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Influential Factors on Oral Health Status of the Elderly Iranians: A Path Analysis

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Abstract

Objectives: This study aimed at assessing the influential factors on oral health status of the elderly Iranian population (65 to 74 years of age) by using Path analysis.

Methods: This study was conducted on 7,521 elderly individuals participating in the Iranian National Oral Health Survey in 2012. The DMFT and functional health (FH) indices were evaluated first. Then socio-economic status (SES), insurance type (IT), dental attendance pattern (DAP), reason of attendance (R of A), tooth cleaning (TC), and nutritional pattern (NP) were evaluated according to responses provided in the questionnaire. Path analysis was applied to analyze the patterns between these variables and DMFT and FH indices.

Results: The participants' mean DMFT was 26.6 ± 8.03, and the median FH was 0 (0.10). Path analysis revealed that seniors with higher SES, and having a dental insurance with greater coverage had direct effect on more regular DAP, and indirect effect on improvement of FH and DMFT index. More regular DAP had direct effect on improvement of FH, and DMFT indices. Likewise, NP with low risk of caries had direct effect on improvement of FH and DMFT index.

Conclusion: Out of all evaluated factors, IT, SES, DAP, and NP demonstrated to be particularly important and significantly affecting DMFT and FH indices in the elderly population. Out of all aforementioned factors, IT in low SES individuals was more important for obtaining required oral healthcare services. Apparently, seniors' oral health is absolutely in need of special attention with particular focus on providing early access to preventive care.

Keywords: Oral Health, Elderly, DMFT, FH Index, Path Analysis, National Survey

Introduction

Although preventable, oral diseases have a considerable prevalence, affecting over 3.5 billion people worldwide. Dental caries is among the most common diseases globally, with a higher prevalence in deprived communities and developing countries.[1] On the other hand, in relation to aging population, we are currently witnessing the most important demographic phenomenon in the 21st century, with respect to the increase in both census and ratio. In 2004, approximately 600 million people worldwide were ≥60 years of age. This rate is estimated to double by the year 2025, and reach 2 billion by 2050; about 80% of which residing in developing countries. In the year 2000, the ratio of the elderly population to the entire population of the world was 10%. This ratio was 6.5% in Iran in the same year. In the year 2020, the ratio of the elderly population to the entire population of the world increased to 13.5%, and this ratio reached to 10% in Iran. According to the available statistics, the population of Iran is moving towards aging, similar to most other parts of the world.[2] At old age, many individuals often suffer from multiple health problems, and usually need to take several medications on a daily basis. Thus, poor oral hygiene and repeated exposure to risk factors in this age group can increase and complicate their oral health status. If left untreated, severe dental caries can lead to complete destruction of the crown, development of periodontal diseases, tooth loss, and related local and systemic complications in the elderly. All these factors can deteriorate the quality of life in this vulnerable population.[3] Benefitting from oral healthcare services is a multi-factorial phenomenon, depending on a number of elements such as the dentition status, oral health attitudes, as well as socioeconomic status (SES).[4] In 2012, approximately 30% of the Iranian elderly population, over 65 years of age had a dental visit in the past year.[5] In the same year, the mean DMFT index of the 65 to 74-year-old individuals in Iran was 25.71, with the number of decayed (D), missing (M) and filled (F) teeth reported as 2.44, 22.56, and 0.71 (11.72%, 84.22%, and 4.05% of the total mean), respectively. The prevalence of complete edentulism was >52% in this age group.[6]

According to available reports, health insurance can enhance the beneficiaries' access to healthcare services. In 2012, aside from the private and supplementary health insurance systems, four main basic insurance systems were available in Iran, namely the Medical Services Insurance Fund (MSIF), social security organization (SSO), Imam-Khomeini Relief Committee (IKRC), and Armed Forces Medical Services Insurance Fund (AFMSIF). In terms of the covered population, MSIF had the largest and AFMSIF had the smallest population under insurance coverage. The four

aforementioned insurance organizations had wide variations in respect to dental service coverage. The franchise was 30% of the fee for dental services in all four insurance systems. In 2012, the share of dental costs paid out of all covered services was 1% for the treatment unit of SSO and MSIF, 5% for IKRC, and 20% for AFMSIF. Also, there was a fund under the name "therapeutic support fund" in the General Council of Armed Forces, that would pay up to 100% of the treatment costs for the insured individuals under certain circumstances (i.e. patients with special need conditions), even covering some dental services, which were not normally covered by this organization. Apparently, those individual covered by the AFMSIF would benefit from considerably wider range of services compared to other three insurance systems.[8] This study aimed to assess the effect of influential factors on oral health status of the Iranian elderly population with 65 to 74 years old.

