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ORIGINAL PAPER

Health Literacy, Acculturation, and the Use of Preventive Oral Health Care by Somali Refugees Living in Massachusetts

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Abstract This study investigated the impact of English health literacy and spoken proficiency and acculturation on preventive dental care use among Somali refugees in Massachusetts. 439 adult Somalis in the US $\leq$10 years were interviewed. English functional health literacy, dental word recognition, and spoken proficiency were measured using STOFHLA, REALD, and BEST Plus. Logistic regression tested associations of language measures with preventive dental care use. Without controlling for acculturation, participants with higher health literacy were 2.0 times more likely to have had preventive care ($P = 0.02$). Subjects with higher word recognition were 1.8 times as likely to have had preventive care ($P = 0.04$). Controlling for acculturation, these were no longer significant, and spoken proficiency was not associated with increased preventive care use. English health literacy and spoken proficiency were not associated with preventive dental care. Other factors, like acculturation, were more predictive of care use than language skills.

Keywords Refugees · Preventive dental care · Acculturation · Health literacy

Introduction

Among refugees newly arrived in Massachusetts, oral abnormalities are the most common health problem in children [1] and the second most common problem in adults (Unpublished data from the Refugee and Immigrant Health Program, Massachusetts Department of Public Health, October 24, 2012). One major determinant of oral health disparities is access to dental care. Such care may in turn impact on how individuals make decisions about dietary and

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oral hygiene practices [2]. Linguistic and cultural factors also may play important roles in determining use of oral health services as well as personal oral hygiene practices. Among these, limited literacy is hypothesized as "one of the many barriers to better oral health outcomes [3]."

Health literacy is embedded in a variety of determinants of oral health [3, 4]. Inadequate health literacy has been associated with limited access to and utilization of health care [6, 7] and adverse health outcomes [5, 8–10], but its relationship with use of oral health care services has never been studied in a refugee population. Racial and ethnic minorities often encounter significant linguistic barriers to care in the US. This is particularly so for refugees who speak languages for which bilingual services and interpretation are limited.

This study used a theoretical framework of decision analysis, behavioral decision theory, and health beliefs [11] to recognize the importance of knowledge, experience, and social and demographic variables as factors influencing refugees' utilization of oral health services. While hypothesizing health literacy and acculturation as key predictors of use, past research has indicated a strong role for social supports and community networks as moderators of health literacy and its impact on health status [12].

The process of adoption of cultural norms of the dominant, host society is described in this paper as "acculturation." The effects of acculturation on oral health have been studied in Haitian immigrants who had a low baseline rate of caries [13]. High acculturation was associated with less caries. In Australia, a study of Vietnamese refugees also revealed an association between acculturation and dental health status [14]. The Vietnamese also had very good oral health status overall with high acculturation associated with better oral health status.

These prior studies of acculturation, however, revealed a non-linear relationship in which refugees with moderate acculturation had worse oral health as compared to refugees with high and low acculturation. Based on the "cultural marginality model [15, 16]," refugees in these studies who had moderate levels of acculturation may have attenuated beneficial, traditional dental practices without adequate integration of preventive practices of their new societal setting. In this manner, moderately acculturated refugees might have adopted behaviors deleterious to oral health, such as greater consumption of refined sugar, without adopting beneficial aspects of Western oral hygiene and related behaviors like preventive dental care [14]. One such beneficial Western behavior is utilization of professional dental preventive services, a more proactive form of dental care. While the relationship between preventive care and improved oral health is not conclusive [17], evidence suggests that routine preventive dental care is cost-effective and leads to better oral health outcomes [18, 19]. This association has not been assessed for refugees.

Somalis are one of the largest refugee populations to have entered the US in recent years, and little is known about their health outcomes after resettlement. As a result of civil war over the past 20 years, many Somalis have lived in refugee camps for long stretches of time. Somalis are almost all practicing Muslims with relative homogeneity of language, culture, and religion and have been observed to maintain close-knit communities in the US [20, 21] More recently-arrived Somalis have very low literacy in English [22] and retain traditional cultural practices such as the use of a stick brush ("*miswak*" or "*aday*") for dental hygiene. Studies have found stick brushes to be effective in removing plaque [22, 23], and have an inhibitory effect on oral cariogenic streptococci [24, 25] and periodontal pathogens [25].

