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Oral health: locus of control, health behavior, self-rated oral health and socio-demographic factors in Istanbul adults

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Abstract

Objectives. To determine oral health control beliefs of Istanbul adults using the Multidimensional Oral Health Locus of Control Scale (MOHLCS) after confirming its factorial validity and to examine the relationships between these beliefs, self-rated oral health, oral health behaviors and socio-demographic factors. ***Material and methods.*** The MOHLCS was administered to a sample of 1200 subjects aged ≥18 years in Istanbul chosen using a quota-sampling method (response 88%). The relationship between the MOHLCS and oral health behaviors, self-rated oral health and socio-demographic factors was assessed after confirming the factorial validity of the MOHLCS. ***Results.*** The MOHLCS demonstrated satisfactory internal reliability. Factor analysis results showed a new four-factor solution, namely Internal, Dentist, Chance, and Socialization agents. Multivariate analysis showed that female gender, younger age, higher socioeconomic status, more frequent daily toothbrushing, and regular dental check-ups were associated with higher Internal beliefs, while older age, lower educational level, lower socioeconomic status, low toothbrushing frequency, and symptom-orientated dental attendance were associated with higher Chance beliefs. Being unmarried and low toothbrushing frequency were associated with lower Dentist beliefs. Males and older subjects had lower Socialization agents beliefs. Internal, Dentist and Chance beliefs were significantly associated with self-rated oral health. ***Conclusions.*** Compared with the original factor structure, the new factor structure had better goodness of fit for this sample. Self-rated oral health, socio-demographic factors, and oral health behaviors were significantly associated with oral health control beliefs. These beliefs may be useful for planning oral health promotion programs and for formulating advice given by oral health professionals about their patients' oral health behaviors.

Key Words: *Internal–external control, oral health behaviors, self-rated oral health, socio-demographic factors*

Introduction

Turkey is experiencing increases in the incidence and severity of oral diseases, partly because of the traditional treatment-based approach of the oral healthcare system. For years, the duties of a dentist have been seen as management of disease and, consequently, oral health professionals have focused on treatment and have neglected health promotion and disease prevention. When the position of oral health services in Turkey's healthcare system is analyzed, it is clear that resources are primarily allocated to curative care, without an underlying oral health policy [1]. Although public dental health centers are responsible for provision of preventive care, these centers offer mostly operative care because oral health services are not well integrated into primary healthcare and because the public dental center staff are remunerated by performance-based payments [2]. A nationwide oral health survey showed that oral diseases, primarily dental caries and periodontal diseases, are major public health problems in Turkey, underlining the need for community-based oral health promotion programs [3].

To be effective, such community-based programs to promote oral health across a population must focus on the underlying socio-behavioral determinants of oral diseases, which include avoidable risk factors [4].

Preventive interventions are likely to be more effective if the factors that motivate health behaviors are known. Beliefs about perceived control over health are now considered to be an important motivational factor for understanding an individual's likelihood of adopting health-promoting behaviors [5–7]. Several studies that have examined these beliefs and health-related behaviors suggest that they may be used for

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planning health-promoting programs and to frame health messages in the educational component of health programs [6,8–10].

One construct which has attracted a lot of attention in this area is the concept of health locus of control, which has been widely used to characterize a person's beliefs about his or her control over health outcomes [10]. It has its origins in the Locus of Control (LOC) construct, originally developed within the framework of Rotter's social learning theory [11]. LOC refers to the degree to which an individual believes the occurrence of reinforcements is contingent on his or her own behavior. Thus an individual who has an internal expectancy of reinforcement believes that he or she could influence outcomes through behavior. If an individual has an external expectancy of reinforcement, he or she believes that external factors (such as chance or powerful others) determine the outcomes. This construct has been extended to cover the multidimensional aspects of health behavior and Multidimensional Health LOC scales have been developed to measure the extent of internal factors, powerful others and chance control over health perceived by individuals [12]. Health LOC is believed to be important, as it is thought to determine whether or not individuals will take responsibility for their own health. Because individuals with a high internal health LOC believe that their health is influenced by their own efforts and skills, they are more likely to engage in health-promoting activities. In addition, LOC beliefs determine the individual's program expectations and outcomes. Also, highly 'internal' individuals are self-motivated and likely to be responsive to health promotion messages. They may benefit more from interventions involving counseling sessions and self-care skills training sessions. People with an external health LOC are unlikely to be responsive to health promotion messages and they may be best targeted by interventions involving health professionals [7,10,13].

