Association between oral health literacy and dental outcomes among users of primary healthcare services

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Abstract: This study aimed to investigate the association between Oral Health Literacy (OHL) and dental outcomes. A sample of 920 adults above 18 years of age living in areas covered by 10 Family Health Units (FHUs) in a large city in São Paulo state, Brazil, was included. OHL was assessed using the short-form Health Literacy in Dentistry Scale (HeLD-14). Data on sociodemographic factors, oral health, and general health were obtained through a structured questionnaire. The investigated outcomes "tooth loss" and "reason for the last dental appointment" were evaluated using self-reported data. Simple logistic regression models were used to analyze the associations between each independent factor and outcomes. Factors that presented a significance level of ≤0.20 in the bivariate analysis were included in the hierarchical multiple logistic regression models. Participants with an education level up to high school, low OHL, and poor/fair self-rated oral health had 1.35 (95%CI, 1.01-1.80), 1.48 (95%CI, 1.12-1.95), and 1.46 (95%CI, 1.11-1.92) times more probability to report missing teeth, respectively. Adults from families with lower monthly income, low OHL, and poor/fair self-rated oral health had 1.70 (95%CI, 1.29-2.26), 1.89 (95%CI, 1.42-2.51), and 1.73 (95%CI, 1.30-2.30) times more chance, respectively, to have gone to the last dental appointment due to pain or caries. Adults with low OHL levels are more likely to have missing teeth and have gone to the last dental visit for pain, reinforcing the importance of OHL as an important determinant for promoting oral health.

Keywords: Oral Health; Health Literacy; Tooth Loss; Health Services.

Introduction

The field of Health Literacy (HL) has been increasingly examined by epidemiologists and clinical researchers because of its relevance to various health outcomes. The World Health Organization (WHO) considers HL an important determinant of health.[1] Although there is no consensus about its definition, the Institute of Medicine report defines HL as "the degree to which individuals have the capacity to obtain, process, and understand the basic health information and services needed to make appropriate health decisions."[2] The core concept of HL is based on the goal of enabling individuals to make informed decisions about their health and to control the determinants that affect their health.[3]

Applied to the field of dentistry, the concept of Oral Health Literacy (OHL) has been identified as a key factor in reducing oral disparities and promoting oral health. OHL is part of a myriad of factors that affect an individual's ability to make decisions regarding their oral health.[4,5] Studies have shown that individuals with low levels of OHL, present higher prevalence rates of oral conditions, such as dental caries, missing teeth, and periodontal disease, in addition to worse self-rated oral health, irregular attendance to dental appointments, poor oral health-related quality of life, and greater deleterious oral habits.[6-12] However, evidence from systematic reviews indicates inconclusive findings regarding these associations.[13-15]

Furthermore, OHL is a construct that influences the use of dental services. Studies showed that individuals with low levels of OHL were associated with searching for dental treatment only in cases of emergency and missing dental consultations.[8,10] In contrast, patients with adequate levels of OHL had dental check-ups more frequently than their counterparts.[6] Therefore, these findings need to be confirmed in other settings, with populations from different countries and using robust samples.[13]

This study aimed to investigate the association between OHL and the dental outcomes "tooth loss" and "reason for the last dental appointment" in a sample of Brazilian users of primary healthcare services. We hypothesized that OHL is a stronger predictor of self-reported missing teeth and reason for the last dental appointment than other contextual and oral health-related factors.

Methodology

A cross-sectional study was conducted from August 2018 to August 2019 with Brazilian users of primary healthcare services in a large city.

The research protocol was approved by the Research Ethics Committee of the Faculty of Dentistry of Piracicaba (CAAE: 58141316.8.0000.5418). Verbal and written informed consent was obtained from all participants.

A pilot study was conducted with 20 adults, and all participants presented a good understanding of the questionnaire. The sample size was calculated considering a test power of 80% (β = 0.20), a significance level of 5% (α = 0.05), a percentage of response in the unexposed group (high OHL) of 30%, and a minimum detectable odds ratio of 1.5. The calculations were performed using EpiInfo statistical software. The minimum sample size required was 894 participants.

