previous study.[15]

The full version of the OHLA-OA is a comprehensive assessment tool that evaluates older adults' abilities across different dimensions of oral health literacy, including functional, communicative, and critical health literacy. Developed through Delphi methods by experts in dental public health and gerontology, this version requires participants to read, understand, and perform tasks related to oral health, such as comprehending prescribed medications and following directions for their use. This self-administered questionnaire is designed to thoroughly test the respondents' literacy in line with the defined criteria.

Table 4: The proposed cut-off scores of the OHLA-OA

Level		OHLA-OA Full version				OHLA-OA Shorten version			
	Quartile	Lower limit score	Upper limit score	n (408)	%	Lower limit score	Upper limit score	n (408)	%
{ Inadequate	<Q1	0	29.75	96	23.5	0	6.50	98	24.0
{ Problematic/Marginal	Q1-Q2	30.00	32.50	106	26.0	6.75	8.00	119	29.2
Sufficient/Adequate	Q2-Q3	32.75	34.50	104	25.5	8.25	8.75	74	18.1
Excellent	>Q3	34.75	39.00	102	25.0	9.00	12.00	117	28.7

OHLA-OA, Oral Health Literacy Assessment for Thai Older Adults

However, the short version of the OHLA-OA, developed as a supplementary tool, addresses the limitations observed during the validation process of the full version. Specifically, some participants were excluded from the study because they were unable to read and write independently, despite demonstrating adequate oral health knowledge and oral health literacy skills. This limitation was also found in the study using the self-administered tool in older adults.[16] Recognizing this gap, the researchers created the short version to include individuals who might have low literacy levels but possess functional oral health literacy. This version simplifies the assessment process and can be adapted to an interview format, thus making it accessible to a broader range of older adults. While the short form is statistically validated and effective for certain populations, it does not fully replicate the comprehensive evaluation provided by the full version. Further empirical studies are required to validate the short version within broader and more diverse populations.

Furthermore, researchers increased the number of participants from the previous study, despite the prior confirmation that a sample size of one hundred participants suffices for validation studies.[24] This study included four hundred participants from four major regions of Thailand, enhancing the statistical power and ensuring the tool's usability in the general Thai older adult population. The increased sample size is crucial for predictive validity analysis, as it affects clinical outcomes.[25]

The tool demonstrated strong psychometric properties. Concurrent validity was confirmed through correlations between OHL scores and expected variables such as age, educational attainment, monthly income, and self-rated literacy abilities. These findings are consistent with previous studies on Thai older adults[15], and also the studies in the diverse population for example in Iranian[26], Dutch[27], Brazilian[28], Japanese[29] and Canadian adults.[30] This consistency indicates that the tool is robust and can be used confidently across various populations to assess oral health literacy. Additionally, the tool's sensitivity to different educational and socioeconomic levels underscores its utility in identifying at-risk populations, enabling healthcare providers and policymakers to tailor educational programs and resources effectively.

However, Table 2 reveals that age is not correlated with the outcomes of the shortened version of the OHLA-OA. This lack of correlation is attributed to the subjective nature of the shortened version, which primarily assesses self-perceived abilities to access, understand, and use health information for oral health management. As a result, the responses are not dependent on age, and there are no right or wrong answers. In contrast, the full version of the OHLA-OA is designed to objectively measure functional, communicative, and critical OHL, with the first and second sections focusing on these objective metrics. These sections require OHL skills related to functional ability, which the scores may be influenced by cognitive decline associated with aging.[31]

The findings from the convergent validity assessment revealed a significant correlation between OHLA-OA and Thai REALD-30. Although Thai REALD-30 assesses a different aspect of health literacy—serving as a pronunciation test, whereas OHLA-OA is a self-administered questionnaire—both instruments are grounded in similar theoretical frameworks and concepts. These results suggest that OHLA-OA can evaluate OHL to a comparable standard as previously validated instruments. This study aligns with prior research, indicating significant correlations among different OHL measurement tools, although the correlations are not strong ($r<0.5$).[18] The lack of robustness in this correlation may be attributed to the fact that OHLA-OA assesses not only functional OHL, as the REALD-30 does, but also attempts to measure functional, interactive, and critical OHL.

OHLA-OA demonstrated favorable predictive validity. It was negatively correlated with the number of active decayed teeth, suggesting that lower OHLA-OA scores are associated with a higher number of decayed teeth. Conversely, higher OHLA-OA scores correlated with a greater number of filled teeth and better self-rated oral health scores. These results are consistent with previous research highlighting the importance of oral health literacy in maintaining overall oral health. Individuals with higher oral health literacy scores exhibited better oral hygiene practices[32] and had lower incidences of dental caries and periodontal disease.[9] This underscores the critical role of oral health literacy in health outcomes and highlights the necessity of integrating literacy assessments into routine dental care and public health interventions.

