

# The correlation between adults' estimated prevalence of healthy behavior in the society and self-reported oral health status and behaviors

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**Objective:** To assess Mashhad residents' self-perceived oral health level (OHL) and behaviors in relation to their perceptions of those of their fellow citizens. **Methods:** Cross-sectional telephone survey of 384 individuals recruited from different communication centers. The interviews followed a validated Persian schedule with three main sections: 1) background information, 2) questions regarding self-reported OHL, and 3) questions regarding respondents' perceptions of the OHL of their fellow citizens. **Results:** Participants' mean self-rated OHL and tooth brushing frequency were higher than those of their fellow citizens. The correlation between self-reported and the estimated decayed and missing (DMT) was highest in the middle and lowest in the upper classes. Perceptions of the Self- and others' OHL and DMT were positively correlated, with the latter being more so. Education level, age, and tooth brushing frequency affected self-perceived OHL and DMT. **Conclusion:** Participants' perceived OHL could be explained by their estimation of the general population's oral health. These findings suggest that social norm interventions could nudge improving oral health behaviors.

**Keywords:** oral health, self-perception, health literacy, social norm, nudge theory, telephone interview

## Introduction

As a highly social species, humans are deeply influenced by the behaviors and actions of others around them (Pettigrew and Mays, 2021). Social norms, the shared understanding of appropriate behavior within a group, guide social conduct without any legal mandate (Cialdini and Goldstein, 2004). These perceived societal standards, known as perceived social norms, subtly pressurize individuals to conform to the group's behavior (Chung and Rimal, 2016). Notably, the conformity effect, the tendency to align behaviors with socially accepted norms, supports the idea that people tend to mimic behaviors seen as desirable or common within their social group, which could be a form of social learning strategy (Cheung *et al.*, 2017; Paz *et al.*, 2022).

Behavioral economists have highlighted the significant impact social norms can have on human behavior in the 21st century (Meeker *et al.*, 2016). Behavioral economics, which incorporates psychological principles into economics, is exemplified by the work of Nobel laureate Richard Thaler. Thaler and Sunstein (2009) advocated using social norms as a 'nudge,' a method to subtly shift behavior and enhance decision-making without significantly changing economic incentives or restricting choices. Social norms, which entail the presentation of statements regarding what other people do (descriptive), or think should be done (injunctive), have been utilized effectively by governments (Hallsworth *et al.*, 2017). It encourages particular behavior by informing

individuals about the actions of others. Evidence of the success of social norm-based nudges spans a range of fields, including vaccination uptake (Lazić *et al.*, 2021), lifestyle changes (Czajkowski *et al.*, 2019), eco-friendly activities (Goldstein *et al.*, 2008), and healthier eating habits (Robinson *et al.*, 2014).

The logic behind the effectiveness of norm nudges is based on the propensity of individuals to conform to common or perceived common societal behaviors. Accordingly, an effective intervention (a nudge) to promote desirable behaviors may involve informing individuals that such behaviors are prevalent within their group or society. This insight could, in theory, stimulate more people to adopt similar behaviors. However, to the best of our knowledge, the application and effectiveness of the social norm concept and norm nudges have not been thoroughly examined within the context of oral health. In this study, we aimed to explore the underlying idea of social norms, i.e., a positive association between individuals' oral health level/behavior and their estimation of the common oral health level/behavior of people in their society. The main question is whether those who think toothbrushing is common in their society to brush their teeth more regularly; or whether those who think the oral health of their society's members is good to have good oral health themselves. To address these questions, we surveyed a random cluster sample of residents in Mashhad, the second large city in Iran, to report both their own oral health level and behaviors and what they consider the oral health level and behavior of the majority of people in Mashhad.

## Method

This analytical cross-sectional phone survey was conducted in Mashhad in 2018. The study protocol was reviewed and approved by the Organizational Ethics Committee of Mashhad University of Medical Sciences, Mashhad, Iran (code: IR.MUMS.DENTISTRY.REC.1398.024).

The participants were recruited from each of Mashhad's 28 communication centers. The telephone numbers were gathered from the city of Mashhad's Telecommunications Center's existing phone lists. Mashhad's population in 2016 was 3,372,660, according to the official Iranian population and housing census. More than 90 percent of Mashhad's households were covered by the Telecommunication Company's phone lines, as indicated by the city's 1,064,000 residential landlines. A weighted sample was chosen from each of the 28 telecommunications centers based on the population ratio of each region to cover all regions of the city. Using the "rand between" command in Excel, a 10-times sample size of 3840 phone numbers was chosen randomly to compensate for the high drop-out rate of phone surveys due to unanswered calls or unwilling respondents.