Initially, 10 Family Health Units (FHUs) in a large city in São Paulo state, Brazil, were randomly selected. Then, a total of 1000 individuals aged ³ 18 years were randomly invited by the community health workers (CHWs) of each FHU to participate in the study. Data were collected from participants' homes through an interview with three previously trained researchers accompanied by CHWs. The researchers went through a 2-h training process, and the training was carried out by a researcher experienced in epidemiological surveys and with the use of the OHL instrument.

The outcome of tooth loss was assessed through the question, "have you had any of your teeth extracted/removed due to pain or dental caries?" Responses were recorded as "yes" or "no." The reason for the last dental appointment was assessed through the question, "what was the reason that led you to your last dental appointment?" Responses were recorded as "dental caries/pain" or "others."

OHL was measured using the Brazilian version of the HL in Dentistry scale (HeLD-14), a 14-item tool that appraises seven contextual domains related to OHL (communication, understanding, receptivity, utilization, support, financial, and access). Response options were recorded using a 5-point Likert scale, ranging from "unable to do" (score 0) to "without any difficulty." Sum scores ranged from 0 to 56, with higher values indicating better OHL. The variable was categorized as "low OHL" and "high OHL" based on a median split.[16]

A structured questionnaire was used to obtain data on sociodemographic and health factors. Variables were dichotomized as follows: sex (female or male), age (18-44 years or > 44 years), marital status (married/cohabiting or single/divorced/widowed), education (up to high school or high school/university), and family income (up to two

Brazilian monthly minimum wages [BMMW] or >2 BMMW [1 BMMW ≈ US$ 245.8]). Self-rated oral health was evaluated by asking participants how they rated their oral health. Response options for both questions were dichotomized as poor/fair and good/very good/excellent.

Statistical analysis

The sample characteristics were reported using descriptive statistics. Simple logistic regression models were used to analyze the unadjusted associations of each independent factor with self-reported outcomes. Factors that presented a significance level of < 20% in the bivariate analysis were included in the hierarchical multiple logistic regression models. Independent variables were grouped into Level 1 (predisposing), Level 2 (enabling), and Level 3 (need) according to the model proposed by Andersen and Davidson (Figure).[17] The entry of variables in multiple models followed the order of levels. Factors that presented a significance level of ≤ 5% remained in the model and were analyzed with the factors of the subsequent block. Variables with a significance level of ≤5% after adjustment remained in the final model. The fit of the models was analyzed using the Akaike information criterion (AIC) and -2 log L (log-likelihood). Analyses were conducted using the statistical software R.[18].

Results

Of the 1000 individuals invited to participate in the research, 920 responded to the questionnaires (response of 93.6%). The mean age of the sample was 43.20 years (± 15.7). The majority of the participants were female (67.4%), without a university degree (66%), and married (86.2%). The median HeLD-14 score was 40 (interquartile range: 30-48). Approximately 60% of the participants rated their oral health as good, very good, or excellent. The prevalence rate of self-reported missing teeth due to pain/caries was 40.2%.

In the bivariate analysis, missing teeth was associated with lower education (OR, 1.50; 95%CI: 1.13-2.00), low OHL level (OR, 1.66; 95%CI: 1.28-2.17), and worse self-rated oral health (OR, 1.58; 95%CI: 1.20-2.06). After the inclusion of these factors to the hierarchical multiple logistic regression model, adults with lower education, low OHL, and worse self-rated oral health were 1.35 (95%CI: 1.01-1.80), 1.48 (95%CI: 1.12-1.95), and 1.46 (95%CI: 1.11-1.92) times more likely to report missing teeth due to pain or caries, respectively (Table 1).