Materials and Methods

Data Sources

The Iranian National Oral Health Survey (INOHS-2012) was conducted in 2012, by using the World Health Organization's (WHO) standard questionnaire. Subjective (self-report) and objective (clinical examination) methods were used to assess the oral health status of the participants.[9] This study is using part of the data related to geriatric cases, including 65 to 74 years old age group. Dental caries was among the oral conditions evaluated in the elderly population. Also, a standard WHO questionnaire was used in order to assess the effect of other influential factors affecting the oral health status. Aside from demographic information (age, gender, place of residence), SES (level of education, occupation, family size, having a personal vehicle, number of rooms in the house living in, as well as home ownership status), TC (tooth cleaning), NP (nutritional pattern), DAP (dental attendance pattern, and insurance-related information were collected.

As recommended by the WHO, a total of 300 elderly individuals were recruited from each province. In the INOHS-2012, samples were collected from all provinces of Iran. In case of Tehran, the capital city, it was considered as two provinces due to its high population (>10 million). Study participants were selected by cluster random sampling. The selected samples filled out the questionnaire if they were willing to participate in the study, and were scheduled for a clinical examination afterwards. The examiners and those recorded the information were calibrated by a WHO representative in order to standardize the process of clinical oral examination and data collection prior to the initiation of study. After collection of the completed questionnaires, distorted instruments and cases without clinical examination report were excluded from the data bank. Through this vigorous process, a total number of 7521 samples remained in the study. More details on implementation of the INOHS-2012 are available elsewhere.[6,7]

Conceptual Framework and Measurements

In the present study, a conceptual model was first designed in order to identify the influential factors on elderly oral health status based on the questions included in the questionnaire (Figure 1). The DMFT and functional health (FH) index were calculated as objective indices for assessment of the health status of the entire dentition according to the data obtained from the clinical examination forms. The DMFT index was calculated by summing the number of decayed (D), missing (M), and filled (F) teeth. The FH index was calculated by summing the number of sound and caries-free restored teeth in the oral cavity for each individual using the formula [32-(M+D)]. To assess the influential factors on oral health of the elderly, the conceptual model was tested by Path analysis.

The four insurance systems, namely the IKRC (=1), MSIF (=2), SSO (=3), and AFMSIF (=4) were considered as answer choices for the question regarding the participants' insurance type (IT) (Other insurance types such as supplemental insurance were not evaluated in this study).

Two questions were asked regarding the life style. The first question was about factors related to hygienic behaviors, such

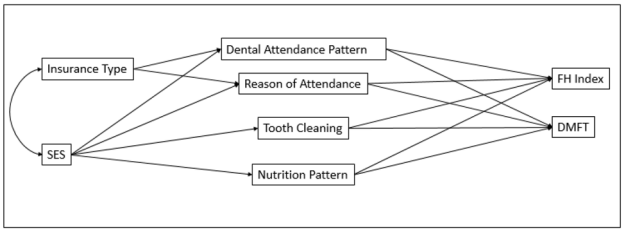

Fig. 1 **Conceptual Framework (Primary model).**

Table 1. **Cariogenic risk of selected cariogenic items**

#	Cariogenic items	Several times a day (=6)	Every day (=5)	Several times a week (=4)	Once a week (=3)	Several times a month (=2)	Seldom/ Never (=7)
1	Biscuit/Cake/ Cookies	×					
2	Sugar containing syrup		×				
3	Jam/Honey	×					
4	Sugar containing gum						×
5	Candy/Chocolate				×		
6	Sweetened Milk					×	
7	Tea with sugar					×	

as "how often do you brush your teeth?" Never (=1), once or several times a month (=2), several times a week (=3), and once or several times a day (=4). The second question was about NP. The participants were asked "how often do you use the following five cariogenic items?" The lowest rate of consumption was allocated a score of 1, and the maximum rate of consumption was allocated a score of 6. Accordingly, the maximum risk for the seven cariogenic items was 42 and minimum risk was 7. Therefore, the participants could be anywhere between the range of 7 to 42 depending on the rate and type of cariogenic items consumed. Based on the frequency of responses, the participants were categorized into three groups: Those with scores between 31–42 were categorized as high risk (group 1), those with scores between 19–30 were categorized as moderate risk (group 2), and those with scores between 7–18 were categorized as low risk (group 3). [Table 1]