Given the importance of health literacy in determining health in the general population, this study sought to investigate the relationship of English language skills with self-reported utilization of dental care services and dental health status among Somali refugees in Massachusetts. The investigators hypothesized that subjects with higher language skills and acculturation would be more likely than others to have more utilization of professional dental care for preventive services.

Methods

Study Design

This cross-sectional survey entailed structured interviews of a convenience sample of Somali adults living in Massachusetts. All communication with subjects was conducted in Somali by a Somali research assistant and Somali dental examiner. All written materials (except the three measures of English language skills) were translated into Somali to enhance standardization of the interviews. The translation process used standard procedures for group, consensus translation [26]. The study was approved and monitored by the Institutional Review Board of the Massachusetts Department of Public Health.

Subjects

Individual refugees were eligible for the study if they were 18 years of age or older, had arrived from overseas no more than 10 years prior to enrollment and were of Somali nationality. Individuals were excluded if they had functional visual impairment; problems with speech articulation; cognitive impairment, learning disabilities or traumatic brain injury; or contraindications to oral examination. Recruitment

utilized messaging by word of mouth and contacts with key community stakeholders supplemented by purposive sampling to ensure that the sample was representative of the expected age and gender distribution of the general population of Somali refugees in Massachusetts. Age and gender groups were targeted for enrollment to match what would be expected in 2009 based on the distribution of age and gender of Somali refugees about whom the Massachusetts Department of Public Health received formal notification of arrival in Massachusetts since 1999. Participants received a gift card on completion of the interview. Interviews took place throughout Massachusetts with clusters in Boston, Lynn, Chelsea, Worcester and Springfield.

Instruments

The research interview included questions on demographics, cultural practices relevant to oral health, educational experiences, oral health practices, and experience with dental care services. Instruments were selected based on their ability to provide specific information pertinent to the key domains of health decision-making in the theoretical model that was the framework for the study [11]. Assessment of dental and oral health care experiences was conducted through the Access to Care Questionnaire of the basic screening survey (BSS) [27]. Questions on access to medical care came from the National Health Interview Survey. These were supplemented with questions regarding personal care and lifestyle practices relevant to oral health. The primary outcomes were derived from these health services questions. Specifically, subjects were asked whether they had any visit with a dentist in the preceding 12 months in the US; subjects then categorized the purpose of any such visits. Based on responses, a composite variable was created to indicate whether subjects had had a preventive dental care visit in the preceding 12 months. To account for the known variation in availability of dental clinics that accept Medicaid, a variable for geographic accessibility was defined as Boston, Cambridge, Somerville, and Lynn versus other locales.

Measures of language skills included assessment of spoken English proficiency using the Basic English Skills Test (BEST Plus) [28], with scores categorized into three ranges that corresponded to no/low, medium, and high. Health literacy was assessed with the short test of functional health literacy in adults (STOFHLA) [29], a 36-item test of reading comprehension that uses a set of sentences from medical scenarios with key words missing. STOFHLA scoring was dichotomized as low (0–22 = inadequate) and high (23–36 = marginal to adequate). Lastly, oral health (dental) literacy was assessed using a basic word recognition test, the rapid estimate of adult literacy in dentistry (REALD) [30]. REALD was also dichotomized as low and moderate/high.

Additional instruments were the Medical Outcomes Study Short-Form 12-Item Survey (SF-12) with physical component summary (PCS) and mental component summary (MCS) scales [31], the oral health quality of life instrument (OHQOL) [32], and a revised version of the 13-item Haitian acculturation scale (r-HAS) [13]. The r-HAS includes measures of participants' language and religious preferences as well as preferences for food and activities such as entertainment and news media. Lastly, because of the potential impact of mental illness on functional and oral health status, the interview included the posttraumatic stress disorder checklist—Civilian Version (PCL-C) and the Patient Health Questionnaire (PHQ) for depression [33, 34]. For the PHQ, the two-item version was used for screening with the remaining 7 items reserved for subjects who gave a positive response to the first two items [35].