In oral care, Rotter's LOC scale and health-specific LOC scales have been used in planning individual preventive programs and in examining the relationships between these beliefs and oral health outcomes such as dental care requirements, the patient's oral hygiene performance and compliance with dental health education [14–19]. To increase the predictive utility in assessing oral health-related LOC beliefs, dental items were added to the basic LOC scales by some researchers [14,15]. When the results of studies using the health-specific LOC scales were inconclusive, researchers developed dental health-specific scales to measure dental beliefs about perceived control over tooth decay and gum disease [20–22].

Some studies suggested that people's health behaviors were rooted in broader health belief systems that are inherent in their culture. If actions are to prevent disease and promote health effectively, they must be based on an understanding of culture, tradition, beliefs, and patterns of family interactions [23].

There have been no published studies examining the relationship between health beliefs and oral health behaviors in Turkish adults. The Multidimensional Oral Health Locus of Control Scale (MOHLCS) has been developed to measure beliefs about adults' control over oral health. Using this scale, it is hoped to evaluate the relationship between the oral health LOC beliefs and oral health behaviors among adults. In a pilot study, the MOHLCS demonstrated acceptable validity and reliability in a sample of 165 adults. Although the results of this pilot study distinguished significant differences in oral health LOC beliefs according to socio-demographic factors and oral health behaviors, the study had several limitations. The participants were employees in the private and public sectors, and thus not representative of the Turkish population. The sample size was too small for factor analysis. Future research, based on longitudinal and cross-sectional data, is needed to examine further the reliability and validity of the MOHLCS and its relationships with oral health behaviors and socio-demographic factors. Oral health promotion programs that have been undertaken have focused on increasing knowledge about oral health behaviors and oral care, without considering the underlying socio-behavioral determinants of oral health in Turkey [24]. It is known that health promotion programs aim at changing behavior through increasing the individual's health control beliefs. Information about the relationship between these beliefs, socio-demographic factors and oral health behaviors could be useful in planning effective oral health promotion programs.

This study therefore aimed to determine the oral health LOC beliefs of a sample of Istanbul adults, to confirm the factorial validity of the MOHLCS, and then to examine the relationships between these beliefs, oral health behaviors, and socio-demographic factors using this scale.

Material and methods

Subjects

The target study population was all adults aged ≥18 years living in Istanbul (population 11.32 million), the largest city in Turkey. This cross-sectional survey was undertaken in November and December 2003. Because the size of the population is known, the study sample size was determined as 1067 subjects aged ≥18 years using the formula $n = Nt^2pq/d^2(N–1)+t^2pq$, where N represents the population size (5 990 460), t is a constant at the 95% confidence level (1.96), p is the proportion of respondents expected to provide a given response to a survey question (0.5), q is equal to 1–p, and d is the acceptable margin of error (3%) for continuous data

[25]. To allow for non-response we increased the sample size by 10%, so that the final calculated sample size was 1174. This number was rounded up to 1200 persons. Proportional quota sampling was used to ensure that respondents were demographically representative of the general Istanbul population, with quotas based on region, district, neighborhood unit, age, sex, and level of education. The sample reflected the actual proportions in the general population of Istanbul. In this study, a two-stage selection procedure was used. First, three electoral regions (Anatolia and the north and south sides of Golden Horn) which were used to choose members of the Turkish National Assembly and districts from each of those regions were selected. The independent districts (Buyukcekmece, Catalca, Sultanbeyli, Sile, and Silivri) were excluded from the study because the study population comprised a total of 27 districts from the boundary of Istanbul. The distribution of the interviewed subjects was calculated using the 2000 Turkey Census [26] in each region and district. Second, the neighborhood units were drawn from those districts with a probability equal to the number of neighborhood units within the district. Subjects were selected randomly according to available quotas such as age, sex, and level of education using a list of neighborhood units obtained from the local statistical/planning office. To prevent the accumulation of the interviewed subjects in one specific point in the county, the neighborhood was changed once in every 10 questionnaires.

Procedure

The Ethics Committee of the Faculty of Medicine, University of Istanbul approved the study protocol. Informed consent was obtained from all participants. Data were collected through personal interviews carried out in the participants' homes by eight trained professional interviewers. In order not to introduce not-at-home bias, the interviewers were given instructions to canvass and interview only after 17.00 on weekdays or at the weekend. The fieldwork stage of the study was completed by eight interviewers of the Mayak Worldwide Research Company within 25 days. The interview length was ≈25 min on average. Quality control measures were employed by the field researchers during data collection and processing. All interviewers were thoroughly briefed by the expert trainer of the company under the supervision of the researcher in a formal interview training session as to the exact procedures to be used in gathering the survey information. A pilot study was run before the field research. The field supervisor reviewed each interview within 24 h of completion to check for a wide range of errors and made telephone contact with all interviewed subjects to check their address. In addition, the supervisor conducted a 10% back check to validate the answers recorded in the interview. If any problem was detected, the interviewers were contacted and instructed to re-contact the subject to obtain missing data in person.