Two questions addressed the care seeking behavior. The first question asked about the reason for the latest dental visit, and the answer choices were: presence of a problem (=1) and check-up (=2). The second question asked for the time of participant's last dental visit (DAP). The answer choices were: had no visit (=1), over a year ago (=2), and during the past year (=3).

Demographics

For SES categorization of participants, the related items including occupation, level of education, home ownership, family size, number of rooms, and having a personal vehicle for leisure (not for work) were weighted. The SES score was calculated separately for the rural and urban populations. Because, the number of family members was not among the SES determinants in urban population; while family members in rural population are considered as human resource for work and family income. Thus, the number of family members was considered as a determining factor for SES in rural populations. Finally, the SES score was calculated for the entire urban and rural populations and categorized as low (=1), moderate (=2), and high (=3).

Statistical Procedures

For describing the data, the frequency (percentage) of categorical variables and mean (standard deviation) and median interquartile range (IQR = Q1, Q3) of the numerical variables were all reported. The mean was reported for DMFT index and median was reported for FH index (since the variance was larger than the mean). The Kolmogorov-Smirnov test was used to assess the normal distribution of all numerical data. The Kruskal-Wallis test was used to compare DMFT and FH based on IT, SES, NP, TC, and time of last dental visit. The Mann-Whitney test was applied to compare DMFT and FH indices based on gender and reason of attendance (R of A). Path analysis was used to analyze the correlation between oral health variables and other variables in a causal model. Path analysis is a technique that determines to what extent a hypothetical model agrees with the existing data. It also enables testing of a causal model according to cross-sectional data. Path model has maximum efficacy when only observed variables are entered in the model. By applying the model fit, it is tested to what extent the conceptual framework is supported by the actual data. In other words, it indicates the fit of the experimental model (based on data) with the theoretical model (conceptualized by the researcher). The fit indices used in the present study included the root mean square error of approximation (RMSEA), comparative fit index (CFI), Tucker-Lewis index (TLI), standardized root mean squared residual (SRMR), and coefficient of determination (CD).[10-13]

Data were analyzed by SPSS 25 and STATA 14. The ethics committee of the School of Dentistry, Shahid Beheshti University of Medical Sciences approved the proposal for this study (IR.SBMU.DRC.1399.021).

Results

The study participants' (n = 7,521) demographic information is demonstrated in Table 2. The participants' mean DMFT was 26.6 ± 8.03 and the median FH Index was 0 (0.10). A total of 4,292 (57.1%) participants had a DMFT of 32 (Diagram 1), and 4,285 (57%) had a FH index of 0 (Diagram 2). The Kolmogorov-Smirnov test showed that, the data were not normally distributed. Thus, appropriate tests were applied to analyze the association of variables with different factors.

The participants' mean DMFT was higher in male (26.74 ± 7.94) than female (26.94 ± 8.10) and the median FH was higher in female 0 (0.11) compared to male 0 (0.10), but the DMFT and FH Index for male and female participants were not significantly different. Although, significant associations detected between SES, IT, TC, and R of A with DMFT and FH, and also between DAP and NP with FH ($P < 0.01$). A significant association was also found between DAP and DMFT ($P < 0.05$). As shown in Table 2, the lowest mean DMFT was recorded in participants covered by the AFMSIF and the highest mean DMFT was recorded in participants covered by the SSO insurance. As shown in Diagram 2, and considering the high frequency of FH index for zero, the median was zero in most cases (Table 2).