Oral Examination

All subjects were examined by a trained dental examiner who conducted a standardized examination for caries assessment and periodontal status. Each tooth was classified as sound, decayed (D), missing (M), or filled (F) using the Modified BSS criteria [27]. Periodontal assessment was based upon World Health Organization (WHO) criteria using the community periodontal index of treatment needs (CPITN) probe [16]. Exam findings were used as confounding variables in multivariable analytic models.

Analytic Approach

Analyses first considered all associations of the risk variables (health literacy scores) with sample characteristics in bivariate analysis. This also included the unadjusted analysis of association of the risk variables with the outcome measure. The outcome measure considered in the analysis was self-reported preventive dental care visit to the dentist within the last year. The independent sample T test was used to analyze associations with continuous variables; the Chi Square test was used for categorical measures. Multivariable regression models were used to assess the association of preventive dental care with each of the three language measures (i.e., STOFHLA, REALD and BEST Plus) while adjusting for possible confounding factors. For these analyses, several main domains of confounder variables were selected. These included: acculturation, sociodemographic factors, oral health practices, general mental and physical health scores, oral examination findings (DMFT and periodontal scores), and geographic accessibility to dental clinics accepting Medicaid. Acculturation

was defined by the r-HAS score and categorized into three levels—low, medium and high—empirically based on the distribution. Socio-demographic factors included gender, age, ethnicity, educational level, years in US, and income. Other variables relevant to oral health included type of dental insurance and geographic accessibility of the dental care provider. While insurance would seemingly be an important predictor of access to oral health care, the vast majority of subjects had Medicaid and thus in preliminary analyses, insurance status did not meet criteria of statistical significance for inclusion in multivariable models. General health scores included PCL-C, and SF-12 physical and MCS scores. The PHQ score, age, oral examination findings and geographic accessibility variables also were not significant in preliminary models and not included in subsequent analyses.

All multivariate analyses tested an interaction between the risk variable (literacy) and years lived in US. The interaction term was added because the relationship between oral health status and literacy was affected by time lived in US. Models with and without the acculturation score were considered. Logistic regressions (SAS Proc GENMOD) were used for these analyses. In order to build more parsimonious models, the backward elimination procedure was used with a 0.2 alpha level for variables to stay in the model. All statistical analyses were performed using SAS software, version 9.2 (SAS Institute Inc, Cary, NC, USA).

Results

A total of 439 refugees participated in the study. The sample was 58.1 % female. Mean age in years was 35.2 with a standard deviation of 14.7. Only 2 % arrived directly from Somalia; others came to the US as refugees by way of other countries including: Kenya (78 %), Ethiopia (9 %) and fifteen other countries. Seventy-five percent had less than a high school education, and most participants reported low or very low income. Inadequate health literacy was highly prevalent, with 74 % scoring in the low range on the STOFHLA and 73 % scoring into the low range on the REALD. Spoken English proficiency was also low, with 56 % speaking no or very limited English (Table 1).

Nearly all participants (98 %) reported brushing their teeth at least daily with 74.5 % reporting brushing at least twice daily, and 40 % reported any use of dental floss. The use of the traditional *miswak* stick brush was reported by 43 %. While 63 % had seen a dentist at some point during their time in the US, 54 % had done so in the past year. A preventive dental visit in the past year was reported by 36 %.

Participants had an average of 1.34 decayed, 1.39 missing, and 2.76 filled teeth. Periodontal disease was noted in 6.5 %. A detailed description of the oral examination findings have been previously reported [36]. Mean PCL-C score (for post-traumatic stress disorder) was 20.5; mean PCS score, 52.1; and mean MCS score, 60.6. These mean functional and behavioral health scores were quite good compared to known referenced norms [31].