The proportion of participants who reported pain or caries as the reason for their last dental appointment was 36.2%. Family income (OR: 1.97, 95%CI: 1.50-2.59), low OHL level (OR, 2.18; 95%CI: 1.65-2.87), and worse self-rated oral health (OR, 2.02; 95%CI,: 1.53-2.65) were significantly associated with the outcome of the last dental appointment in the bivariate analysis. In the final model, adults with low family income, low OHL, and worse self-rated oral health were 1.70 (95% CI, 1.29-2.26), 1.89 (95%CI: 1.42-2.51), and 1.73 (95%CI: 1.30-2.30) times more likely to report pain or caries, respectively, as the reason for their last dental appointment compared to their counterparts (Table 2). The AIC values indicated a better fit of the final model than the empty model for both outcomes.
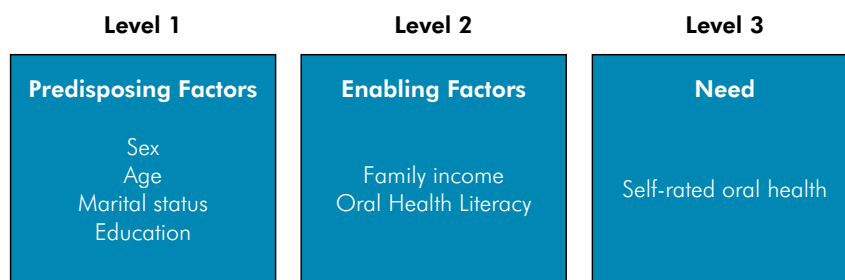

Figure. Framework employed in the analytical process (adapted from the model proposed by Andersen and Davidson, 1997).

Table 1. Analysis (crude and adjusted) of the associations between tooth loss and independent variables.

Variables	n (%)	Tooth loss		OR crude	p-value	OR adjusted	p-value
		No	*Yes	(IC95%)		(IC95%)	
		n (%)	n (%)				
Level 1 Predisposing							
Sex							
Male	300 (32.6)	189 (63.0)	111 (37.0)	Ref			
Female	620 (67.4)	361 (58.2)	259 (41.8)	1.22 (0.92–1.62)	0.167		
Age (years)							
18 to 44	516 (56.1)	309 (59.9)	207 (40.1)	Ref			
≥ 44	404 (43.9)	241 (59.6)	163 (40.4)	1.01 (0.77–1.32)	0.944		
Marital status							
Married	793 (86.2)	464 (58.5)	329 (41.5)	1.49 (1.00–2.21)			
Not Married	127 (13.8)	86 (67.7)	41 (32.3)	Ref	0.051		
Education (years)							
Up to high school	607 (66.0)	343 (56.5)	264 (43.5)	1.50 (1.13–2.00)	0.005	1.35 (1.01–1.80)	0.047
Above high school	313 (34.0)	207 (66.1)	106 (33.9)	Ref		Ref	
Level 2 Enabling							
Family income							
Up to 2 BMMW	457 (49.7)	267 (58.4)	190 (41.6)	1.12 (0.86–1.46)	0.404		
Above 2 BMMW	463 (50.3)	283 (61.1)	180 (38.9)	Ref			
OHL							
Low	465 (50.5)	250 (53.8)	215 (46.2)	1.66 (1.28–2.17)	< .001	1.48 (1.12–1.95)	0.005
High	455 (49.5)	300 (65.9)	155 (34.1)	Ref		Ref	
Level 3 Need							
Self-rated oral health							
Poor/fair	365 (39.7)	194 (53.2)	171 (46.8)	1.58 (1.20-2.06)	0.001	1.46 (1.11-1.92)	0.007
Good/very good/ excellentexcellent	555 (60.3)	356 (64.1)	199 (35.9)	Ref		Ref	

*Reference category for the outcome variable. OR: odds ratio; CI: confidence interval; BMMW: Brazilian monthly minimum wage; OHL: oral health literacy; AIC: Akaike information criterion. AIC (empty model) = 1241.94; -2Log L (empty model) = 1239.94; AIC (final model) = 1220.41; -2 Log L (final model) = 1210.41.