A sample of 384 individuals (phone numbers) was determined based on the study's finite population, with a 95% confidence interval and a 5% margin of error. This number corresponded to Krejcie and Morgan's (1970) table using the following formula:  $n = \frac{X^2 \times N \times P \times (1-P)}{(ME)^2 \times (N-1) + (X^2 \times P \times (1-P))}$ , where  $n$  = sample size,  $X^2$  = Chi-square for the specified confidence level at 1 degree of freedom,  $N$  = population size, and  $ME$  = desired margin of error.

$$n = \frac{X^2 \times N \times P \times (1-P)}{(ME)^2 \times (N-1) + (X^2 \times P \times (1-P))}$$

Inclusion criteria included being adults (18 years or older), having access to landline phones, speaking Persian, and providing informed consent to participate. The exclusion criterion was the respondent's intellectual inability. Each interview was conducted with a single member of every household.

The interviews commenced with screening and introduction, elaborating on the purpose of the study and providing relevant information regarding the project. After ensuring the confidentiality of the data, the participants were asked to provide verbal informed consent upon enrolment. Data were collected between May 15, 2018, and December 31, 2018. On average, each interview lasted fifteen minutes. One skilled interviewer conducted all of the interviews (M.Sh.) to avoid inter-rater inconsistency.

We used a modified version of a validated Persian interview schedule to assess participants' perceived oral health status and their estimation of the frequency of oral health behaviors among their fellow citizens (Sistani *et al.*, 2017). It consisted of three main sections: 1) background information, including age, gender, and education; 2) questions about self-reported oral health behaviors and self-rated oral health level; and 3) questions about participants' perceptions of the oral health status and oral health behaviors of their fellow citizens. In the second section, participants assessed their own oral health using categorical and quantitative variables. In addition, they were asked to report the number of decayed, missing, and filled teeth (DMFT) and their frequency of tooth brushing. The participants were then asked to provide a mean estimate for the same variables among Mashhad's residents.

Districts of Mashhad were classified into five socio-economic levels based on income, educational attainment, and employment. The first and fifth zones corresponded to the residents' highest and lowest socioeconomic status (Yousefi, 2010). After data collection, the 5-level classification was recoded to a 3-levels.

SPSS version 21.0 was used for data cleaning, management, and analysis. The Pearson correlation coefficient and Chi-Square test were used to analyze the correlation between variables. ANOVA compared the distribution of quantitative variables across categorical variables. In addition, regression analysis examined the relationship between self-rated OHL and number of decayed and missing teeth (DMT) and perceptions of the public's OHL and DMT, controlling for age, education level, frequency of tooth brushing, and the number of fillings, decayed, and missing teeth.

## Results

The mean age of participants was 40.85 years, with a range from 16 to 86 years. Most (71.3%) were female. Demographic information, patterns of sugary product consumption, and records of the most recent dental visits are presented in Table 1. 38.0% were residents of Zone 1 (high socioeconomic status), 36.2% were from Zone 2, and the remaining 25.8% from Zone 3 (low).

**Table 1.** Demography and self-reported oral health of 384 residents of Mashhad.

		%
Gender	Male	28.6
	Female	71.4
Education	Illiterate	4.1
	Primary school	15.4
	Secondary school	11.5
	High school diploma	34.6
	Bachelors degree	28.0
	Masters degree and PHD	6.5
Socioeconomic level	Zone 1 (highest)	25.8
	Zone 2 (middle)	36.2
	Zone 3 (lowest)	38.0
Self-reported sugary product consumption	Rarely or never	7.6
	sometimes	9.6
	Once a day	15.6
	Twice a day	12
	Three times a day or more	55.2
Last dental visit	I have not ever visited dentist	3.1
	I cannot remember	3.4
	More than 5 years ago	11.5
	2-5 years ago	12.5
	1-2 years ago	16.7
	6-12 months ago	15.1
	6 months ago	37.5

Table 2 summarizes the correlation between participants' self-perceived OHL and oral health behaviors and their perceptions of these variables among their fellow citizens. Nearly half (45.3%) of participants rated their own OHL as "good" or "very good," whereas only 21.87% assessed their fellow citizens at this level (Pearson's rank correlation coefficient = 0.199,  $p < 0.001$ ).

Mean self-assessed OHL, rated on a 10-point scale, was  $6.58 \pm 2.24$ , while participants' ratings of their peers in Mashhad was lower (mean =  $5.55 \pm 1.96$ ,  $r = 0.040$ ,  $p < 0.001$ ).

Self-reported tooth brushing frequency was also higher but positively correlated ( $r = 0.10$ ,  $p = 0.001$ ) with that estimated for fellow citizens.