Questionnaire

The questionnaire consisted of the MOHLCS (see Appendix), self-rated oral health (SROH), patterns of oral health behavior, and a socio-demographic section.

The MOHLCS contains 26 items scored on a four-point Likert-type scale ranging from 'strongly disagree' to 'strongly agree'. The MOHLCS yields five subscales reflecting different aspects of oral health LOC, identified via factor analysis in the development of the measure: (1) Internal; (2) External/Dentist—information; (3) External/Dentist—prevention; (4) External/Chance; and (5) External/Socialization agents. These subscales indicate the degree to which a person believes that his/her oral health outcomes are controlled by him/herself, by chance, by the dentist's recommendation and advice, by the dentist's preventive dental care, or by socialization agents (e.g. family member, friends, colleagues, relatives, etc.). Subscale scores are calculated by adding the scores for all the items within a particular subscale, and dividing the sum by the number of items. Higher scores reflect stronger endorsement of the MOHLCS subscales. In the pilot study with 165 subjects, reliability was tested by internal consistency and test–retest reliability. Internal consistency of the scale was quantified by Cronbach's alpha. Test–retest reliability was assessed by the intra-class correlation coefficient calculated for 79 out of 165 subjects who were re-tested 2 weeks after the first set. It demonstrated satisfactory internal consistency (Cronbach's alpha 0.80) and a high test–retest reliability (intra-class correlation coefficient = 0.91; $P < 0.001$).

SROH was assessed using a single-item question ("How would you rate your oral health?") with possible ordinal responses: excellent, very good, good, fair, and poor, which were grouped into good (excellent, very good, good) and bad (fair and poor) [27].

The measure of self-reported oral health behaviors included four questions: toothbrushing frequency (greater than or equal to twice a day, less than or equal to once a day); use of dental floss (use/do not use); dental attendance patterns (symptom-oriented/regular dental check-up at least once a year); and use of fluoride mouthrinse (use/do not use).

The subject's age, education, and socioeconomic levels were recorded in this study in ordinal fashion. Age was categorized into three groups: 18–30, 31–45, and 46+ years. Educational level was categorized into three groups according to years of completed

schooling: primary (0–5 years), secondary (6–11 years), and higher (>11 years). Socioeconomic status (SES) was measured using the VERİ Socio-Economic Status Index, a social stratification model developed by the Veri Research Company in Turkey, made up of an equal-weight combination of values based on average educational level and working status of the household members, life-facilitating property ownership, area of residence, and house ownership. SES was categorized into three groups according to VERİ Socio-Economic Status Index score: low (4–9), medium (11–14), and high (15–20). Marital status was recorded as married or not married (never married, separated, widowed, or divorced).

Statistical analysis

Data from questionnaires were processed for analysis using SPSS 10.0 for Windows. The internal consistency reliability of the scale was assessed by means of Cronbach's alpha [28]. The scale's construct validity was tested using a principal components analysis (PCA), followed by varimax rotation. The optimal number of factors was based on two criteria: Kaiser's Eigenvalue rule and Cattel's scree test [29]. The orthogonal varimax rotation was preferred because the dimensions of oral health LOC beliefs, such as Multidimensional Health LOC beliefs, are envisaged to be conceptually distinct [30]. Pearson's product moment correlation coefficients were also computed to assess the inter-correlations between subscales and total scales. The new factor structure was compared to the five-factor structure obtained from the pilot study by performing confirmatory factor analysis (CFA) using structural equation modeling techniques [31]. Maximum likelihood estimation, using LISREL 8.3 software, was employed for this analysis using a covariance matrix. Structural equation modeling employs fit indices to provide estimates of how well the data fit the *a priori* hypothesized model. The fit indices selected for the analysis were as follows: (a) chi-square, (b) the goodness-of-fit index (GFI), (c) the comparative fit index (CFI), (d) the root mean square error of approximation (RMSEA), and (e) the adjusted goodness-of-fit index (AGFI). Chi-square statistics can be improved by using χ^2/d.f. Results closer to one indicate a better fit, and up to five a reasonable fit. In general, results >0.90 for GFI, AGFI, and CFI and <0.50 for RMSEA indicate a good model fit [32].

