

Socioeconomic status is associated with dental healthcare utilization among Iranian breast cancer survivors

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Abstract

Background: Oral health conditions are a group of complications that are partially associated with breast cancer (BC) treatments. However, evidence on the sociodemographic risk factors of oral health conditions among BC patients is scarce. This study aimed to investigate the relationship between the socioeconomic status (SES) and dental health in a population of Iranian female BC patients in 2020.

Methods: A cross-sectional study was conducted in Kerman, Iran. Indices of decayed, extracted, and filled teeth were measured based on clinical examination by a general dentist. Data were collected through structured face-to-face interviews, review of the patients' medical records, and clinical examination for six months. Data were analyzed by applying univariate and multivariable generalized negative binomial regression (GNBReg). Data were analyzed using the Stata.

Results: Data from 1760 BC patients were collected, 1707 of whom were included in the analysis. The mean age of the participants was 46.3 ± 9.8 years. The mean of the total decayed, missing, and filled teeth, and the number of decayed teeth (DT), missing teeth (MT), and filled teeth (FT) were 12.8 ± 5.8 , 3.5 ± 3.1 , 4.6 ± 5.2 , and 4.6 ± 4.4 teeth, respectively. Regarding SES, the number of participants with high, high-middle, low-middle, and low SES were 421, 432, 395 and 459, respectively. According to univariate analysis, there was no significant difference between different SES in mean DMFT (decayed, missing, and filled teeth), while SES was significantly associated with DT, MT and FT among the study participants.

Conclusion: Female BC patients in Iran have lower levels of dental health regardless of their SES. As those from different socioeconomic classes are seeking different and mostly inadequate or unsuitable dental healthcare services, tailored interventional programs are needed to address the dental healthcare needs of patients in each socioeconomic class.

Keywords: Socioeconomic status, Dental healthcare, Breast cancer

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Introduction

Breast cancer (BC) is the most common cancer among women. According to GLOBOCAN 2020, the global incidence and mortality of BC were estimated at 2.3 million and 658 000 individuals per year, respectively.¹ The estimated global prevalence of BC till the end of 2020 was about 7.8 million women,² with its burden rising even in low- and middle-income countries.³ Moreover, as a result of population growth, population aging, and higher availability and utilization of BC treatments across the globe, the number of women who survive BC is rising both in developed and developing countries.⁴ Those BC patients who are from low- and middle-income countries

may experience more cancer-related adverse experiences than those who are from developed countries.⁵ This may be mainly due to their unfavorable environment; they may not have adequate access to timely and qualified cancer-related diagnostic and treatment services, or may even have less access to other healthcare services such as psychiatric services.^{6,7} Their situation in relation with supportive care may even be worse.⁸ In such an environment, when patients are less prepared to deal with life crises and there is no support plan for them, they may be more vulnerable to the intermediate- and long-term effects of cancer that occur alongside the usual difficulties of cancer treatment.^{9,10} Notably, in developing countries,



women with cancer may experience a lower quality of life than similar women in developed areas.¹¹

Oral health conditions are a group of complications that can arise in association with BC.¹² A few studies in developed countries have shown that these conditions are more common in BC survivors than in the general population. These complications include dental caries, periodontal disease, and apical lesions, which are partially associated with BC treatments such as chemotherapy, surgery, radiation, and anti-estrogen drugs.¹²⁻¹⁵ However, evidence on the sociodemographic risk factors of oral health conditions among BC patients is scarce.

A better socioeconomic situation may lead to a more supportive environment consisting of greater availability of cancer-related and non-cancer-related healthcare services, increased oral health literacy, more extended social capital, and greater familial support.⁸ We hypothesized that in Iran, as a developing country suffering from severe economic sanctions, socioeconomic status (SES) may play a significant role in the access to and utilization of dental care services by BC patients and survivors, consequently affecting the dental health of this population.

This study aimed to investigate the relationship between the SES of Iranian female BC patients and their dental health indicators, including decayed teeth (DT), missing teeth (MT), and filled teeth (FT). The conceptual framework of our study is shown in Figure 1.

Methods

Study population and design

A cross-sectional study was conducted in Kerman, Iran.

Kerman is the most populous city in the southeastern region of Iran. According to the latest census, the population of adult women in this city is 178000. The human development index in Kerman is 0.763,¹⁶ and the literacy rate of women is 85%. The main part of BC treatment services in Kerman is provided by the public sector, but the private sector also has an undeniable share. It is estimated that charities have a share of less than ten percent in providing these services. Specialized healthcare centers in Kerman face a significant number of non-native patients from surrounding cities and even neighboring provinces, including Sistan and Baluchestan and Hormozgan. The annual incidence of BC in women in the Kerman province is estimated at 13.5 in 100 000 population¹⁷ based on the latest available reports. Reports also indicate an increasing trend in the incidence and mortality rate of BC in Kerman.¹⁷

Inclusion criteria

Women who referred to Kerman cancer treatment centers, had a confirmed diagnosis of BC at least 6 months before the study, were aged between 18 and 60 years, were able to speak, were aware of their disease (about 20% of women with BC in Kerman are unaware of their disease), and were in good general condition for dental examinations and face-to-face interviews (based on their own opinion) were enrolled in our study.

