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Original Article

Socioeconomic Disparities in Oral Health Practices: Insights From a Cohort Study in Southwestern Iran

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Abstract

Introduction: Iran faces a high burden of oral disease loads, including decay, gum issues, and loss, prevalent across all age groups. The present investigation explored disparities related to socioeconomic factors in oral health practices among adults aged 35–70 years from the Hoveyzeh cohort in Iran.

Methods: This cross-sectional analysis was conducted within a population framework and included 10,009 individuals from the Hoveyzeh Cohort Study (HCS). Information was gathered on demographic characteristics, economic status, and oral health routines. In addition, living conditions were evaluated using a wealth index derived from household possessions, with favorable oral health defined as tooth brushing at least twice a day. Moreover, inequality in socioeconomic terms was quantified through the concentration index (CI), while a decomposition method pinpointed underlying elements. Finally, the statistical analysis was conducted using Stata 14.

Results: Participants averaged 48.76 years in age, comprising 59.78% females and 87.52% married. Urban dwellers predominated at 70%, with 20.87% and 1.97% reporting tobacco use and alcohol intake, respectively. Favorable oral health practices remained scarce, as merely 12.87% engaged in recommended routines, 4.87% utilized rinses, and 2.73% employed floss. The CI of 0.180 signaled superior practices among affluent groups. The key drivers of disparity included economic position (42.9%), living location (27.6%), schooling attainment (38.16%), and chronological age (4.50%).

Conclusion: The findings underscore suboptimal oral health routines, notably in less privileged strata, advocating for strengthened initiatives in prevention and learning to elevate outcomes in deprived zones.

Keywords: Socioeconomic status, Oral health behaviors, Concentration index, Decomposition C

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1. Introduction

Although integral to general well-being, oral health has frequently been sidelined from international medical systems. It continues to be detached from broad health protections, resulting in limited governmental focus (1). As defined by the World Health Organization, oral health encompasses the condition of oral structures enabling core activities (e.g., consumption, respiration, and communication), alongside fostering interpersonal and occupational engagements free from distress or awkwardness (2). Even though avoidable, evidence indicates that oral conditions persist extensively across the globe, profoundly influencing personal life quality and straining medical infrastructures universally (3). Such ailments rank among the leading non-transmissible conditions, touching almost 50% of humanity, around 3.5 billion individuals spanning various life stages (4).

In recent decades, oral condition rates have risen by nearly 50% on average. Predominant global issues encompass tooth decay, gum disorders, dental absence, and cancers affecting the lips or mouth (5). Annually, direct expenditures for managing these problems reach approximately 298 billion USD, equating to 4.6% of worldwide health budgets, with indirect burdens at 144 billion USD, which is comparable to the impacts of major mortality causes (6). Disparities tied to economic and social factors intensify this challenge. Those in lower strata face diminished outcomes, elevated death risks, and heightened impairments (7). Oral issues disproportionately burden vulnerable populations, with lower strata experiencing amplified effects relative to affluent counterparts (8). Currently, three-quarters of affected individuals reside in developing nations (4).

Several studies have investigated the determinants of oral health inequalities, focusing on a number of factors, such as income, education, employment status, and place

of residence. For example, a study in Iran demonstrated socioeconomic inequalities in oral health outcomes associated with income levels (9). Similar work in South Korea revealed associations with earnings, schooling, and professional roles (10). Chandra Shekar and Reddy further reported that lower-income populations exhibited higher rates of untreated dental caries and tooth loss (11).

Iran faces a high burden of oral disease loads, including decay, gum issues, and loss, prevalent across all age groups. Therefore, there is an urgent need for research to better understand socioeconomic and geographic inequalities in oral health within the country (12). However, there is a limited body of research across different regions of Iran, particularly in relation to inequalities in oral health behaviors. Accordingly, it is hypothesized that significant socioeconomic inequalities exist in oral health behaviors.

2. Objectives

This study aimed to investigate inequalities in oral health behaviors among individuals aged 35–70 years participating in the Hoveyzeh Cohort Study (HCS) and to identify the contributing factors underlying these inequalities through a decomposition analysis approach.

3. Methods

Study Design and Participants

This cross-sectional population inquiry was conducted among individuals aged 35–70 years who were enrolled in the HCS in southwestern Iran. The methodological details of the HCS have been reported elsewhere (13). Eligible participants were those within the age range of 35–70 years who had resided in the Hoveyzeh area for at least nine months prior to enrollment. However, individuals with missing data on oral health or socioeconomic status (SES), as well as those unwilling to participate, were excluded from the study. In total, 10,009 participants were included in the analysis.