Bivariate analyses were performed to identify significant associations among the subscale scores of the MOHLCS, self-reported oral health behaviors, SROH, and socio-demographic factors. Differences in the mean subscale scores of the MOHLCS among groups were determined by an independent-sample *t*-test, by Wilcoxon's two-sample *t*-test for two groups, and by a one-way ANOVA with a post-hoc Bonferroni test for multiple-group comparisons. In this study, there was no theoretical assumption to explain the relationships between the self-reported oral health behaviors and socio-demographic factors. This study was concerned with finding the best predictors of oral health LOC beliefs. Backward stepwise regression appeared to be the preferred method of exploratory analyses, where the analysis begins with a full or saturated model and variables are eliminated from it using an iterative process. The fit of the model was tested after the elimination of each variable to ensure that the model still adequately fitted the data [33]. Thus, backward stepwise multiple linear regression analyses were performed, including potential confounding factors significant at the conventional *P*-level of 0.05 in the bivariate analysis, to identify factors independently associated with oral health LOC beliefs. A *P*-value of ≤0.05 was considered statistically significant.

Results

Subjects

From the original sample (n = 1200), 91 persons refused to participate, 72 were not at home, and 1037 completed the in-home interview. A total of 51 subjects were excluded because they did not complete the MOHLCS, leaving 986 subjects available for analysis. The sample thus consisted of 495 men and 491 women and the mean (standard deviation [SD]) age was 36.7 (13.7) years; 68% had formal school education for ≤8 years, 57% had a moderate SES, and 43% were not married.

MOHLCS reliability and factorial validity

Internal consistency reliability, as measured by Cronbach's alpha, was 0.71 for the whole scale, and 0.82 for the Internal subscale, 0.79 for the External/Dentist subscale, 0.71 for the External/Chance subscale, and 0.72 for the External/Socialization agents subscale. The mean item subscale scores were 3.49 (SD 0.43, range 1.82–4) for Internal, 2.77 (SD 0.57, range 1–4) for External/Dentist, 1.97 (SD 0.57, range 0.86–4) for External/Chance, and 2.70 (SD 0.79, range 0.50–4) for External/Socialization agents (Table I).

Factorial validity

Results of factor analysis of the MOHLCS are shown in Table I. Using PCA with a criterion of eigenvalue >1, four factors were extracted. Visual inspection of the Scree plot also supported a four-factor solution.

Table I. Factor analysis of the MOHLCS items using the varimax rotation method and descriptive data for subscales.

Internal			External/Dentist			External/Chance			External/Socialization agents		
Item	Loading	r^a	Item	Loading	r^a	Item	Loading	r^a	Item	Loading	r^a
2	0.38	0.57	3	0.59	0.65	1	0.59	0.59	6	0.86	0.89
5	0.31	0.53	12	0.72	0.71	4	0.69	0.68	9	0.86	0.87
8	0.45	0.59	15	0.73	0.73	7	0.67	0.68			
11	0.54	0.52	18	0.74	0.72	10	0.72	0.70			
14	0.56	0.59	21	0.65	0.67	13	0.53	0.61			
17	0.70	0.71	26	0.66	0.69	16	0.66	0.68			
19	0.72	0.68				23	0.32	0.35			
20	0.69	0.64									
22	0.60	0.60									
24	0.57	0.62									
25	0.74	0.68									
Eigenvalue = 4.17			3.23			2.98			1.64		
Var[b] (%) = 16.06			12.43			11.46			6.31		
Cronbach's alpha = 0.82			0.79			0.71			0.72		
Mean (SD) 3.49 (0.43)			2.77 (0.57)			1.97 (0.57)			2.70 (0.79)		

[a]r = item–subscale total correlation coefficient.
[b]Var = proportion of variance explained by rotated factors.
SD = standard deviation.

The four factors explained a total of 46.27% of variance of the 26 variables. Loadings on the four subscales ranged from 0.31 to 0.86, while alphas ranged from 0.71 to 0.82. The PCA yielded a 26-item, four-factor model termed Internal, External—Dentist, External—Chance, and External—Socialization agents. All items of the original Internal scale loaded consistently on factor 1 (Internal); items 3, 12, 15, 18, 21, and 26 loaded on factor 2 (External/Dentist); items 1, 4, 7, 10, 13, 16, and 23 loaded on factor 3 (External/Chance); items 6 and 9 loaded consistent with the External/Socialization agents subscale in determining development study on factor 4 (External/Socialization agents). In this study, the original External/Dentist—information and External/Dentist—prevention items loaded together on factor 2.