Health Literacy and Preventive Care Visit in Past Year

In preliminary analytical models without controlling for acculturation, subjects with higher functional health literacy scores were 2.0 times as likely to have attended a preventive dental care visit in the past year (95 % confidence interval: 1.1–3.6) independent of time in the US and insurance coverage (Table 2). Similarly, subjects with higher dental word recognition similarly were more likely to have had a preventive dental care visit in the past year (odd ratio 1.85, 95 % confidence interval 1.0–3.3 with $P = 0.04$) (Table 3). Those with higher spoken English proficiency were 2.3 times as likely to have had a preventive visit in the past year in comparison to those with lower proficiency (95 % CI = 1.1–4.3) without controlling for acculturation. Those with medium levels of spoken English proficiency were also more likely to have had a preventive visit compared to those with lower proficiency (odds ratio 2.0, 95 % confidence interval 1.0–4.2); however no differences existed between high and medium score group (Table 4). When controlling for the effects of acculturation and stratifying by time in the US (in the dental word recognition model), none of these associations remained significant.

In the fully-controlled analyses, the relationship between acculturation with use of care contrasted with that of the language measures. High acculturation level was significantly associated with use of preventive dental care when compared to low level. Subjects with high acculturation levels had increased odds of a self-reported preventive dental care visit that ranged from 2.8 to 3.8 times that reported by those with a low level of acculturation (Tables 2, 3, 4).

Discussion

In adjusted analyses, both written and spoken English language skills were not associated with use of preventive dental care as self-reported by this sample of mostly very low-income and poorly educated Somali refugees. Despite having very low rates of English functional health literacy and spoken proficiency, these Somali refugees also reported good personal oral care practices with regular and

Table 1 Descriptive characteristics of 439 Somali refugees in Massachusetts by English health literacy and spoken proficiency levels

Characteristic	Overall (N = 439)	REALD 0–22 Low (N = 319)	REALD 23–30 Moderate/high (N = 120)	STOFHLA 0–22 Inadequate (N = 326)	STOFHLA 23–36 Marginal/adequate (N = 113)	BEST+ 0–329 Low (N = 247)	BEST+ 330–598 Medium (N = 68)	BEST+ 599–999 High (N = 109)
Acculturation group[a]								
Low	148 (33.7 %)	148 (46.4 %)	0 (0.0 %)	148 (45.4 %)	0 (0.0 %)	142 (57.5 %)	1 (1.5 %)	3 (2.8 %)
Medium	147 (33.5 %)	127 (39.8 %)	20 (16.7 %)	130 (39.9 %)	17 (15 %)	95 (38.5 %)	24 (35.3 %)	24 (22 %)
High	144 (32.8 %)	44 (13.8 %)	100 (83.3 %)	48 (14.7 %)	96 (85 %)	10 (4 %)	43 (63.2 %)	82 (75.2 %)
Accessibility of dental care[b]								
High access (greater Boston)	339 (77.2 %)	244 (76.5 %)	95 (79.2 %)	246 (75.5 %)	93 (82.3 %)	180 (72.9 %)	50 (73.5 %)	94 (86.2 %)
Low access (other cities)	100 (22.8 %)	75 (23.5 %)	25 (20.8 %)	80 (24.5 %)	20 (17.7 %)	67 (27.1 %)	18 (26.5 %)	15 (13.8 %)
Gender[a]								
Male	184 (41.9 %)	107 (33.5 %)	77 (64.2 %)	118 (36.2 %)	66 (58.4 %)	72 (29.1 %)	42 (61.8 %)	63 (57.8 %)
Female	255 (58.1 %)	212 (66.5 %)	43 (35.8 %)	208 (63.8 %)	47 (41.6 %)	175 (70.9 %)	26 (38.2 %)	46 (42.2 %)
Age[a]								
Mean ± SD	35.2 ± 14.7	37.8 ± 15.2	28.2 ± 10.6	37.7 ± 15.2	27.8 ± 10.5	40.1 ± 15.4	28.4 ± 11.5	28.8 ± 10.9
Ethnicity[a]								
Somali	382 (87 %)	264 (82.8 %)	118 (98.3 %)	271 (83.1 %)	111 (98.2 %)	199 (80.6 %)	62 (91.2 %)	107 (98.2 %)
Somali Bantu	57 (13 %)	55 (17.2 %)	2 (1.7 %)	55 (16.9 %)	2 (1.8 %)	48 (19.4 %)	6 (8.8 %)	2 (1.8 %)
Education[a]								
None	163 (37.1 %)	158 (49.5 %)	5 (4.2 %)	155 (47.5 %)	8 (7.1 %)	140 (56.7 %)	12 (17.6 %)	8 (7.3 %)
Pre-high school	168 (38.3 %)	126 (39.5 %)	42 (35 %)	128 (39.3 %)	40 (35.4 %)	84 (34 %)	29 (42.6 %)	50 (45.9 %)
High school or more	108 (24.6 %)	35 (11 %)	73 (60.8 %)	43 (13.2 %)	65 (57.5 %)	23 (9.3 %)	27 (39.7 %)	51 (46.8 %)
Income per month[c]								
<$1,000	284 (72.1 %)	217 (74.1 %)	67 (66.3 %)	221 (74.2 %)	63 (65.6 %)	169 (73.8 %)	46 (76.7 %)	59 (64.1 %)
≥$1,000	110 (27.9 %)	76 (25.9 %)	34 (33.7 %)	77 (25.8 %)	33 (34.4 %)	60 (26.2 %)	14 (23.3 %)	33 (35.9 %)
Number of years in US[c]								
Mean ± SD	3.8 ± 2.8	3.6 ± 2.7	4.5 ± 3	3.6 ± 2.7	4.5 ± 2.9	3.4 ± 2.8	3.4 ± 2.6	4.9 ± 2.7
Dental insurance[c]								
Yes	383 (89.9 %)	280 (90.9 %)	103 (87.3 %)	285 (90.2 %)	98 (89.1 %)	218 (92 %)	58 (85.3 %)	95 (89.6 %)
No	43 (10.1 %)	28 (9.1 %)	15 (12.7 %)	31 (9.8 %)	12 (10.9 %)	19 (8 %)	10 (14.7 %)	11 (10.4 %)
Oral quality of life[c]								
Mean ± SD	1.2 ± 0.3	1.2 ± 0.3	1.2 ± 0.3	1.2 ± 0.3	1.2 ± 0.3	1.2 ± 0.3	1.1 ± 0.2	1.2 ± 0.2
PCL-C score[c]								
Mean ± SD	20.5 ± 5.6	20.5 ± 4.8	20.7 ± 7.4	20.4 ± 4.8	21 ± 7.5	20.5 ± 4.9	19.5 ± 5.3	21.2 ± 7.2
SF-12: PCS[a]								
Mean ± SD	52.1 ± 6.7	51.3 ± 7.2	54.1 ± 4.7	51.4 ± 7.1	54.1 ± 4.9	50.7 ± 7.3	53.4 ± 3.7	54 ± 6.2