Covariates

Data encompassed age categories (35–39, 40–44, 45–49, 50–54, 55–59, 60–64, and 65+), gender (male/female), partnership status (unattached, partnered, bereaved, or separated), habitat type (city/village), and schooling (none, basic, intermediate, certificate, associate, or advanced). Further items covered alcohol use (affirmative/negative) and tobacco habits. Moreover, smokers were those with 100+lifetime cigarettes (yes/no).

Socioeconomic Index

The wealth index, representing a composite measure of household SES, served as an indicator of overall living standards. It was constructed using data on the household possession of various assets (e.g., television, freezer, motorcycle, car, mobile phone, internet connection, washing machine, vacuum cleaner, computer, and other appliances). Additional measures included home ownership and the ratio of household rooms to members. Principal component analysis was employed to assign weights to these assets, and the first component's scores were used to calculate wealth values. These values were then categorized into five levels: poorest, poor, middle, rich, and richest (14).

Assessment of Oral Health Behaviors

Oral health assessment consisted of the completion of a structured questionnaire and direct oral examination, which was performed by a trained physician under the supervision of a dentist. The participants were asked about their use of dental floss, mouthwash, and the frequency of toothbrushing. Toothbrushing frequency was categorized as never, once daily, twice daily, three times daily, or less than once daily (other). In this study, appropriate oral health behavior was defined as toothbrushing with toothpaste at least twice per day.

Statistical Analysis

Socioeconomic disparities in oral health behaviors were assessed using the concentration index (CI), a widely applied measure of income-related inequality in health outcomes. The CI is defined as twice the area between the concentration curve and the line of equality (the 45-degree diagonal running from the bottom-left to the top-right corner of the distribution). It should be noted that deviations of the concentration curve from this line indicate the degree and direction of inequality associated with SES.

The CI, here referred to as the standard CI, ranges between −1 and+1 under specific conditions. A value of zero denotes perfect equality, where the concentration curve coincides with the line of equality (15). Additionally, the concentration curve represents the cumulative proportion of the population, ranked by SES, against the cumulative proportion of the health outcome. The sign of the CI demonstrates the direction of inequality; negative values reflect a concentration of the health variable among the socioeconomically disadvantaged, whereas positive values indicate concentrations among the socioeconomically advantaged. In addition, the absolute value of the CI quantifies the magnitude of inequality, with larger values corresponding to greater disparities. For grouped data, the CI is calculated using the following formula:

$$C = (P_1L_2 - P_2L_1) + (P_2L_3 - P_3L_2) + \ldots + (P_{T-1}L_T - P_TL_{T-1}),$$

where p_i denotes the cumulative proportion of the sample ranked by economic status, and L_i is the corresponding concentration curve ordinate. Furthermore, T is the number of socioeconomic groups.

Decomposition analysis was employed to identify the specific factors contributing to socioeconomic inequality in oral health outcomes. This method links the concentration indices of the determinants of a health variable with the CI of the health variable itself through a regression-based approach. The decomposition of the normalized CI (C_n) can be expressed as follows:

$$C = \sum_K (\beta_K X / \mu) C_K + GC_\varepsilon / \mu$$

Data analyses were performed using Stata software, version 14.

4. Results

The mean age of the 10,009 participants included in this study was 48.76 ± 9.21 years. Most of them were women (59.78%), married (87.52%), and illiterate (62.03%). Approximately 70% of the participants resided in urban areas, 20.87% were smokers, and 1.97% reported alcohol consumption in the past year (Table 1).

Moreover, the prevalence of good oral health behavior was low, with only 12.87% of participants reporting tooth brushing at least twice daily with toothpaste. In addition, only 4.87% and 2.73% of the participants used mouthwash and dental floss, respectively (Table 2).

Socioeconomic Inequality in Oral Health Behavior

The concentration curve deviated from the line of equality (45-degree line), indicating the presence of socioeconomic inequality in oral health behaviors (Figure 1). The normalized CI (C_n) for good oral health behavior was 0.180 (95% confidence interval: 0.152–0.208), 0.191 (95% CI: 0.143–0.240), and 0.186 (95% CI: 0.151–0.222) for the total population, men, and women, respectively. Positive C_n values demonstrated that good oral health behaviors were disproportionately concentrated among individuals with higher SES (Figure 1).

Determinants of Socioeconomic Inequalities in Oral Health Behavior

Decomposition analysis revealed that age, education level, and place of residence positively contributed to C_n, implying that these factors were associated with better oral health behaviors among individuals with higher SES. In contrast, gender had a negative contribution, suggesting a concentration of oral health behaviors among lower-SES groups within this category. Overall, SES (42.9%), type of residence (27.6%), education level (38.16%), and age (4.30%) were the main contributors to inequality in good oral health behaviors (Table 3).