Participants mean self-reported DMT was 5.41, was lower than that for their fellow citizens to be 8.41 ( $r = 0.437$ ,  $p < 0.001$ ). The highest correlation between self-reported and estimated DMT was among middle-class residents ( $r = 0.592$ , Table 3), followed by participants from lower socioeconomic areas ( $r = 0.429$ ). High socioeconomic status participants demonstrated the weakest correlation ( $r = 0.264$ ). ( $p < 0.001$  for all correlation coefficients). Moreover, residents of Zone 1 exhibited a greater disparity between self-reported and estimated DMT compared to Zone 3 residents (4.51 vs. 1.70,  $p = 0.023$ ).

Regression analysis was conducted to investigate the relationship between self-perceived and estimated public OHL and DMT, while considering potential confounders (Table 4). The first model examined the association between self-perceived and public OHL, controlling for demographic variables, brushing frequency, and DMFT. Estimated OHL amongst one's fellow citizens predicted self-rated oral health. An increase of one level in the perception of public oral health, measured on a scale of 1 to 5, lead to a 5.3% increase in self-perceived OHL. Individuals tended rate their own oral health as better than that of others. Self-rated OHL was also predicted by higher educational attainment, more frequent tooth-brushing and the numbers of missing and filling teeth.

Self-reported number of DMT was predicted by perceived DMT in the population, age, education level and brushing frequency (Table 4).

## Discussion

This paper presents a secondary analysis of data from a 2018 telephone interview survey with residents of Mashhad city. This study investigated the relationship between an individual's self-reported oral health level or behavior and their perception of the societal frequency of

**Table 2.** Self-rated oral health and oral health estimated in the public in Mashhad.

		Self-rated <i>n</i> =384 %	Estimated <i>n</i> =384 %	Correlation Pearson's Rank ( <i>p</i> )
Oral health	Very good	9.4	0.52	0.199 (0.000)
	Good	35.9	21.3	
	Fair	38.9	48.5	
	Poor	12.9	24.5	
	Very bad	2.9	4.9	
Tooth brushing frequency	Rarely or never	5.7	11.5	0.101 (0.001)
	Once a week	4.2	43.5	
	Twice or three times a week	12.5	20.3	
	Once a day	51.6	6.5	
	Twice a day or more	26.0	18.2	
		Mean (SD)	Mean (SD)	
Self-rated oral health (0-10)		6.58/2.239	5.55/1.960	0.040 (0.000)
Missing teeth		1.46/2.429		
Filled teeth		3.45/3.874		
Decayed teeth		3.95/3.340		
Missing and decayed teeth		5.41/7.64	8.41/8.580	0.437 (0.000)

**Table 3.** Self-rated and estimated DMT in Mashhad by socioeconomic zone.

Socioeconomic zones	<i>N</i>	Self-rated DMT Mean (SD)	Estimated DMT Mean (SD)	Mean Difference	Correlation Pearson's Rank ( <i>p</i> )
Zone 1 (highest)	146	4.20 (6.43)	8.71 (8.56)	4.51	0.26 (0.001)
Zone 2 (middle)	139	6.17 (8.97)	8.51 (8.85)	2.34	0.59 (0.000)
Zone 3 (lowest)	99	6.11 (7.78)	7.81 (8.27)	1.70	0.43 (0.000)
Total	384	5.41 (7.64)	8.41 (8.58)	3.00	0.44 (0.000)

**Table 4.** Predictors of self-rated oral health among 384 adults.

	Oral Health Level (OHL) $\beta$ (Robust <i>t</i> statistic)	No. Decayed or Missing Teeth (DMT) $\beta$ (Robust <i>t</i> statistic)
Estimated OHL in the public	0.053* (0.02)	-----
Estimated number of DMT in the public	-----	0.160* (0.04)
Age	-0.005 (0.00)	0.182* (0.02)
Education	-0.062* (0.03)	-1.121* (0.22)
Brushing	-0.082* (0.04)	-0.613* (0.30)
Filling	0.064* (0.01)	-0.315* (0.08)
Decayed	0.006/ (0.01)	-----
Missing	0.180* (0.02)	-----
R2	0.33	0.42

\**p* < 5%

healthy oral behaviors and OHL. We applied the social characteristics of behavioral economics to oral health.