Efforts to manage oral diseases and conditions in older adults should be enhanced by providing accessible and affordable oral health services that are tailored to their specific needs, particularly for underprivileged and vulnerable populations.[33] Established cut-off scores of the OHLA-OA are crucial in this context as they enable the identification of individuals most at risk of poor oral health outcomes due to inadequate literacy. These scores facilitate the precise targeting of interventions and efficient allocation of resources, ensuring that those below designated thresholds receive intensive educational programs or preventive measures.[2] Incorporating these cut-off scores into clinical practice and public health research allows for the early detection of at-risk groups, enabling proactive and tailored interventions. This approach not only improves the effectiveness of programs aimed at enhancing oral health literacy but also ensures that interventions are timely and appropriate for each level of oral health literacy. Consequently, it is essential to develop specific interventions tailored to meet the distinct needs of each literacy group in the future studies.

The development of OHLA-OA aimed to address gaps identified in the previous OA-TOFHLiD tool.[15] Utilizing a comprehensive development approach, including expert consensus, pilot testing, and iterative revisions, contributed to the tool's acceptable validity. The inclusion of both objective knowledge-based and skill-based questions and subjective self-assessment items ensured a thorough evaluation of individuals' understanding and attitudes towards oral health. This dual approach not only measures health literacy but also provides insights into behavioral and attitudinal barriers affecting oral health practices. Additionally, the study introduces a shortened version of the tool, which has been optimized for use as an interview questionnaire, complete with established cut-off scores to facilitate future research. To further enhance the utility of the OHLA-OA, it is imperative that the shortened version undergoes separate validation. This rigorous validation process is essential to ensure its accuracy and reliability before its application in broader research contexts.

However, the cross-sectional study design limits the ability to infer causality between oral health literacy and health outcomes. Longitudinal studies are recommended to establish temporal relationships and examine the impact of interventions aimed at improving oral health literacy over time. Additionally, while the tool was tested in a diverse population, further validation in specific subgroups, such as dependent older adults, is recommended. Future research should also explore the integration of this tool into digital platforms.

Conclusions

In conclusion, the Oral Health Literacy Assessment for Thai Older Adults (OHLA-OA) represents a significant advancement in the assessment of oral health literacy. Its reliable and valid measures offer a valuable resource for healthcare professionals, educators, and policymakers. By identifying and addressing oral health literacy gaps, we can enhance oral health prevention and promotion, reduce oral health disparities, and ultimately improve the oral health and quality of life of the older adult population.

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Conflicts of Interest

The authors declare no conflict of interest.

References

1. The Report of Situation of The Thai Older Persons 2020. Foundation of Thai Gerontology Research and Development Institute; 2021.
2. Petersen PE, Ogawa H. Promoting oral health and quality of life of older people - the need for public health action. Oral Health Prev Dent. 2018;16(2):113-24.
3. World Health O. Shanghai declaration on promoting health in the 2030 agenda for sustainable development. Health Promot Int. 2017;32(1):7-8.
4. MacEntee MI, Hole R, Stolar E. The significance of the mouth in old age. Soc Sci Med. 1997;45(9):1449-58.
5. Isman B. Healthy People 2010: Oral Health Toolkit. Bethesda, Maryland: National Institute of Dental and Craniofacial Research, Health NIo; 2007. Contract No.: ED499715.
6. Nutbeam D. Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. Health Promot Int. 2000;15(3):259-67.
7. Neves ETB, Dutra LDC, Gomes MC, Paiva SM, de Abreu M, Ferreira FM, *et al*. The impact of oral health literacy and family cohesion on dental caries in early adolescence. Community Dent Oral Epidemiol. 2020;48(3):232-9.