Table 1. Demographic and Socio-Economic Characteristics of the Participants in HCS

Variables	N	%
Age groups		
35–44	3,937	39.33
45–54	3,279	32.76
55–64	2,079	20.77
65 and older	714	7.13
Gender		
Male	4,026	40.22
Females	5,983	59.78
Marital status		
Single	343	3.43
Married	8,768	87.52
Widowed	737	7.36
Divorced	169	1.69
Educational level		
Illiterate	6,209	62.03
Primary school	1,665	16.64
Secondary school	673	6.72
High school	741	7.40
University	721	7.20
Wealth index		
Poorest	2,000	19.98
Poor	2,033	20.31
Moderate	1,982	19.80
Rich	2,023	20.21
Richest	1,971	19.69
Residency type		
Urban	6,176	61.70
Rural	3,833	38.30
Smoker		
Yes	2,089	20.87
No	7,920	79.13
Alcohol consumption		
Yes	197	1.97
No	9,812	98.03

Note. HCS: Hoveyzeh Cohort Study.

5. Discussion

This study examined socioeconomic inequalities in oral health behaviors among adults aged 35–70 years enrolled in the HCS in southwestern Iran. The prevalence of favorable oral health behaviors, including regular toothbrushing, use of mouthwash, and dental flossing, was 12.87%, 4.87%, and 2.73%, respectively, which are alarmingly low. The analysis using the CI (C_n) revealed a positive value of 0.180, representing a disproportionate concentration of adherence to favorable oral health behaviors among individuals with higher SES.

The decomposition analysis demonstrated that SES (42.95%), educational level (38.16%), type of residence (27.57%), and age (4.30%) were the main determinants of these inequalities, while gender showed a negative contribution.

In the present study, the prevalence of favorable oral health behaviors was concerningly low. These findings highlight a substantial gap in the adoption of essential oral health practices among adults in this region, which may have long-term consequences for both oral and general health. A national study in Iran reported that only 20.1% of the general population brushed their teeth two or more times per day (15). In the national PERSIAN Cohort Study, 65.5% of adults aged 35–70 years declared brushing at least twice daily (8). Cultural beliefs regarding health may shape the prioritization of oral care. In some communities, traditional practices may overshadow modern dental health recommendations. In this region,

Table 2. Oral Health Status in People Participating in the HCS

Variables	N	%
Oral health		
Good	1,279	12.78
Poor	8,730	87.22
Mouth wash		
Yes	487	4.87
No	9,522	95.13
Use flossing		
Yes	273	2.73
No	9,736	97.27

Note. HCS: Hoveyzeh Cohort Study.

traditional methods (e.g., using saltwater or walnut sticks) were frequently preferred over conventional practices (e.g., regular toothbrushing and flossing).

Our findings revealed that approximately 4.3% of the inequality in favorable oral health behaviors was attributable to age. A cohort study among Iranian adults reported that age group differences accounted for only 4.2% of overall inequality. Age groups 55–70 years positively contributed to the concentration of favorable oral health behaviors among individuals with higher SES, indicating an amplification of the effect of SES with increasing age (8).

SES is one of the most important determinants of inequalities in oral health (1). Wealthier individuals are more likely to have the financial resources and opportunities to use dental services compared to those with lower incomes (16). The present study confirmed SES as the strongest determinant of oral health inequality. In this regard, a meta-analysis demonstrated that individuals with lower SES had poorer oral health-related quality of life (OHRQL). Moreover, a socioeconomic gradient was observed in OHRQL, with lower SES associated with worse OHRQL (17).

In addition, socioeconomic factors play a vital role in shaping oral health inequalities between urban and rural populations. Previous studies have shown that income level, education, and insurance coverage are key contributors to inequalities in the utilization of oral health services (18, 19). Evidence further suggests that diabetic patients living in rural areas experience lower incidence rates of periodontal disease compared to their urban counterparts, reflecting disparities in access to dental care. Additionally, area-level socio-environmental deprivation has been strongly associated with poorer oral health among older adults, independent of individual socioeconomic position (20,21). In rural areas, lower educational attainment has been identified as a key risk factor for adverse oral health outcomes, underscoring the need for timely screening programs and awareness campaigns to improve oral health (22).