Table 1 continued

Characteristic	Overall (N = 439)	READ 0–22 Low (N = 319)	READ 23–30 Moderate/high (N = 120)	STOFHLA 0–22 Inadequate (N = 326)	STOFHLA 23–36 Marginal/adequate (N = 113)	BEST+ 0–329 Low (N = 247)	BEST+ 330–598 Medium (N = 68)	BEST+ 599–999 High (N = 109)
SF-12: MCS[d]								
Mean ± SD	60.6 ± 6.3	60.7 ± 6.1	60.3 ± 6.6	60.8 ± 6	60.1 ± 7.1	61 ± 5.3	61.9 ± 3.4	59.3 ± 8.5
Any dental visit in past year[e]								
Yes	234 (53.5 %)	162 (51.1 %)	72 (60 %)	163 (50.3 %)	71 (62.8 %)	120 (48.6 %)	38 (57.6 %)	68 (62.4 %)
No	203 (46.5 %)	155 (48.9 %)	48 (40 %)	161 (49.7 %)	42 (37.2 %)	127 (51.4 %)	28 (42.4 %)	41 (37.6 %)
Preventive visit in last year[f]								
Yes	152 (35.5 %)	96 (31.1 %)	56 (47.1 %)	96 (30.3 %)	56 (50.5 %)	66 (27.4 %)	29 (43.9 %)	51 (48.1 %)
No	276 (64.5 %)	213 (68.9 %)	63 (52.9 %)	221 (69.7 %)	55 (49.5 %)	175 (72.6 %)	37 (56.1 %)	55 (51.9 %)