The correlations between the following factors were: $r_{(\text{factor } 1\text{–}3)} = -0.46, P < 0.01$; $r_{(\text{factor } 1\text{–}2)} = 0.37, P < 0.01$; $r_{(\text{factor } 1\text{–}4)} = 0.17, P < 0.01$; $r_{(\text{factor } 2\text{–}4)} = 0.16, P < 0.01$; $r_{(\text{factor } 2\text{–}3)} = -0.10$, $P < 0.01$. The inter-subscale correlation varied from low to moderate, suggesting that most subscales were measuring different and unique aspects of oral health LOC beliefs. CFA to compare the four-factor structure with the five-factor structure derived from the pilot study showed that both models were acceptable, but that the four-factor model had a better fit (Table II).

Relations between the MOHLCS subscales and socio-demographic, self-reported oral health behaviours, and SROH

The mean scores revealed significant differences among the following groups: Internal and Socialization agents subscales in relation to gender; all subscales in relation to age groups and the frequency of tooth brushing; Internal and Chance subscales in relation to SES and education level; Internal, Dentist, and Chance subscales in relation to dental attendance, dental flossing, and SROH; and Dentist and Chance subscales in relation to marital status (Table III). A Bonferroni post-hoc test revealed

Table II. Fit indices for two models.

Model	χ^2	d.f.	P	χ^2/d.f.	GFI	AGFI	CFI	RMSEA (90% CI)
Four-factor model	1247.15	293	0.00	4.25	0.91	0.9	0.91	0.057 (0.054–0.06)
Five-factor model	1241.42	289	0.00	4.29	0.91	0.89	0.91	0.057 (0.054–0.061)

GFI = Goodness of Fit Index; AGFI = Adjusted Goodness of Fit Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; CI = confidence interval.

Table III. Comparison of the subscale scores [mean (SD)] according to socio-demographic variables, SROH, and oral health behaviors.

	n	F1	F2	F3	F4
Gender[a]					
Female	491	3.54 (0.41)	2.78 (0.58)	1.98 (0.58)	2.80 (0.78)
Male	495	3.44 (0.44)	2.75 (0.57)	1.96 (0.55)	2.59 (0.79)
P		<0.001	0.395	0.665	<0.001
Age[b]					
Aged 18–30 years (A)	400	3.53 (0.39)^{C*}	2.69 (0.56)^{B,C*}	1.92 (0.51)^{C*}	2.74 (0.77)^{C*}
Aged 31–45 years (B)	341	3.50 (0.42)^{C*}	2.82 (0.56)^{A*}	1.97 (0.57)	2.73 (0.83)
Aged 46 years and above (C)	245	3.41 (0.48)^{A,B*}	2.82 (0.59)^{A*}	2.06 (0.63)^{A*}	2.58 (0.78)^{A*}
P		0.004	0.002	0.009	0.029
Education[b]					
Primary or less (A)	667	3.45 (0.45)^{C*}	2.78 (0.57)	2.07 (0.57)^{B,C*}	2.70 (0.79)
Secondary (B)	213	3.53 (0.38)	2.74 (0.56)	1.81 (0.53)^{A*}	2.70 (0.81)
Higher (C)	106	3.61 (0.37)^{A*}	2.74 (0.59)	1.70 (0.45)^{A*}	2.68 (0.75)
P		0.001	0.633	< 0.001	0.967
SES[b]					
High (A)	174	3.61 (0.35)^{B,C*}	2.82 (0.57)	1.72 (0.48)^{B,C*}	2.67 (0.80)
Moderate (B)	557	3.50 (0.40)^{A,C*}	2.76 (0.56)	1.95 (0.53)^{A,C*}	2.73 (0.81)
Low (C)	255	3.36 (0.50)^{A,B*}	2.75 (0.61)	2.19 (0.61)^{A,B*}	2.64 (0.74)
P		<0.001	0.357	<0.001	0.237
Marital status[a]					
Married	559	3.48 (0.44)	2.81 (0.59)	2.00 (0.59)	2.74 (0.80)
Not married	427	3.50 (0.41)	2.71 (0.55)	1.93 (0.54)	2.64 (0.78)
P		0.577	0.013	0.038	0.057
SROH[a]					
Bad	634	3.44 (0.42)	2.67 (0.54)	2.01 (0.54)	2.71 (0.77)
Good	345	3.57 (0.42)	2.93 (0.60)	1.90 (0.60)	2.68 (0.83)
P		< 0.001	< 0.001	0.006	0.602
Toothbrushing[a]					
≥twice a day	337	3.60 (0.37)	2.86 (0.56)	1.82 (0.51)	2.79 (0.80)
≤once a day	614	3.43 (0.44)	2.72 (0.58)	2.06 (0.58)	2.66 (0.78)
P		<0.001	<0.001	<0.001	0.019
Dental attendance[a]					
Regular dental check-up	176	3.67 (0.32)	2.85 (0.61)	1.74 (0.54)	2.62 (0.79)
Symptoms-oriented	810	3.45 (0.44)	2.75 (0.56)	2.02 (0.56)	2.72 (0.79)
P		<0.001	0.038	<0.001	0.138
Dental flossing[a]					
Yes	62	3.62 (0.40)	2.91 (0.55)	1.78 (0.54)	2.54 (0.78)
No	922	3.48 (0.43)	2.76 (0.57)	1.98 (0.57)	2.71 (0.79)
P		0.014	0.047	0.006	0.098
Use of fluoride mouthrinse[a]					
Yes	260	3.58 (0.38)	2.71 (0.56)	1.92 (0.55)	2.75 (0.78)
No	726	3.45 (0.44)	2.79 (0.57)	1.99 (0.57)	2.68 (0.79)
P		<0.001	0.058	0.106	0.196