Exclusion criteria

Patients with multiple cancers, patients with complete edentulousness, patients who had been diagnosed with

healthcare utilization of female breast cancer (BC) patients.

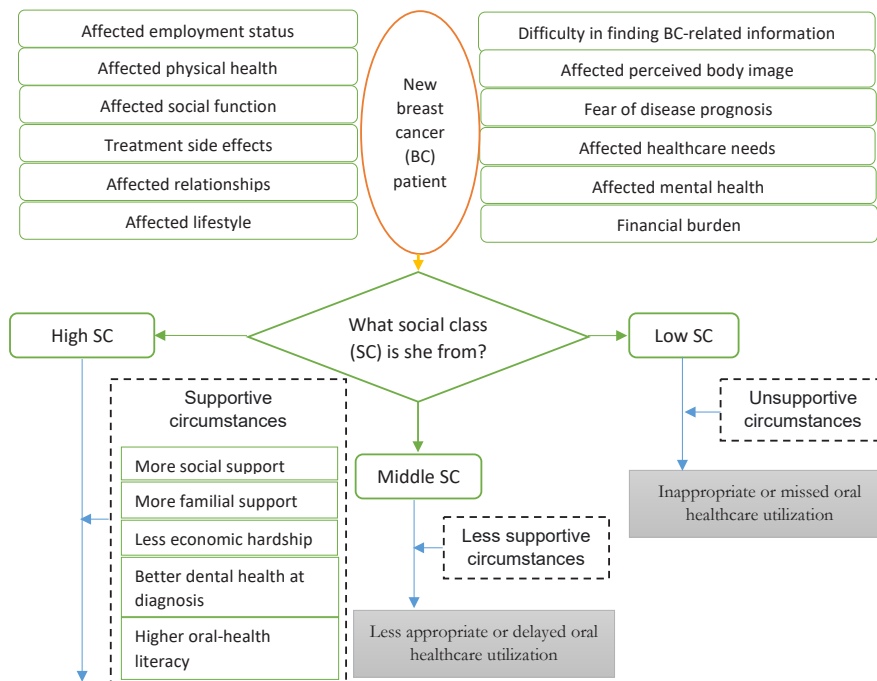


Figure 1. The conceptual framework of the study

BC for more than 5 years, and women who did not participate in the study completely (e.g., did not attend the dental examination) were excluded from the study.

Eligible patients were introduced to the goals and steps of the study before being asked if they were willing to participate in the study. All participants provided informed written consent to participate in the study.

Sample size calculation

Assuming an average number of seven and five FT in people with the highest and lowest SES,¹⁸ respectively (assuming the effect of about 40% of the highest SES in improving dental health compared to the lowest SES), and assuming a Poisson distribution for the number of FT in the population, the sample size for each of the four socio-economic groups was estimated to be 308. Regarding SES, participants were compared with each other, and classified into four groups. The first quarter was classified as low, the second as low-middle, the third as high-middle, and the fourth as high SES. Assuming a response rate and study completion of 70%, the final sample size of the study was estimated at 1760 people.

Sampling procedure

For sampling, a list of cancer treatment centers in Kerman was prepared. Four centers in the public sector, two in the private sector, and one in the charity sector were selected by available methods to ensure the sampling was representative. The centers were chosen due to their accessibility, using convenient sampling from the list of available centers. The number of patients in each of the selected centers was estimated based on the number of visits per week. Sampling of patients, performed during the second half of 2019, continued during all working hours and all days of the week until the required number of participants from each center was obtained. Data were collected while the patients were waiting for their dentist's appointment by structured face-to-face interviews. A review of patients' medical records was conducted by a trained female nurse with experience working in BC treatment centers. Then their dental examination was performed by a general dentist who had been previously trained and sufficiently informed about the purpose of the study. Indices of covered, extracted, and FT were measured according to the recommendations of the World Health Organization (WHO).

Description of variables and instruments

Collected data included information related to underlying variables, variables related to the patient's BC status and medical history, SES, health-related quality of life, mental health, oral healthcare behavior, and the indices of covered teeth, extracted teeth, and FT. We used the section related to measuring the underlying variables (age, gender, level of education, occupation, marital

status, residency, smoking status, cancer history) and also the section related to measuring the SES (individual and family assets) from the standard Persian Questionnaire for Socioeconomic Determinants used in the PERSIAN Cohort.¹⁹ We measured the quality of life associated with cancer in patients using the Persian version of the EQ-5D-3L questionnaire. The validity and reliability of this questionnaire in Persian have already been evaluated and approved.²⁰ We used the Persian version of the Hospital Anxiety and Depression Scale (HADS) questionnaire to measure the patients' mental health. The validity and reliability of this questionnaire have previously been evaluated and approved for use in the Iranian population.²¹ This questionnaire measures patients' anxiety and depression status. The status of oral healthcare behaviors and amount of sugar consumption were assessed using the standard questionnaire of the WHO,²² which has been evaluated and approved for use among Iranian adults.²³ Information about the person's illness, including the type of cancer treatment (surgery, chemotherapy, or radiation therapy) was extracted from their file. Main dental indices assessed by the dentist includes DT, MT, and FT, and the DMFT (decayed, missing, and filled teeth) index. All patients first answered the questions, "Why did you come to this center?", "Are you sick?", and "What is your illness?".