[a] $P < 0.001$ for all three language measures

[b] $P = 0.02$ for BEST+; $P > 0.05$ for READ and STOFHLA

[c] $P > 0.05$ for all three language measures

[d] $P = 0.01$ for BEST+; $P > 0.05$ for READ and STOFHLA

[e] $P = 0.02$ for STOFHLA and 0.04 for BEST+; $P > 0.05$ for READ

[f] $P < 0.01$ for all three language measures

Table 2 Self-reported preventive care visit in the past year related to STOFHLA Score among 439 Somali refugees in Massachusetts

	Adj. odds ratio	Lower 95 % confidence limit	Upper 95 % confidence limit
Part 1: Self-reported preventive care visit in the past year related to STOFHLA Score (Low = 0–22; High = 23–36) among 439 Somali refugees in Massachusetts			
STOFHLA: high versus low	2.0	1.1	3.6
Females versus males	1.6	0.9	2.8
Income: >$1,000 versus <$1,000	1.7	0.9	2.9
Years in US: 5–10 versus 0–4	1.8	1.1	3.1
Insurance: yes versus no	4.7	1.5	14.3
PCL-C	1.1	1.0	1.1
SF-12: PCS	1.1	1.0	1.1
SF-12: MCS	1.1	1.0	1.1
Part 2: Self-reported preventive care visit in the past year related to STOFHLA Score (Low = 0–22; High = 23–36) among 439 Somali refugees in Massachusetts, controlling for acculturation			
STOFHLA: high versus low	1.2	0.6	2.4
Acculturation: high versus low	3.1	1.3	7.5
Acculturation: high versus med	1.9	0.9	4.0
Females versus males	1.9	1.1	3.4
Income: >$1,000 versus <$1,000	1.6	0.9	2.9
Years in US: 5–10 versus 0–4	1.6	0.9	2.7
Insurance: yes versus no	5.2	1.7	16.0
PCL-C	1.1	1.0	1.1
SF-12: MCS	1.1	1.0	1.1

frequent use of brushing and moderately good use of dental care services for both restorative and preventive care.

The study hypothesized that individuals with high health literacy would be more likely to utilize preventive dental care; yet self-reported use of dental care services was significantly impacted by health literacy only when not controlling for the effect of acculturation. As such, literacy seems to be one factor within a larger picture of acculturation that affects use of health care. Such a relationship has been suggested in recent epidemiologic research on self-rated overall health status and limited English proficiency [37]. Over time, Somalis may be more likely to adopt Western cultural norms of dietary and personal care practices that are

Table 3 Self-reported preventive care visit in the past year related to REALD score among 439 Somali refugees in Massachusetts

	Adj. odds ratio	Lower 95 % confidence limit	Upper 95 % confidence limit
Part 1: Self-reported preventive care visit in the past year related to REALD Score (Low = 0–22; High = 23–36) among 439 Somali refugees in Massachusetts			
REALD: high versus low	1.8	1.0	3.3
Females versus males	1.6	0.9	2.9
Income: >$1,000 versus <$1,000	1.7	0.9	3.0
Years in US: 5–10 versus 0–4	1.8	1.0	3.0
Insurance: yes versus no	4.8	1.6	14.6
PCL-C	1.1	1.0	1.1
SF-12: PCS	1.1	1.0	1.1
SF-12: MCS	1.1	1.0	1.1
Part 2: Self-reported preventive care visit in the past year related to REALD Score (Low = 22; High = 23–36) among 439 Somali refugees in Massachusetts, controlling for acculturation			
REALD: high versus low for 0–4 years in US	0.5	0.2	1.4
REALD: high versus low for 5–10 years in US	2.1	0.8	5.9
Acculturation: high versus low	3.8	1.5	9.6
Acculturation: high versus med	2.2	1.0	4.8
Females versus males	1.7	1.0	3.1
Income: >$1,000 versus <$1,000	1.5	0.8	2.7
Insurance: yes versus no	5.4	1.8	16.8
PCL-C	1.1	1.0	1.1
SF-12: PCS	1.0	1.0	1.1
SF-12: MCS	1.1	1.0	1.1