Path Analysis

According to available literature, RMSEA < 0.10 indicates reasonable fit. Also, SRMR < 0.05 indicates a good fit. CFI > 0.9, TLI > 0.9, and CD close to 1 indicate good fit as well.[14,15] In goodness of fit test conducted on present data, RMSEA, SRMR, and CD showed optimal fit (Table 3). As shown in Table 4 and Figure 2, direct effect of SES on DAP, R of A, TC, and NP, and also direct effect of DAP and NP on DMFT and FH were noted. Moreover, SES and IT had indirect effects on DMFT and FH as well. The assessment of total effects, confirmed the significance of the abovementioned direct and indirect effects. Figure 2, shows the estimated parameters for the final model. According to the path model, significant pathways noted from SES and IT to DAP, and increased SES level [β (standardized coefficient) = 0.05] and changing the IT from IKRC to AFMSIF (β = 0.04) that resulted in a more regular DAP. The path from SES to R of A indicated that, increasing the level of SES (β = 0.02) resulted in higher attendance of participants for prevention (rather than treatment). The path from SES to TC indicated that, increased SES level (β = 0.28) led to increased frequency of tooth brushing. The path from SES to NP showed that increased level of SES (β = −0.05) led to higher consumption of cariogenic items. The path from DAP to DMFT and FH indicated that, more regular DAP (β = −4.42) led to a reduction in DMFT and increase in FH (β = 4.89). The path from NP to DMFT and FH showed that as the cariogenic risk of items decreased, DMFT decreased (β = −0.46) and

Table 2. **Mean (SD) distribution of DMFT and FH median (first and third quarters) and association of DMFT and FH variables with other risk factors**

Variables		Type/Levels	Frequency (%)	DMFT Mean (SD)	*P* Value	FH Index	*P* Value
Gender		Male	4235 (49.1%)	26.74 ± 7.94	0.721[a]	0 (0,10)	0.456[a]
		Female	4398 (50.9%)	26.49 ± 8.10		0(0,11)	
SES		Low	2781 (37%)	27.14 ± 7.61	<0.001[b]	0 (0,9)	<0.001[b]
		Moderate	2364 (31.4%)	27.9 ± 7.84		0 (0,9)	
		High	2376 (31.6%)	25.52 ± 8.55		0 (0,14)	
Insurance type		IKRC	174 (3.1%)	25.91 ± 8.77	0.001[b]	0 (0,10)	0.002[b]
		MSIF	2858 (50.5%)	26.44 ± 7.86		0 (0,10.25)	
		SSO	2290 (40.5%)	26.87 ± 7.95		0 (0,10)	
		AFMSIF	337 (6%)	25.32 ± 9.04		0 (0,15)	
Life Style Behaviors	Tooth Cleaning (Hygienic behaviors)	Never	1386 (22%)	26.67 ± 7.15	0.001[b]	0 (0,9)	<0.001[b]
		Once or several times a month	828 (13.2%)	26.02 ± 7.97		0 (0,12)	
		Several times a week	805 (12.8%)	25.53 ± 8.76		0 (0,13)	
		Once or several times a day	1262 (57.3%)	26.67 ± 8.25		2 (0,11)	
	Nutrition Pattern	High Risk	5776 (88.7%)	26.42 ± 7.89	0.086[b]	0 (0,12)	0.003[a]
		Moderate risk	368 (5.7%)	26.94 ± 7.78		0 (0,10)	
		Low risk	367 (5.6%)	26.81 ± 8.75		0 (0,11)	
Care Seeking Behaviors	Reason of Attendance	Problem	4721 (92.8%)	26.22 ± 8.01	0.001[b]	0 (0,12)	0.003[a]
		Check up	369 (7.2%)	26.81 ± 8.75		0 (0,9)	
	Dental Attendance Pattern	Never (no visit)	387 (8.7%)	25.09 ± 8.43	0.047[b]	0 (0,12)	<0.001[b]
		Over a year ago	3565 (80.1%)	27.88 ± 7.44		0 (0,6)	
		During the past year	497 (11.2%)	24.64 ± 8.52		4 (0,14)	

[a]Man-Whitney test, [b]Kruskal-Wallis test.

FH increased (β = 0.46) accordingly. Indirect significant paths included the path from SES and IT to DMFT and FH. Increased level of SES and IT had an indirect effect on reduction of DMFT (β = –0.15, –0.17, respectively). Also, they had an indirect effect on increasing the FH (β = 0.21, 0.19, respectively). A mutual arrow between SES and IT shows the positive correlation between these two factors (covariance = 0.09). IT had no effect on R of A (β = –0.000), for this reason a straight line was drawn (instead of an arrow) in the final model.