Discussion

In this study, we conducted an exploratory investigation of the associations between OHL and dental outcomes in a large sample of Brazilian users of primary healthcare services. Our findings partially confirmed the initial hypothesis that low OHL is a stronger predictor of missing teeth and the reason for the last dental appointment than other contextual and oral health-related factors. Sociodemographic characteristics, such as education and family income, were also associated with the outcomes.

The proportion of older adults who reported at least one missing tooth due to pain or caries (40.2%) was substantially lower than the prevalence rate of missing teeth observed in the 2015 São Paulo Oral Health Survey among adults aged 35-44 years (77%).[19] These differences may be attributed to distinct sample characteristics and methodological differences related to how the outcome was assessed. Our study findings on the proportion of participants who had their last dental visit due to pain or caries (36.2%) were consistent with the study findings reported by Tellez et al.[20] in the USA and Devaraj and Eswar[21] in India. The 2010 National Oral Health Survey

Table 2. Analysis (crude and adjusted) of the associations between the reason for the last dental appointment and independent variables.

Variable	n (%)	Reason for the last dental appointment		OR crude	p-value	OR adjusted	p-value
		Review	*Pain/Caries	(IC95%)		(IC95%)	
		n (%)	n (%)				
Level 1 Predisposing							
Sex							
Male	300 (32.6)	191 (63.7)	109 (36.3)	Ref			
Female	620 (67.4)	396 (63.9)	224 (36.1)	0.99 (0.74–1.32)	0.952		
Age (years)							
18 to 44	516 (56.1)	336 (65.1)	180 (34.9)	Ref			
≥ 44	404 (43.9)	251 (62.1)	153 (37.9)	1.14 (0.87–1.49)	0.349		
Marital status							
Married	793 (86.2)	501 (63.2)	292 (36.8)	1.22 (0.82–1.82)	0.324		
Not Married	127 (13.8)	86 (67.7)	41 (32.3)	Ref			
Education (years)							
Up to high school	607 (66.0)	377 (62.1)	230 (37.9)	1.24 (0.93–1.66)	0.136		
Above high school	313 (34.0)	210 (37.1)	103 (32.9)	Ref			
Level 2 Enabling							
Family income							
Up to 2 BMMW	457 (49.7)	256 (56.0)	201 (44.0)	1.97 (1.50–2.59)	< 0.001	1.70 (1.29–2.26)	< 0.001
Above 2 BMMW	463 (50.3)	331 (71.5)	132 (28.5)	Ref		Ref	
OHL							
Low	465 (50.5)	256 (55.0)	209 (45.0)	2.18 (1.65–2.87)	< 0.001	1.89 (1.42–2.51)	< 0.001
High	455 (49.5)	331 (72.8)	124 (27.2)	Ref		Ref	
Level 3 Need							
Self-rated oral health							
Poor/fair	365 (39.7)	197 (54.0)	168 (46.0)	2.02 (1.53-2.65)	<0.001	1.73 (1.30-2.30)	< 0.001
Good/very good/ excellent	555 (60.3)	390 (70.3)	165 (29.7)	Ref		Ref	

*Reference category for the outcome variable. OR: odds ratio; CI: confidence interval; BMMW: Brazilian monthly minimum wage; OHL: oral health literacy; AIC: Akaike information criterion. *Reference category for the outcome variable. AIC (empty model) = 1206.35; -2Log L (empty model) = 1204.35; AIC (final model) = 1149.27; -2 Log L (final model) = 1141.27.

observed that 37% of Brazilian adults indicated pain or extraction as the reason for their previous dental appointment; however, these data cannot be directly compared to our findings because of differences in how the variable was categorized.[22]

Based on our findings, low OHL was strongly associated with missing at least one tooth due to pain or caries among users of primary healthcare services. Similar findings have been reported in studies conducted with populations from the USA,[10,23]

Japan,[11] and Belarus.[24] Because untreated dental caries and periodontal disease are the main causes of tooth loss worldwide, the most favorable approach to stop the progress of these conditions and prevent tooth loss is early treatment.[25] However, individuals with low OHL may not be equipped with the skills required to understand and apply health information, recognize the need for early treatment, and navigate the often complex health systems. It is hypothesized that individuals with adequate levels of OHL can

identify early signs of oral conditions and are more likely to seek prompt treatment. These assumptions are supported by our findings of higher chances of reporting a last dental appointment motivated by pain or caries among individuals with low OHL.

