

Association of oral health literacy with oral health behaviour and oral health status in Belarus

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Objectives: To explore the level of oral health literacy among adults in Belarus, a former part of the Soviet Union, and to analyse the associations between oral health literacy, socio-demographics, health behaviour and oral health status. **Basic research design:** A cross-sectional study. **Participants:** 281 adult (18-60 years old) dental patients. **Main outcome measure:** The participants completed a self-administered questionnaire collecting information about socio-demographics and health behaviours, and oral health literacy test (the R-OHLI). Clinical oral examination followed the questionnaire survey. **Results:** Among participants, 68.7% had adequate, 18.9% had marginal and 12.4% inadequate oral health literacy levels. Females and those with higher education were more likely to have adequate oral health literacy ($p<0.05$ and $p<0.001$). Participants with adequate oral health literacy had fewer missing and more filled teeth than those with inadequate literacy ($p<0.001$). This association remained significant after adjusting for socio-demographics, behavioural characteristics and oral hygiene status ($p<0.05$ and $p<0.001$). **Conclusions:** Adequate oral health literacy was strongly related with better oral health status. Improvement of oral health literacy should be addressed when developing community oral health promotions.

Key words: oral health, health literacy, health behaviour, health promotion, Belarus

Introduction

Oral health literacy is often defined as “the degree to which individuals have the capacity to obtain, process, and understand basic oral health information and services needed to make appropriate health decisions” (Institute of Medicine, 2013) implying that enhancement of oral health literacy is necessary to improve individuals’ skills and abilities in gaining and using health information. Measurement of health literacy is complicated because of the complex structure of the concept itself (Sørensen *et al.*, 2012). Validated instruments mostly assess functional literacy by using health-related literature and measuring either word recognition or reading comprehension.

Low oral health literacy was found to be associated with limited awareness of oral health, ignorance of preventive care, dental anxiety and irregular or failed dental attendance and, among parents, worse oral health in their children (Bridges *et al.*, 2014; Divaris *et al.*, 2012; Holtzman *et al.*, 2014; Horowitz and Kleinman, 2012a,b; Miller *et al.*, 2010; Shin *et al.*, 2014; Vann *et al.*, 2010). Many of these studies were based on self-reported oral health and few included clinical oral examination.

The Republic of Belarus, a former Soviet Union member, has a health care system highly influenced by its socio-political past (Balabanova *et al.*, 2004). DMFT among 35-44 year-olds was 13.1 in 2009 when MT among over 65 year-olds was 18.9 though access to dental services seems to be sufficient (Tserakhava *et al.*, 2011), inappropriate oral health behaviour could be impacting oral health. However, no study on oral health literacy and behaviour has been conducted in Belarus to test this possibility.

We hypothesised that oral health literacy among Belarusian adults was low and could negatively affect health behaviours and oral health status. Thus, the objectives of this study were to explore oral health literacy level among adults in Belarus and to analyse the associations between oral health literacy, socio-demographic status, health behaviours and oral health status.

Material and methods

Permission to conduct the survey was obtained from the hospital’s administration and the research protocol was approved by the Tokyo Medical and Dental University Ethics Committee (Approval No 901). Then patients aged 18 to 60 years (without physical or mental disabilities) who visited the dental division of a typical urban district hospital in Belarus during July and August of 2013, were asked to participate in this study. Written informed consent was obtained from each participant who then filled out a self-administered questionnaire collecting information on socio-demographics (gender, age, and education), health behaviours (smoking, regularity of dental visits, and tooth brushing frequency) and finally, oral health literacy using the Russian language version of the Oral Health Literacy Instrument (R-OHLI) of proven reliability and validity (Blizniuk *et al.*, 2014; Sabbahi *et al.*, 2009).

The R-OHLI has a reading comprehension section and a numeracy section which evaluates ability to perform the basic mathematic operations necessary to understand medication prescriptions and postoperative instructions. Of the R-OHLI’s 57 items; 38 address reading comprehension and 19, numeracy, each item is scored 1 if correct or 0 if

incorrect or unanswered. Then the scores are multiplied by 1.316 (50/38) and 2.632 (50/19), respectively, equally weighting the sections to range from 0 to 50. The total R-OHLI score (range 0-100) is categorised using the original cut-offs: inadequate (>60), marginal (60-74) and adequate (>74) oral health literacy.