Discussion

Descriptive findings of the present study showed significant positive correlations between FH and DMFT with SES, IT, TC, R of A, and DAP, and also between NP with FH. This study revealed complex pathways between different factors such as the IT, SES and DAP with DMFT and FH among the Iranian elderly population by using Path analysis. As shown in Figure 2 (bilateral arrows) a positive correlation was detected between SES and IT. Also noted, direct correlations

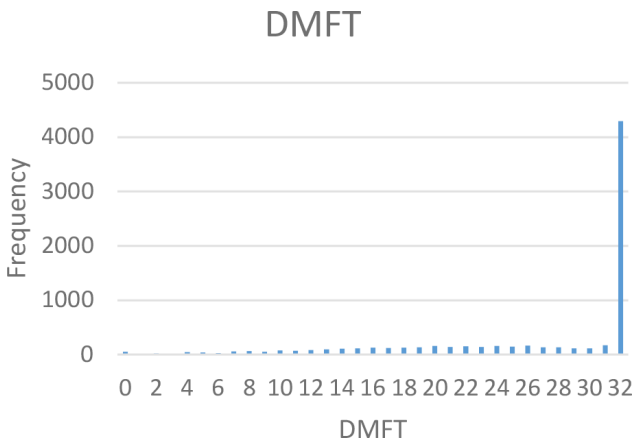

Diagram 1. **Data accumulation at point 32 for DMFT.**

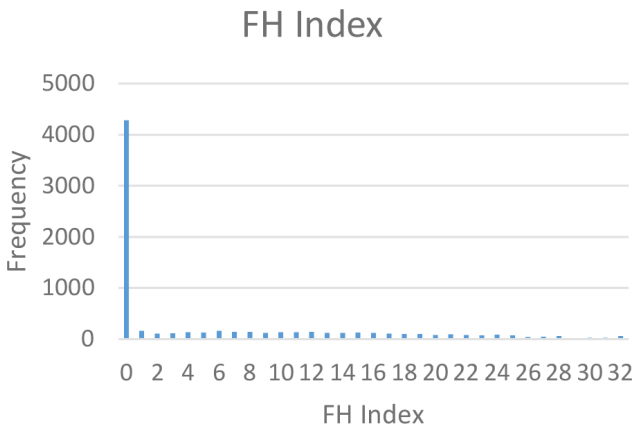

Diagram 2. **Data accumulation at point 0 for FH index.**

Table 3. **Fit Indices for path model for DMFT and FH Index**

Population error			Baseline comparison		Size of residuals	
RMSEA	90% CI (lower bound, upper bound)	Pclose	CFI	TLI	SRMR	CD
0.06	**(0.047, 0.070)**	**0.10**	0.72	0.35	**0.03**	**0.8**

Note: Bold values indicate optimal fit.

between SES and IT with DAP, and between SES with R of A, TC, and NP, in such a way that, higher SES was positively correlated with better insurance coverage. Likewise, it appeared that individuals with higher financial status or better insurance coverage had more regular DAP. Such individuals often went for a check-up without having a certain complaint. Thus, despite having higher consumption rate of cariogenic items, they less commonly experienced caries and its related problems due to practicing better oral hygiene and dental care. This study detected the direct effect of DAP and NP on FH and DMFT. Those with more regular DAP and better NP (eating less cariogenic items) had better oral health indices. SES and IT both had indirect correlations (through DAP as a mediator variable) with FH and DMFT, in such a way that, the frequency of dental visits significantly affected oral health status and its related indices. Similarly, IT (based on its coverage) can significantly affect the improvement of oral health

Table 4. **The decomposition of effects into direct, indirect, and total effects between DMFT, FH and the other risk factors**