[a]Statistical evaluation by *t*-test.
[b]Statistical evaluation by one-way ANOVA F test.
[⋆]Significant differences among groups according to a post-hoc Bonferroni test ($P < 0.05$).
F1 = Internal; F2 = Dentist; F3 = Chance; F4 = Socialization agents.

statistically significant differences in the Internal subscale score between the ≥46 years group and others, in the Dentist subscale score between the 18–30 years group and others, in the Chance and Socialization agents subscale scores between the 18–30 and ≥46 years groups, in the Internal subscale score between the primary or less and higher education groups, and in the Chance subscale score between the primary or less education group and others. In addition, there were statistically significant differences in the Internal and Chance subscale scores among all SES groups.

Results from multiple linear regression analyses of socio-demographic variables, SROH, self-reported oral health behaviors, and oral health LOC beliefs are presented in Table IV. The findings from regression analyses showed that gender ($\beta = -0.059$, $P = 0.033$), age ($\beta = -0.077$, $P < 0.001$), SES ($\beta = 0.097$, $P < 0.001$), SROH ($\beta = 0.143$, $P < 0.001$), pattern of toothbrushing ($\beta = -0.083$, $P = 0.005$), and dental attendance ($\beta = -0.159$, $P < 0.001$) were the significant factors explaining 11.7% of the variance in Internal LOC beliefs.

Pattern of toothbrushing ($\beta = -0.136$, $P = 0.001$), SROH ($\beta = 0.239$, $P < 0.001$), and marital status ($\beta = -0.076$, $P = 0.047$) were significant factors explaining 6.5% of Dentist LOC beliefs.

Patterns of toothbrushing ($\beta = 0.127$, $P = 0.001$) and dental attendance ($\beta = 0.193$, $P < 0.001$), SROH ($\beta = -0.121$, $P = 0.002$), SES ($\beta = -0.159$, $P < 0.001$), education ($\beta = -0.100$, $P < 0.001$), and age ($\beta = 0.072$, $P = 0.003$) were significant factors explaining 14.3% of Chance LOC beliefs.

Gender ($\beta = -0.201$, $P < 0.001$) and age ($\beta = -0.073$, $P = 0.025$) were statistically significant factors explaining 2.1% of Socialization agents LOC beliefs.

A comparison of mean subscale scores showed that the mean score for the Internal subscale was significantly higher than those for each of the External subscales ($P < 0.001$). No significant difference in mean scores between the Dentist and Socialization agents subscales ($P > 0.05$) and a significant difference in mean scores among the Chance, Dentist, and Socialization agents subscales were found.

Table IV. Summary of backward stepwise multiple linear regression analysis of effect of socio-demographic variables, SROH, and self-reported oral health behaviors on oral health LOC beliefs.

	β[a]	t	*P*
Predicted Internal Control Beliefs ($R = 0.342$; $R^2 = 0.117$; $P < 0.001$)			
Gender[c]	–0.059	–2.140	0.033
Age (years)	–0.077	–4.232	<0.001
SES[b]	0.097	4.659	<0.001
SROH[c]	0.143	4.792	<0.001
Pattern of toothbrushing[c]	–0.083	–2.800	0.005
Pattern of dental attendance[c]	–0.159	–4.528	<0.001
Predicted Dentist Control Beliefs ($R = 0.255$; $R^2 = 0.065$; $P < 0.001$)			
SROH[c]	0.239	6.103	<0.001
Pattern of toothbrushing[c]	–0.136	–3.490	0.001
Pattern of dental flossing[c]	–0.123	–1.659	0.098
Marital status[c]	–0.076	–1.989	0.047
Predicted Chance Control Beliefs ($R = 0.379$; $R^2 = 0.143$; $P < 0.001$)			
Age (years)	0.072	3.007	0.003
SROH[c]	–0.121	–3.104	0.002
Pattern of toothbrushing[c]	0.127	3.385	0.001
Pattern of dental attendance[c]	0.193	4.225	<0.001
Education (years)	–0.100	–3.565	<0.001
SES[b]	–0.159	–5.348	<0.001
Predicted Socialization Agents Beliefs ($R = 0.144$; $R^2 = 0.021$; $P < 0.001$)			
Gender[c]	–0.201	–3.937	<0.001
Age (years)	–0.073	–2.242	0.025