Clinical oral examination was performed by one dentist (AB) with participants sitting in a dental chair. An operatory light, a dental mirror, an explorer and a periodontal probe were used and the examination was performed according to WHO recommendations and included tooth status (numbers of decayed, missing and filled teeth), oral hygiene, pocket depth, and gingival bleeding on probing. Third molars were excluded from the examination.

Oral hygiene status was assessed with Silness-Löe plaque index (PLI) (Silness and Löe, 1964). Plaque was scored on four surfaces (buccal, lingual, mesial and distal) of the six index teeth from 0 to 3 according to standard criteria, and the PLI score was calculated.

Pocket depth was measured using the UNC 15 probe (Hu-Friedy, Chicago, IL) on each tooth surface circumferentially and the deepest measurement scored for each tooth. Periodontal pockets ≥ 4 mm were considered deep. Presence of bleeding on probing was assessed for each tooth following the pocket depth examination.

Descriptive statistics of oral health status such as number of decayed teeth, number of missing teeth, number of filled teeth, PLI, number of deep pockets and number of teeth with bleeding on probing were calculated. Associations of the R-OHLI with gender, education level (high school/lower; university/higher), smoking behaviour (non/past smoker; current smoker), regularity of dental visits (\geq annually; <annually) and tooth brushing frequency (less than twice a day, twice a day or more,) were analysed by t-tests and Chi-square tests. Bivariate analyses using ANOVA were performed to examine the relationship of three R-OHLI levels with oral health status. To further analyse the association of oral health status with R-OHLI scores, adjusted means were calculated accounting for socio-behavioural characteristics (gender, age, education, smoking, regularity of dental visits, and tooth brushing frequency) and oral hygiene status (PLI). All statistical analyses were performed using SPSS v17.0.

Results

Of the 370 patients invited, 281 (76%) participated. Characteristics of the sample are presented in Table 1. Most were women (64.1%) and they were generally older than the men (mean age in years 35.9 vs 28.0, $p < 0.001$). Education level was similar across the genders as were the mean ages of those with and without a university degree (35.3 years sd 11.3 and 32.3 sd 12.4). Almost a quarter claimed they were current smokers, more often males than females (44.6% vs 12.8%, $p < 0.001$). The mean age of current smokers was lower than that of non-smokers (29.3 vs 34.3 years, $p < 0.01$). Half the sample attended dental appointments at least once a year but were more likely to be female (58.9% vs 38.6%, $p < 0.01$) but did not differ by age. Toothbrushing twice daily or better was reported by 66.2% and similar across the genders but these participants were a little younger than the others (mean age in years 31.7 sd 11.6 vs 35.8 sd 12.9, $p < 0.01$).

The mean total R-OHLI score was 77.2 sd 14.5 and greater among: females (79.3 sd 13.6 vs 73.6 sd 16.4, $p < 0.01$); graduates (83.5 sd 10.0 vs 75.2 sd 15.1, $p < 0.001$); and regular dental attenders (79.3 sd 14.0 vs 75.1 sd 14.8, $p < 0.05$) but with no significant differences by smoking behaviour (do 78.1 sd 14.0 vs do not 74.5 sd 15.7) or toothbrushing (twice daily 7.9 sd 14.7 vs less often 75.9 sd 14.1)

For categorised R-OHLI scores, 68.7% of participants had adequate, 18.9% marginal and 12.4% inadequate oral health literacy levels. The mean ages were similar across those three levels (see Table 2). The proportions of participants with adequate literacy were greater for females, graduates though no differences were noted for health behaviours such as smoking, regularity of dental visits and tooth brushing frequency (Table 3).

In bivariate analyses (Table 4), participants with adequate oral health literacy level had fewer missing teeth than their counterparts and more filled teeth than those with inadequate literacy. The same tendency was observed for the Silness-Löe plaque index (PLI) but no difference was observed for number of decayed teeth, number of teeth with deep pockets or gingival bleeding on probing. After adjusting for socio-economic and behavioural characteristics (Table 5), plaque index was no longer significantly associated with oral health literacy level. Numbers of missing and filled teeth were still significantly different between participants with adequate literacy level and those with inadequate literacy ($p < 0.01$ and $p < 0.05$).