	Cov. (IT, SES)		Coef.	*P* value	[Conf. Interval 95%]	
Direct Effects			**0.09**	**<0.001**	0.07	0.10
	DAP←	IT	**0.04**	**0.001**	0.01	0.06
		SES	**0.05**	**<0.001**	0.03	0.06
	R of A←	IT	0.00	0.99	−0.01	0.011
		SES	**0.02**	**<0.001**	0. 00	0. 027
	TC←	SES	**0.28**	**<0.001**	0.24	0.32
	NP←	SES	**−0.05**	**<0.001**	−0.06	−0.03
	DMFT←	DAP	**−4.42**	**<0.001**	−4.99	−3.84
		R of A	0.62	0.22	−0.39	1.65
		TC	0.14	0.09	−0.02	0.31
		NP	**−0.46**	**0.02**	−0.85	−0.06
	FH Index←	DAP	**4.89**	**<0.001**	4.27	5.50
		R of A	−0.58	0.28	−1.66	0.48
		TC	−0.02	0.76	−0.20	0.20
		NP	**0.46**	**0.03**	0.04	0.88
Indirect Effects	DMFT←	IT	**−0.17**	**<0.001**	−0.27	−0.07
		SES	**−0.15**	**<0.001**	−0.34	−0.06
	FH Index←	IT	**0.19**	**<0.001**	0.07	0.30
		SES	**0.21**	**<0.001**	0.11	0.31
Total Effects	DMFT←	DAP	**−4.42**	**<0.001**	−4.99	−3.84
		R of A	0.62	0.22	−0.39	1.65
		TC	0.14	0.09	−0.02	0.31
		NP	**−0.46**	**0.02**	−0.85	−0.06
		IT	**−0.17**	**<0.001**	−0.27	−0.07
		SES	**−0.15**	**<0.001**	−0.24	−0.06
	FH Index←	DAP	**4.89**	**<0.001**	4.27	5.50
		R of A	−0.58	0.28	−1.66	0.48
		TC	−0.02	0.76	−0.20	0.15
		NP	**0.46**	**0.03**	0.04	0.88
		IT	**0.19**	**<0.001**	0.07	0.30
		SES	**0.21**	**<0.001**	0.11	0.31

Note: Abbreviations: SES, Socio-Economic Status; IT, Insurance Type; DAP, Dental Attendance Pattern; R of A, Reason of Attendance; TC, Tooth Cleaning; NP, Nutrition Pattern.

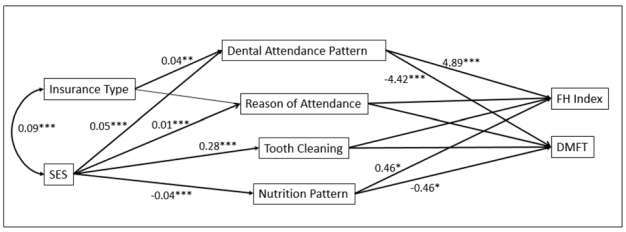

Fig. 2 **Experimental Framework (final model) Note: All significant values indicate standardized coefficients (*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$).**

indices. Furthermore, this study revealed that, all individuals regardless of their SES status were at high risk of dental problems, except those who could afford paying for their dental services.

The goodness of fit test showed good fit for RMSEA value, very good fitting for SRMR, and relatively good fit for CD. Although, CFI and TLI did not show a good fit. Overall, majority of the variables showed relatively good fit for the model (Table 3). The Path analysis clearly revealed the

correlations, causal relationships, and the pathways between the variables and data followed our conceptual model, confirming the role of DAP as a mediator variable.[11]

The results showed that, DAP had a causal relationship with oral health, confirming better oral health with more regular DAP. Likewise, other studies reported routine dental attenders had better oral health status.[16-18] In line with the present findings regarding the relationship between DAP and DMFT, Bottenberg et al, in 2019[19] demonstrated that, dental attenders with more regular DAP had significantly lower number of untreated caries compared with irregular attenders. Also, Aarabi et al.[13] indicated that the geriatric cases with a history of a dental visit in the past year had fewer carious teeth. Other studies also confirmed higher perceived oral health in those who had access to oral healthcare services and had more regular DAP.[20,21] In this study, individuals with higher SES had high consumption of cariogenic items. However, they experienced less caries due to better TC pattern, which was in agreement with the results of Sabbah et al,[22] who showed higher SES individuals had better TC behaviors. The present study revealed that, IT affected the oral health status, which was in line with the results of Moradi et al,[23] who confirmed that, in addition to SES, IT had a direct correlation with better oral health status, (except the study participants were between 15 to 45 years old).