The results of the present study indicated that SES and education were the most important determinants of inequalities in oral health behaviors, respectively. The role of education in shaping oral health disparities has

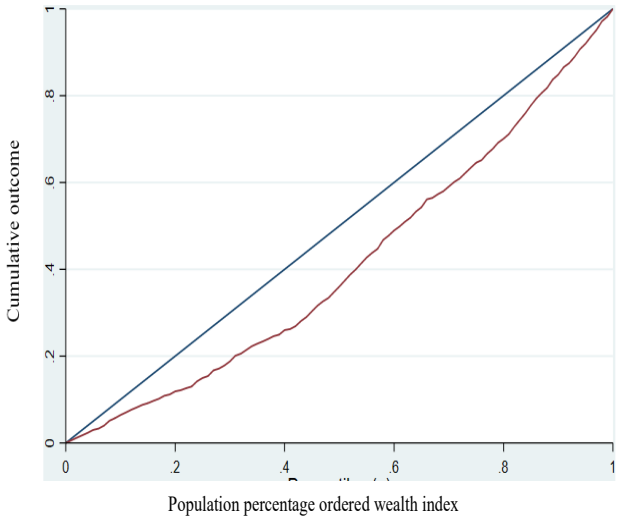

Figure 1. The Concentration Curve for Oral Health for Total Samples

been consistently confirmed in multiple studies. Research from Singapore and Japan revealed that education-related inequalities in oral health were greater in Singapore compared to Japan among older adults. Japan exhibited lower inequalities in edentulism and minimum functional dentition compared to Singapore (23). Similarly, a study in Brazil reported a higher prevalence of edentulism among individuals with lower education, while the use of dental services reduced education-based inequalities in edentulism among adults (24). Furthermore, another study in the United States demonstrated an educational gradient in dental visits, where a higher proportion of individuals with lower education had not visited a dentist, reflecting persistent inequalities and social injustice in the utilization of oral health care (25).

6. Strengths and Limitations of the Study

This study was designed as a population-based cohort study, which strengthens the reliability of the findings. Nevertheless, several limitations must be considered in its execution and interpretation. First, oral health data were self-reported, which may be subject to recall or reporting bias. Second, the participants may have overreported positive oral health behaviors or underreported unfavorable ones. Third, differences in oral health inequalities across regions and countries may have stemmed from variations in health policies, cultural norms, access to care, and socioeconomic conditions, thereby limiting the generalizability of our findings. Fourth, the absence of universally accepted and standardized definitions of "adequate oral health" may have led to inconsistencies in the measurement and interpretation of oral health outcomes.

7. Conclusion

The findings revealed a low prevalence of favorable oral health behaviors within the study population. Notably, toothbrushing and other oral hygiene behaviors were disproportionately concentrated among individuals with higher SES. SES and educational attainment emerged as

Table 3. Decomposition of Socioeconomic Inequalities in Oral Health Behavior in Participants of HCS

Variables	Coefficient	Elasticity	RCI	Absolute contribution	% Contribution	% Contribution summed
Age groups						4.30
35–44	Ref.					
45–54	-0.009	-0.026	0.057	-0.001	-0.7	
55–64	-0.047	-0.076	-0.054	0.004	1.99	
65 and older	-0.054	-0.030	-0.205	0.006	3.01	
Gender						-22.66
Male	Ref.					
Females	0.073	0.340	-0.138	-0.047	- 22.66	
Educational level						38.16
Illiterate	Ref.					
Primary school	0.044	0.058	0.119	0.007	3.33	
Secondary school	0.061	0.032	0.238	0.008	3.71	
High school	0.097	0.056	0.352	0.020	9.58	
University	0.141	0.079	0.561	0.045	21.54	
Wealth index						42.95
Poorest	ref					
Poor	0.011	0.017	-0.498	-0.008	-4.06	
Moderate	0.040	0.062	0.005	0.001	0.1	
Rich	0.028	0.044	0.506	0.022	10.83	
Richest	0.048	0.07	1	0.075	36.08	
Residency type						27.57
Urban	ref					
Rural	-0.051	-0.154	-.370	.057	27.57	

Note. HCS: Hoveyzeh Cohort Study; RCI: Relative concentration index.

the primary determinants of these inequalities, indicating that these factors should be prioritized in the design of public health interventions aimed at promoting oral health behaviors. Despite the integration of oral health into primary health care in Iran, service provision remains insufficient. Moreover, in some regions, including the study area, cultural barriers and low health literacy exacerbate poor oral health behaviors (e.g., inadequate toothbrushing). If left unaddressed, these trends may lead to more severe health complications. Therefore, it is recommended that policymakers implement comprehensive preventive, educational, and therapeutic programs, with special emphasis on underserved areas, by improving service accessibility and eliminating economic and social barriers.

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Competing Interests
The authors declare they have no competing interests.

Consent for Publication
Not applicable.

Data Availability Statement
Data supporting the results of this study are available from the corresponding author upon reasonable request.

Ethical Approval
The study protocol was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (approval code IR.AJUMS.REC.1403.195). In addition, all procedures were conducted in accordance with the principles of the Declaration of Helsinki and its subsequent amendments. Furthermore, participants provided written agreement upon entry.

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