Table 1. Socio-demographics and health behaviours of participants overall and by gender

	Overall (n=281)		Male (n=101)		Female (n=180)		p value
	n	%	n	%	n	%	
Education							0.472
high school or lower	212	75.4	79	78.2	133	73.9	
university	69	24.6	22	21.8	47	26.1	
Smoking							<0.001
non-smoker or past smoker	213	75.8	56	55.4	157	87.2	
current smoker	68	24.2	45	44.6	23	12.8	
Regular dental visits							<0.01
once a year or more	145	51.6	39	38.6	106	58.9	
less than once a year	136	48.4	62	61.4	74	41.1	
Tooth brushing frequency							0.072
twice a day or more	186	66.2	60	59.4	126	70.0	
less than twice a day	95	33.8	41	40.6	54	30.0	
Age in years, mean (SD)	33.1 (12.2)		28.0 (10.3)		35.9 (12.3)		<0.001

Table 2. Distribution of socio-demographics (age, gender, education) by oral health literacy levels

Oral health literacy level	Age, years		Gender				Education			
	mean	SD	Male		Female		High school or lower		University	
			n	%	n	%	n	%	n	%
Inadequate	33.9	13.8	17	16.8	18	10.0	33	15.6	2	2.9
Marginal	30.5	11.8	25	24.8	28	15.6	48	22.6	5	7.2
Adequate	33.6	12.0	59	58.4	134	74.4	131	61.8	62	89.9
p-value	0.239		<0.05				<0.001			

SD, standard deviation

Table 3. Distribution of health behaviours (smoking, dental visits, toothbrushing) by oral health literacy levels

Oral health literacy level	Smoking				Regular dental visits				Tooth brushing frequency			
	Non- or past smoker		Current smoker		Regular		Not regular		Twice a day or more		Less than twice a day	
	n	%	n	%	n	%	n	%	n	%	n	%
Inadequate	25	71.4	10	28.6	15	42.9	20	57.1	22	62.9	13	37.1
Marginal	37	69.8	16	30.2	23	43.4	30	56.6	33	62.3	20	37.7
Adequate	151	78.2	42	21.8	107	55.4	86	44.6	131	67.9	62	32.1
p-value	0.363				0.162				0.676			

Table 4. Oral health status (mean and SD) by oral health literacy level

Oral health literacy level	Decayed teeth Mean (SD)	Missing teeth Mean (SD)	Filled teeth Mean (SD)	PLI, plaque index Mean (SD)	Deep pockets Mean (SD)	BOP Mean (SD)
Inadequate	2.0 (1.9)	4.8 (5.5) *	3.9 (3.4)	0.9 (0.5)	3.0 (4.4)	5.7 (4.1)
Marginal	2.1 (2.8)	2.6 (4.1) **	5.5 (4.3) **	0.9 (0.4) *	2.9 (4.8)	7.3 (4.7)
Adequate	1.5 (2.1)	2.4 (3.2)	6.8 (4.8)	0.7 (0.5) **	2.5 (4.1)	5.8 (5.1)
Overall	1.7 (2.2)	2.7 (3.8)	6.2 (4.6)	0.8 (0.5)	2.6 (4.3)	6.1 (5.0)

*p<0.05; **p<0.01; SD, standard deviation; PLI, Silness-Löe plaque index; BOP, bleeding on probing

Table 5. Oral health status (adjusted mean and SD) by oral health literacy level, adjusted for gender, age, education, smoking behaviour, regularity of dental visits, tooth brushing frequency and PLI

Oral health literacy level	Decayed teeth ^a Mean (SD)	Missing teeth ^a Mean (SD)	Filled teeth ^a Mean (SD)	PLI ^b plaque index Mean (SD)	Deep pockets ^a Mean (SD)	BOP ^a Mean (SD)
Inadequate	1.7 (2.1)	4.3 (2.9)	4.5 (4.2)	0.9 (0.5)	2.6 (4.0)	5.0 (4.6)
Marginal	1.8 (2.1)	2.8 (2.9) **	6.2 (4.2) **	0.8 (0.5)	3.0 (3.9)	6.8 (4.6)
Adequate	1.6 (2.1)	2.4 (2.9)	6.6 (4.2)	0.7 (0.5)	2.5 (3.9)	6.0 (4.6)

^aAdjusted for gender, age, education, smoking behaviour, regularity of dental visits, brushing frequency and PLI; ^bAdjusted for gender, age, education, smoking behaviour, regularity of dental visits and brushing frequency; **p<0.01; SD, standard deviation; PLI, Silness-Löe plaque index; BOP, bleeding on probing

Discussion

In this study we examined oral health literacy and its associations with socio-demographics, health behaviours and oral health status in Belarus. Our first hypothesis that oral health literacy level would be low was rejected as about 70% of participants had adequate oral health literacy. The next hypothesis that oral health literacy level negatively affects health behaviours and oral health status was accepted only partially. Oral health literacy was significantly related with socio-demographics and oral health status but not with health behaviours.