This study showed the causal relationship between SES and oral health status with DAP being more important mediating factor than NP. In fact, according to present results, SES had an inverse correlation with NP in the elderly population, because consumption of cariogenic items increased by increasing SES level. Deihnelt et al.[24] reported that, the consumption of sugar is lower in people with lower SES, living in developing countries, compared with those with moderate and high SES group. This finding probably confirms the elimination of NP as a mediator variable in causal relationship with oral health. However, it should be noted that high sugar consumption alone is not enough to cause dental caries, especially if the consumers practice good oral hygiene and brush their teeth after consumption of sugary substances.[25-27]

In line with current study results regarding the causal relationship between insurance and FH; Simon et al.,[28] showed that, insurance status was significantly correlated with edentulism (FH = 0). Those without insurance were at higher risk (1.56 times) of edentulism. Those without dental insurance coverage were more interested or forced to extract their carious or even all the remaining sound teeth in order to use a denture instead of restoring their teeth. Ghorbani et al.,[29] evaluated 18 to 84-year-old residents in Tehran and showed that individuals with low SES who did not have dental insurance had twice the number of extracted teeth compared with others. Meanwhile, it should be noted that, type of dental procedures covered by the insurance system is also an important factor. Those insurance systems covering preventive procedures, playing highly effective role in oral health promotion. In contrast, an insurance system that only covers tooth extraction and denture replacement, contribute to mass edentulism of insured population, and should be held responsible for tooth loss in low SES individuals. Conversely, the insurance systems that cover level 2 preventive services (treatment) help preserving the natural dentition.

In line with current results regarding the inverse causal relationship of IT with DMFT, a cross-sectional study by Singh et al.[30] was conducted on workers with and without SSO insurance as part of a national survey. The mean DMFT of uninsured workers was higher with odds of dental caries being 2 times (OR = 1.94) higher than insured workers.[30]

Overall, the findings of this study indicate that, IT, SES, DAP, and life style (including TC and NP) affected the DMFT and FH indices for all elderly individuals. Thus, higher budget should be allocated to expand the basic insurance coverage for at risk elderly population. Also, preventive and therapeutic interventions should be provided simultaneously for the benefit of geriatric target group. Although based on present results, the insured individuals had better oral health status than the uninsured ones, the oral health status was still below the optimal level for all. Therefore, further attention should be directed to major determinants of oral health such as SES and regular DAP in order to promote the oral health of the insured elderly. Concerning the national statistics showing that 52% of the Iranian elderly are completely edentulous, obviously, any program and intervention for oral health promotion of senior citizens should be started at a younger age. Unfavorable oral health status of the elderly in the present study can be the result of unhealthy life style, inappropriate oral health behaviors, and poor DAP throughout their life. Moreover, it should be noted that the majority of the seniors pay less attention to their oral health since they mostly need to deal with a number of underlying local and systemic diseases.

Nonetheless, it should be noted that in assessment of oral health status, the main limitation of DMFT index is that it measures disease instead of health. To overcome this shortcoming, the FH index which was extracted from DMFT index used in the present study as a harmonizing factor. This index provides some information regarding the function and quality of dentition, and is in fact representing the number of functional dentition. Some individuals may have a high number of non-functional carious teeth; in such cases, DMFT alone cannot indicate the actual status of the masticatory system.

It should be noted that there are some organizations, providing supplemental insurance coverage to their employees with better coverage, (in addition to basic coverage provided by the four main insurance systems) such as banks, municipality, petroleum company, and communication organization.[8] Due to their very small covered population, a separate group was not allocated to such category. Further studies are required if the effect of greater coverage under supplemental insurance is considered. Also, it should be taken into consideration that, analysis of secondary population-based data often has some limitations, and this study was no exception. Considering the prominent role of insurance systems in oral health promotion, future national surveys are recommended to collect more detailed information regarding the number and types of services provided by different supplementary insurance systems. Likewise, longitudinal studies with respect to the parameters mentioned in this study are recommended to include cases from early adulthood to old age in order to better reveal the protective factors in elderly oral health promotion.

Conclusion

Of all parameters evaluated in this study, IT, SES, DAP, and NP were found to be particularly important in affecting DMFT and FH indices in the elderly population. Out of all aforementioned factors, IT in low SES individuals was more important for obtaining required oral healthcare services. Apparently,

seniors' oral health is absolutely in need of special attention with particular focus on providing access to early prevention and care.

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Conflict of Interest

The authors have no conflict of interests regarding the authorship or publication of this paper.

Author Contribution

All authors contributed equally to study design, data analysis and data interpretation. AFT was the main author, MHK, MPJ and HGH provided guidance throughout the study, and revised and finalized the manuscript. MHK was responsible for the national oral health survey and data collection, and MN and FB provided consultation and reanalyzed the data.

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