Participants' perceptions of societal oral health predicted their ratings of their own oral health. Participant's assessments of their own and societal OHL and healthy behaviors, such as brushing were related modestly, whereas self-rated number of decayed and missing teeth was more strongly related to the number estimated in the population. The study by Trubey et al. (2014) supports our findings, demonstrating that parents' behaviors and satisfaction levels with their children's brushing habits are influenced by their perception of other parents' brushing behaviors. Most parents believe their behavior is comparable to that of other parents. Behavioral economists have found correlations between participants' estimates of the prevalence of behavior in their society and their likelihood of adopting the same behavior. Without contradictory information, individuals often attribute their own traits and attitudes to others, a phenomenon that may have evolutionary and physiological origins (Pronin, 2008). Mirror neurons, playing a critical role in adjusting social interaction based on observation, are activated when observing others (Bonini et al., 2022; Paz et al., 2022).

This suggests that people might "mirror" observed behaviors, which has implications for "nudging" behavioral change through social norms interventions, i.e., to induce behavioral change by capitalizing on people's desire to fit in with others. Our data suggest that people might be "nudgeable" for oral health behavioral change via social norms nudge interventions. In a series of randomized controlled trials involving approximately 20,000 public health professionals, Belle and Cantarelli (2021) reported that informing social norms about getting a flu shot increased the vaccination rate. Tankard and Paluck (2016) proposed that norm interventions might be effective for behaviors that are not publicly observable; a criterion that is relevant to oral health. Similarly, Dolinski et al. (2020) suggested that increasing people's awareness of others' adherence to medical and preventive recommendations might reduce their comparative optimism about not being

infected by the coronavirus. According to the focus theory of normative conduct, emphasizing specific norms can influence behavior (Cialdini et al., 1990). Alongside accentuating social norms, norms can be made more salient by drawing attention to potential consequences for their violation (Tankard and Paluck, 2016). As a meta-analysis suggests, informing individuals how their behavior in a certain area aligns with others can impact subsequent perceptions of social approval and the perceived injunctive norm for that action (Rhodes et al., 2020). Consequently, normative interventions that disseminate "rich" messages on how others uphold their oral health could encourage individuals to follow similar practices. Moreover, shedding light on the drawbacks of poor oral health could serve as a motivational force toward healthier oral habits.

The relationship between self-reported and estimated DMT was greatest among middle and lowest among the highest class participants. This may be of importance for designing nudges, since norm nudge interventions should be tactically targeted at the appropriate reference groups (Tankard and Paluck, 2016). In Belle and Cantarelli's (2021), investigation of social norm nudges to improve vaccination rates, nudges were most effective in organizations that already had high vaccination coverage. This suggests that successful execution of nudge interventions, should recognise oral health's social and cultural determinants across different groups, in this case, socioeconomic zones.

Participants tended to rate their own health as better than that of others, especially when reporting DMT, which is a more tangible measure than OHL. This self-superiority trend aligns with previous research (Pronin, 2008; Dolinski et al., 2020). Hoorens et al. (2022) found that individuals tend to overestimate their risk of COVID-19 infection and perceive their adherence to infection control measures as above average. Self-superiority was greater for events deemed more controllable (getting infected) than less so (the severity of illness). Self-superiority was associated with less information seeking and less trust in information sources about the disease.

We collected data via telephone interviews, which despite potential limitations of non-response or non-coverage bias (e.g., due to disconnected lines), provides greater geographical coverage, efficient use of resources, enhanced data collection quality, and interviewer security. These were modest limitations as over 90% of households in Mashad had telephones. Telephone interviews' greatest obstacles are the inability to use visual elements to gain interviewers' trust, the lack of transparent communication and the difficulty of maintaining it, asking irrelevant questions, and family members' resistance to participating (Boland et al., 2006).

Individuals of lower socioeconomic status reported more missing teeth than those with higher socioeconomic status, which aligns with existing literature of a social gradient in oral health (Hernández-Palacios et al., 2015). The observed disparity in the self-assessed DMFT index across various educational levels might stem from differences in health literacy. Education and health literacy are key mediators of how socioeconomic status influences health outcomes, behaviors, and healthcare access (Stormacq et al., 2019). Therefore, it is suggested that enhancing health literacy can help mitigate the detrimental effects of socioeconomic factors on health disparities.

Our study offers valuable insight for public health policymakers. The positive correlation between an individual's perception of their own and societal health suggests the potential effectiveness of "nudging" health behaviors by disseminating positive messages about societal oral health. Nevertheless, it is crucial to acknowledge the role of socioeconomic determinants and access to healthcare on public health outcomes. Further research is needed to design and evaluate the effectiveness of social norm nudge interventions on oral health.

In conclusion, individuals' perceptions of public oral health predicted their ratings of their own oral health. These findings suggest a role for nudge interventions that target perceived social norms within society to enhance oral health.

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### Conflict of Interest

The authors declare no conflict of interest.

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