8. Firmino RT, Ferreira FM, Martins CC, Granville-Garcia AF, Fraiz FC, Paiva SM. Is parental oral health literacy a predictor of children's oral health outcomes? systematic review of the literature. Int J Paediatr Dent. 2018. doi:10.1111/ipd.12378
9. Baskaradoss JK. Relationship between oral health literacy and oral health status. BMC Oral Health. 2018;18(1):172.
10. Silva-Junior MF, Rosario de Sousa MDL, Batista MJ. Health literacy on oral health practice and condition in an adult and elderly population. Health Promot Int. 2021;36(4):933-42.
11. Tenani CF, Silva Junior MF, Lino CM, Sousa M, Batista MJ. The role of health literacy as a factor associated with tooth loss. Rev Saude Publica. 2021;55:116.
12. Tenani CF, De Checchi MHR, Bado FMR, Ju X, Jamieson L, Mialhe FL. Influence of oral health literacy on dissatisfaction with oral health among older people. Gerodontology. 2020;37(1):46-52.
13. Wanichsaithong P, Goodwin M, Pretty IA. Oral health status of Thai older adults with different oral health literacy levels. CM Dent J. 2021;42(2):104-13.
14. Sermsuti-Anuwat N, Piyakhunakorn P. Association between oral health literacy and number of remaining teeth among the Thai elderly: a cross-sectional study. Clin Cosmet Investig Dent. 2021;13:113-9.
15. Wanichsaithong P, Goodwin M, Pretty IA. Development and pilot study of an oral health literacy tool for older adults. J Investig Clin Dent. 2019;10(4):e12465.
16. Janrak N. CP, Wanichsaithong P., Nirunsittirat A. Oral health literacy and health seeking behavior of older adults in rural community. CM Dent J. 2023;44(1):37-45.
17. Regier DA, Narrow WE, Clarke DE, Kraemer HC, Kuramoto SJ, Kuhl EA, *et al*. DSM-5 field trials in the United States and Canada, Part II: test-retest reliability of selected categorical diagnoses. Am J Psychiatry. 2013;170(1):59-70.
18. Gong DA, Lee JY, Rozier RG, Pahel BT, Richman JA, Vann WF, Jr. Development and testing of the Test of Functional Health Literacy in Dentistry (TOFHLiD). J Public Health Dent. 2007;67(2):105-12.
19. Deeraksa S, Chaichit R, Muktabhant B, Udompanich S. Reliability and validity of the thai version of rapid estimate of adult literacy in dentistry. J Int Oral Health. 2019;11(3):132-6.
20. Dental Health Bureau. The 7th national oral health survey of Thailand. Bangkok: Department of Health; 2013.
21. World Health Organization. Oral Health Surveys Basic Methods. 5th ed. Geneva2013. 125 p.
22. Sorensen K, Pelikan JM, Rothlin F, Ganahl K, Slonska Z, Doyle G, *et al*. Health literacy in Europe: comparative results of the European health literacy survey (HLS-EU). Eur J Public Health. 2015;25(6):1053-8.
23. Dickson-Swift V, Kenny A, Farmer J, Gussy M, Larkins S. Measuring oral health literacy: a scoping review of existing tools. BMC Oral Health. 2014;14:148.
24. Anthoine E, Moret L, Regnault A, Sebille V, Hardouin JB. Sample size used to validate a scale: a review of publications on newly-developed patient reported outcomes measures. Health Qual Life Outcomes. 2014;12:176.
25. Faber J, Fonseca LM. How sample size influences research outcomes. Dental Press J Orthod. 2014;19(4):27-9.
26. Naghibi Sistani MM, Montazeri A, Yazdani R, Murtomaa H. New oral health literacy instrument for public health: development and pilot testing. J Investig Clin Dent. 2014;5(4):313-21.
27. van der Heide I, Wang J, Droomers M, Spreeuwenberg P, Rademakers J, Uiters E. The relationship between health, education, and health literacy: results from the Dutch adult literacy and life skills survey. J Health Commun. 2013;18 Suppl 1(Suppl 1):172-84.
28. Mialhe FL, Bado FMR, Ju X, Brennan DS, Jamieson L. Validation of the health literacy in dentistry scale in Brazilian adults. Int Dent J. 2020;70(2):116-26.
29. Furuya Y, Kondo N, Yamagata Z, Hashimoto H. Health literacy, socioeconomic status and self-rated health in Japan. Health Promot Int. 2015;30(3):505-13.
30. Sabbahi DA, Lawrence HP, Limeback H, Rootman I. Development and evaluation of an oral health literacy instrument for adults. Community Dent Oral Epidemiol. 2009;37(5):451-62.
31. Paasche-Orlow MK, Wolf MS. The causal pathways linking health literacy to health outcomes. Am J Health Behav. 2007;31 Suppl 1:S19-26.
32. Charophasrat S, Thitasomakul S, Tianviwat S. Development and validation of oral health literacy questionnaire for Thai adults. J Int Soc Prev Community Dent. 2021;11(6):685-94.
33. Petersen PE, Yamamoto T. Improving the oral health of older people: the approach of the WHO global oral health programme. Community Dent Oral Epidemiol. 2005; 33(2):81-92.