This study had some limitations. Generalisation of the results is limited because of the convenience sample of

dental patients attending for free state-provided treatment (Tserakhava *et al.*, 2011) thus reducing financial barriers to access which may exist elsewhere. Secondly, measuring oral health literacy via reading comprehension assesses only its functional aspect. Though word recognition types of oral health literacy tools were available they are based on correct pronunciation, which could not be used because of the Russian language's phonetic structure. Despite these limitations we believe the findings are important because of the scarcity of European data on oral health literacy, the investigation of its link to behaviours and outcomes, and the use of a Belarusian population and the more reliable clinical examination instead of self-report to assess oral health status.

This was the first research to evaluate oral health literacy in Belarus. Comparison with other oral health literacy findings elsewhere is complicated by the different instruments used, samples tested and different socio-economic and cultural backgrounds. Many US studies employed the REALD-30 word-recognition instrument (Lee *et al.*, 2007). Overall, these studies revealed that about one quarter to half of participants had limited oral health literacy (Divaris *et al.*, 2012; Jones *et al.*, 2007; Miller *et al.*, 2010) though most of the participants were from vulnerable groups with low socio-economic status. However, elsewhere only a small proportion of individuals displayed low oral health literacy, e.g. in Hong Kong and Japan (Bridges *et al.*, 2014; Ueno *et al.*, 2013). Regional differences have a significant impact on oral health literacy suggesting that international comparisons should be made cautiously.

Considering socio-demographics our study found that oral health literacy significantly differed by gender and education level. Females having higher oral health literacy has been observed elsewhere (Atchison *et al.*, 2010; Naghibi Sistani *et al.*, 2013). Generally women in Belarus are more likely than males to encounter health information, especially during pregnancy and child-rearing and through their more frequent visits to medical institutions. It is plausible that the better educated would more easily find and understand health related information then make decisions based on this information. The effect of education on oral health literacy is well established (Atchison *et al.*, 2010; Jones *et al.*, 2007; Lee *et al.*, 2011; Sabbahi *et al.*, 2009), most clearly between graduates and others, (Lee *et al.*, 2011) but postgraduate education was not significant (Atchison *et al.*, 2010).

The mechanism by which oral health literacy is linked to oral health behaviour and health status has not been well explored. Children's oral health practices were associated with their caregivers' oral health literacy in some studies (Divaris *et al.*, 2012; Vann *et al.*, 2010) but not all (Miller *et al.*, 2010). Likewise, associations between regular dental visits and oral health literacy are noted in a Japanese study (Ueno *et al.*, 2013) but not US ones (Jones *et al.*, 2007; Lee *et al.*, 2011; Shin *et al.*, 2014). Such conflicting data suggest that health behaviour may be strongly affected by the sample's socio-demographic characteristics while good oral health literacy may be a necessary but not sufficient factor in effecting behavioural change (Lee *et al.*, 2012).

In contrast, oral health status was related to oral health literacy. Our participants with higher oral health literacy levels had fewer missing teeth and more filled teeth as found in the Japanese study (Ueno *et al.*, 2013) study's finding of an association with periodontal disease was not observed in the present research. Differences in race, age and severity of periodontal disease may contribute to this discrepancy - our sample was relatively young with a narrow spread of periodontal status.

Dental attendance patterns may play a role in the relationship between better oral health literacy and better oral health status. The less literate may be reluctant to visit a dentist until in pain which increases the risk of extractions. Individuals with inadequate oral health literacy have reported higher dental anxiety and failed dental appointments (Holtzman *et al.*, 2014; Shin *et al.*,

2014). On the other hand, those with high oral health literacy may be more likely than others to complete dental treatment even across several visits, resulting in more teeth with restorations and less tooth loss.

Oral health literacy has proved to be highly dependent on the research setting. In case of Belarus, although oral health literacy seems to be high, health behaviour is worse than expected. Future interventions might usefully be tailored to increase people's awareness of the effectiveness of regular dental check-ups, professional care and treatment of early stages of disease rather than to concentrate on general recommendations about oral hygiene and healthy diets.

Oral health literacy level among adults in Belarus appeared to be high, but further research is required to confirm whether these findings can be generalised for the entire Belarusian population. The current study showed that adequate oral health literacy was strongly related with better oral health outcomes. Therefore, it is important that oral health literacy is considered when developing community oral health promotion activities, at least in Belarus.

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