[a]Unstandardized coefficients.
[b]SES index ranging from lowest degree to highest degree.
[c]Dichotomized variables: gender (0 = females,1 = males), marital status (0 = married, 1 = not married), toothbrushing (0 = ≥ twice a day, 1 = ≤ once a day), SROH (0 = bad, 1 = good), dental flossing (0 = yes, 1 = no), dental attendance (0 = regular dental check-up at least once a year, 1 = symptoms-oriented).

Discussion

The results of our study are consistent with the MOHLCS having good reliability and validity. Cronbach's alpha values were all well above the minimum recommended level of 0.70, providing strong evidence for the internal consistency of the total scale as well as for all the subscales [28].

This study has presented a four-factor model estimated with CFA methods that showed good overall fit using 26 items of the MOHLCS. According to the new factor solution, the Dentist—information and Dentist—prevention subscales items in the pilot study loaded together on factor 2, namely External—Dentist. We thought that the change in factor solution may have originated from the sample size of the studies. In this research, the external/powerful others dimension according to factor analysis was separated into two dimensions, i.e. Dentist and Socialization agents. Similarly, Marshall et al. [34] and Wallston et al. [35] have also suggested that attributing control over health to professional caregivers differs conceptually and empirically from attributing control to non-professionals (e.g. family and friends); additional items should be developed to assess beliefs regarding non-professional control over health.

We found a negative correlation between the Chance and Internal subscales and positive correlations among the Internal, Dentist, and Socialization agents

subscales. Similarly, Wallston et al. found a positive correlation between the Internal and Doctors dimensions, and a negative correlation between the Internal and Chance dimensions [36]. Furthermore, the correlation coefficients between subscales indicated that the Internal, Dentist, Socialization agents, and Chance subscales were orthogonal to one another, a finding which is similar to that of Wallston and co-workers [12,35,36] and Åström and Blay [19].

The results of multivariate analyses showed that higher Internal LOC beliefs were consistently associated with regular dental attendance and more frequent daily toothbrushing, while higher Chance LOC beliefs were associated with adverse oral health behaviors such as a low toothbrushing frequency and symptom-orientated dental attendance. Although Wallston and Wallston [36] found no relationship between internal health LOC beliefs and oral health behaviors, our findings are consistent with those of other researchers who reported that individuals who brushed their teeth regularly and visited the dentist frequently had greater internal LOC beliefs [37,38].

Higher Dentist LOC beliefs were associated only with more frequent daily toothbrushing. Similarly, some researchers found positive associations between the Powerful others LOC beliefs and performance of oral hygiene behaviors, but there is little evidence to support the view that Powerful others beliefs are more likely to act preventively [17,19].

More surprisingly, we found no significant behavioral factor related to the Socialization agents beliefs. It is known that social influence processes are relevant to some oral health behaviors [39]. Thus, additional research should be designed to understand the pathway between socialization agents, LOC beliefs, and oral health behaviors. The results of our study also indicated that Dentist and Chance subscales as well as the Internal subscale were successful in discriminating between those adults who engaged in oral health behaviors and those who did not.

In line with previous findings [5,14,35,40,41], we found that Internal, Dentist, and Socialization agents LOC beliefs were significantly associated with the SROH. These adults seemed to perceive their oral health to be better as the scores obtained from the Internal and Dentist subscales increased and to be worse as the scores obtained from the Chance subscale increased.

With regard to socio-demographic variation in oral health LOC beliefs, it was found that women had higher levels of Internal and Socialization agents LOC beliefs. It is also worth mentioning the age effects for the three MOHLCS subscales. Our study showed that levels of Internal and Socialization agents beliefs decreased gradually with age, but Chance LOC beliefs increased gradually with age. Similarly, Ludenia & Donham [17] reported that young patients had greater internal LOC beliefs. In addition, we found that older people had higher scores than young people on the Dentist subscale. This may well reflect the important psychological and social development of ageing and an increasing need for prosthetic and restorative treatment in older participants. Married subjects had higher scores on the Dentist subscale. This finding was consistent with the study of Doherty [42], which reported that married people were more external than unmarried ones. Due to increasing family responsibility and limited time for oral self-care, married people may be more likely to prefer professional oral care instead of home-based oral hygiene.