Table 4 Self-reported preventive care visit in the past year related to BEST plus score among 439 Somali refugees in Massachusetts

	Adj. odds ratio	Lower 95 % confidence limit	Upper 95 % confidence limit
Part 1: Self-reported preventive care visit in the past year related to BEST Plus Score (Low = 0–329; Med = 330–598; High = 599–999) among 439 Somali refugees in Massachusetts			
BEST+: high versus low	2.2	1.1	4.3
BEST+: high versus med	1.1	0.5	2.5
BEST+: med versus low	2.0	1.0	4.2
Females versus males	1.9	1.0	3.3
Income: >$1,000 versus <$1,000	1.8	1.0	3.2
Years in US: 5–10 versus 0–4	1.6	0.9	2.7
Insurance: yes versus no	4.5	1.5	14.0
PCL-C	1.1	1.0	1.1
SF-12: PCS	1.1	1.0	1.1
SF-12: MCS	1.1	1.0	1.1
Part 2: Self-reported preventive care visit in the past year related to BEST Plus Score (Low = 0–329; Med = 330–598; High = 599–999) among 439 Somali refugees in Massachusetts, controlling for acculturation			
BEST+: high versus low	1.4	0.6	3.2
BEST+: high versus med	1.2	0.5	2.7
BEST+: med versus low	1.1	0.5	2.8
Acculturation: high versus low	2.8	1.0	7.7
Acculturation: high versus med	1.8	0.8	4.0
Females versus males	2.1	1.2	3.8
Income: >$1,000 versus <$1,000	1.7	1.0	3.1
Insurance: yes versus no	4.6	1.5	14.2
PCL-C	1.1	1.0	1.1
SF-12: PCS	1.0	1.0	1.1
SF-12: MCS	1.1	1.0	1.1

largely deleterious to oral health when compared to traditional Somali practices. Consequently, preventive care becomes increasingly important as a refugee spends more time in the US.

While the associations we report appear to be consistent across the three English language measures, the magnitude of these findings appears to be small to moderate. Notably, the participant population (believed to be representative of the larger Somali refugee community in Massachusetts) had very low functional health literacy, dental word recognition, and spoken proficiency in English. Thus the skewed distribution of the language measures—with many participants clustered in the very low proficiency range—may have affected the extent to which the relationship could be demonstrated with the study data.

When the acculturation summary measure, r-HAS, was included, the language measures were no longer significant predictors of access to preventive oral health care.

Acculturation and health literacy appear to interact to impact Somali refugees' use of dental care. Overall, the study found that in Somali refugees who arrived within the past ten years, the great majority identified as fully Somali, and acculturation appeared to occur very slowly. Surprisingly, a wider range of responses was noted in one particular item in the r-HAS: language preference; yet it is clear that a higher level of engagement with non-Somali aspects of life was associated with a higher level of preventive dental services.

In contrast to past studies of acculturation and oral health outcomes in Vietnamese and Haitian refugees that described the relationship as U-shaped, this study suggests that acculturation level has a unidirectional affect on how Somali refugees utilize dental care. This relationship with dental care may be one mechanism through which oral health outcomes are determined. In the absence of validated instruments to measure acculturation in newer refugee populations such as the Somalis, measurement of acculturation will continue to be imprecise. Another limitation of the study is the lack of external data from which to ascertain actual utilization of health care services. Self-reported use of services within the past year was considered the most helpful outcome because it was thought to be most likely to indicate proactive action.

Lastly, it was anticipated that social support and other cultural factors within the Somali community could limit the ways in which acculturation and health literacy affect health outcomes. Experience in refugee resettlement suggests that Somalis are quite close-knit and leverage community resources very effectively. Social capital may explain, to some degree, the mechanism by which this refugee population with very low levels of English proficiency and literacy managed to maintain relatively good oral health status [12]; however, differences in levels of community support and detailed elements of social capital were not measured. Future studies should include investigation of the ways community support may be experienced differently according demographic variables or proximity to other community members and may mediate the associations between literacy and health outcomes.

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