We observed that individuals with low OHL were 1.89 times more likely to have had their previous dental appointment due to acute reasons than individuals with high OHL levels. Previous studies have demonstrated that the pattern of dental service utilization is associated with OHL levels. Batista et al.[9] reported that Brazilian adults who sought dental treatment due to pain had a two-fold increased chance of presenting low OHL. Ueno et al.[11] observed in Japanese adults that the higher the OHL levels, the more frequently they had a preventive dental checkup. Furthermore, the higher OHL was associated with visiting a dentist sometime in life among 12 year-old adolescents.[26] Lower OHL levels were also associated with missed dental appointments.[10] Conversely, studies found no association between OHL levels and the time of the last dental visit.[8,27] In general, individuals with poor HL and OHL are those who least access health services or access it only in cases of emergency, as they may not have the skills needed to obtain, evaluate, and apply complex health information related to the importance of dental treatment and pathways to accessing dental services.[28] Furthermore, these groups may face additional barriers related to OHL, such as financial hardship and unfriendly health systems.

It is important to note that our estimates of the associations between OHL and dental outcomes were adjusted using socioeconomic and self-rated oral health data. A growing body of evidence has demonstrated that income, education, and self-rated oral health are important predictors of OHL across different populations.[29-31] The associations between tooth loss, education, and self-rated oral health have also been largely documented in the literature.[32-35] Similar to our findings, previous studies indicate that income and self-rated oral health are important predictors of dental service utilization.[12,36,37]

In the past two decades, several instruments have been developed to measure population and individual levels of OHL. Nonetheless, the vast majority of these tools are exclusively focused on word recognition, ignoring the important dimensions of OHL.[38] In this study, we employed a Brazilian validated version of the HeLD-14, a scale that evaluates the OHL in seven different domains: communication, understanding, receptivity, utilization, support, finance, and access. Thus, our findings provide a comprehensive and reliable assessment of OHL among a large sample of users of primary healthcare services. Furthermore, it is important to expand the limited understanding of OHL as an individual trait to consistently interpret our findings. From the perspective of the "health literacy environment," HL and OHL are conceptualized as structural components of the health system itself, a view that opens a new field of practical implications and potential interventions.[39] For instance, our findings highlight the need to adopt processes, infrastructure, relationships, and policies in the primary healthcare sector that enable patients to understand, apply, access, and navigate health information and health services. This approach represents an important shift from the individualistic notion that patients are solely responsible for their deficit of skills related to health and emphasizes the importance of creating person-centered healthcare environments that are accessible and friendly for people with different levels of OHL.[40] Ultimately, these changes may contribute to reducing inequalities in oral health.[41]

Our findings should be interpreted in light of the limitations of this study. Causal inference is precluded by the cross-sectional nature of the data. Self-reported data on missing teeth may be subject to recall bias. Although there is evidence that self-reporting is a reliable method to determine the number of teeth in population studies,[42] it may not be as accurate as oral examinations performed by trained dentists. The findings may not be generalizable to nonurban populations and groups that do not use public primary healthcare services in Brazil.

Conclusion

Adults with low levels of OHL were more likely to report missing teeth and to have gone to their last dental appointment due to pain or caries. Socioeconomic factors and self-rated oral health were important predictors of missing teeth and the

reason for the last dental appointment. Our findings highlight the importance of targeting OHL in oral health promotion strategies, in addition to creating person-centered healthcare environments.

Acknowledgments

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