We found that Internal and Chance LOC beliefs varied substantially across different socioeconomic groups and levels of education. Internal subscale scores increased in parallel with increases in SES and education, but the Chance scores declined with increasing SES and educational levels. These results are in line with previous findings that control beliefs partly mediate the association between socioeconomic status, education, and health [15,40–43].

These results also suggest that people living in economically deprived circumstances and individuals with less education have less control over their oral health.

The results reported here provide relevant information for the development of oral health promotion programs by oral health professionals in different socioeconomic groups characterized by lower oral health control beliefs and adverse oral health behaviors. The MOHLCS can be useful to recognize an individual's existing belief about oral health outcomes and to provide information consistent with that belief to promote oral health behaviors. By noting an individual's responses to the MOHLCS items, an oral health professional may be able to identify the pattern of orientation as being related more strongly to belief in internal control or control by externals. It is known that, considering educational and motivational requirements, different types of oral health promotion programs will be required for individuals with an internal versus external LOC, as suggested by Galloway [7], Haber [13], Kent et al. [14], and Ludenia & Donham [17]. For internals, self-care skills programs could be designed to promote home care. For the externals, oral health interventions involving dentists could be designed to increase their beliefs' control over health and to promote the oral health awareness of these people regarding self-care oral hygiene practices and regular visits to the dentist.

Using this information as a guideline in dental practice, the oral health professional should strive to provide advice about oral health behaviors, in line with the individual's existing control orientations.

Our study has several limitations. Due to a limited research budget, quota sampling was chosen as the most cost-effective means of obtaining a

representative sample of adults, although it is a non-probability sampling technique. This study, however, sampled a representative cross-section of Istanbul adults and the sample size was large. Even though the regression models were statistically significant, the proportion of variance explained was quite low. We failed to measure and account for other theoretically relevant variables, such as health value, outcome expectancies, or disease severity in determining oral health LOC beliefs. Future research should take these variables into account and use the information in tandem with oral health LOC beliefs to predict behavior, as suggested by Rotter and Wallston [11,44]. This study had a cross-sectional design and it is thus difficult to establish a causal relationship among socio-demographic factors, SROH, oral health behaviors, and oral health LOC beliefs. Longitudinal and interventional research are needed to determine the direction of the associations found in this study, and to examine the effectiveness of the oral health promotion programs that accord with an individual's control orientations and which might evolve from this research.

Conclusions

Our study showed that the new four-factor structure has a better goodness of fit for this study sample. Self-rated oral health, socio-demographic factors, and oral health behaviors are significantly associated with oral health LOC beliefs. Oral health LOC orientations may be helpful in the planning of oral health promotional programs in different socioeconomic groups characterized by lower oral health control beliefs and adverse oral health behaviors. The determination of the individual's control orientations using the MOHLCS may be useful in the design of oral health promotional programs and may provide clear guidance to assist oral health professionals to promote favorable oral health behaviors in their patients.

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Appendix

Items of the MOHLCS.

1. I will have tooth decay whatever I do, because I cannot change the structure of my teeth.
2. I can prevent tooth decay and gum diseases if I brush my teeth regularly.
3. I can maintain my oral health only with information from my dentist.
4. I think that whatever caused the deterioration of my oral health is due to bad luck.
5. I immediately go to my dentist whenever I feel that something is wrong with my oral health.
6. The warnings of my family have an important influence on my oral health.
7. My dental diseases will improve rapidly if I am lucky enough.
8. I am aware of what to do to maintain my oral health.
9. The warnings of my friends and people in my close environment have an important influence on my oral health.
10. If my oral health condition worsens, it's a matter of fate.
11. I am directly responsible for my oral health.
12. My oral health depends on dentists.
13. When my oral health worsens, I leave everything to its course and say, "I will bear whatever I have to suffer".
14. I blame myself if I have tooth decay.
15. Dentists maintain my oral health.
16. My gums will be diseased and will bleed whatever I do, because I cannot change their structure.
17. The only factor that maintains my oral health is my care for my oral health.
18. I owe the avoidance of tooth decay and gum diseases and the improvement in my oral health to my dentists.
19. My teeth will be healthy in the long term if I care for them.
20. I will prevent tooth decay and gum diseases if I care for my oral health properly.
21. I do only what is told by the dentist.
22. I know that I have neglected caring for my teeth when I have problems with my oral health.
23. Luck plays a big part in determining how soon I will recover from tooth decay and gum disease.
24. I take care to maintain and improve my oral health.
25. It is possible to have healthy teeth in the long term if I do what should be done.
26. The only way to maintain my oral health is to comply with the dentists' recommendations.