Statistical analysis

Data were first refined. To determine the SES, we analyzed the assets using the multiple correspondence analysis technique and then ranked the patients into four groups. Data were analyzed assuming a Poisson distribution for the DT, MT, FT, and DMFT indices. As these indices may be misleading in the raw count format, we calculated their respective rates. The rates of DMFT and MT were calculated by dividing the value of each variable by 32 (total number of teeth). The denominator for calculating the rate of DT or FT was the number of remaining teeth. Because of the significant over-dispersion and inflation of the distribution of the dental health indices, data were analyzed by applying univariate and multivariable generalized negative binomial regression (GNBReg).

Four GNBReg models were fitted. Each model assessed the correlation of SES with one of the four dental health indices. Crude and adjusted incidence rate ratios (IRR) and their 95% confidence intervals (CIs) were estimated. A *P* value less than 0.05 was considered significant. Data were analyzed using Stata software (Release 11; StataCorp. College Station, TX, USA).

Results

Data from 1760 BC patients were collected, 1707 of whom were included in the analysis. Fifty-three patients refused the dental examination. The mean age of the participants was 46.3 ± 9.8 years. The mean DMFT, DT,

MT, and FT values were 12.8 ± 5.8 , 3.5 ± 3.1 , 4.6 ± 5.2 , and 4.6 ± 4.4 teeth, respectively. Regarding SES, the number of participants in each group including high, high-middle, low-middle and low were 421, 432, 395, and 459, respectively. The participants' background data and mean dental health indices are presented in Table 1.

Overall, 649 (38%) patients were within the first year of BC diagnosis. The most prevalent tumor stage at diagnosis was stage III, with a frequency of 595 (35%). Notably, 1701 (99%) of the participants had undergone surgical treatment. The cancer-related characteristics of the patients are presented in Table 2. This table also

Table 1. Participants' characteristics and mean (standard deviation) number of DMFT among female breast cancer patients in Kerman, Iran

Variable	No. (%)	DMFT	Filled teeth	Missing teeth	Decayed teeth
Age (y)		$P < 0.001$	$P = 0.121$	$P < 0.001$	$P < 0.001$
<40	177 (10)	14.8 (6.3)	4.1 (4.3)	8.0 (7.0)	2.8 (2.5)
>40	1530 (90)	12.5 (5.7)	4.7 (4.4)	4.3 (4.8)	3.6 (3.1)
Marital status		$P = 0.964$	$P < 0.001$	$P = 0.003$	$P = 0.145$
Single	253 (15)	12.8 (5.8)	3.6 (4.2)	5.7 (6.3)	3.5 (2.4)
Married	1454 (85)	12.8 (5.8)	4.8 (4.4)	4.5 (5.0)	3.5 (3.1)
Residency		$P < 0.001$	$P < 0.001$	$P = 0.005$	$P < 0.001$
Kerman	921 (53)	13.4 (5.7)	5.5 (4.2)	5.0 (5.6)	3.0 (2.7)
Other	786 (46)	12.0 (5.8)	3.7 (4.3)	4.3 (4.6)	4.1 (3.3)
Employment		$P < 0.001$	$P = 0.001$	$P < 0.001$	$P < 0.001$
No	1404 (82)	13.1 (6.1)	4.3 (4.4)	5.2 (3.4)	3.6 (3.2)
Yes	303 (18)	11.3 (3.8)	6.3 (3.7)	2.1 (3.1)	3.2 (2.5)
Education		$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Illiterate	452 (26)	14.1 (6.6)	2.5 (3.4)	8.1 (6.0)	3.5 (2.7)
Diploma & less	877 (51)	13.0 (5.9)	4.8 (4.4)	4.4 (4.6)	3.9 (3.4)
Higher than diploma	378 (22)	10.6 (3.5)	6.8 (4.0)	1.2 (1.9)	2.7 (2.2)
Current cigarette smoker		$P = 0.005$	$P = 0.003$	$P = 0.006$	$P < 0.001$
Yes	126 (7.3)	11.4 (7.1)	3.1 (4.1)	6.1 (6.5)	2.2 (2.4)
No	1581 (92.6)	12.9 (5.7)	4.8 (4.4)	4.5 (5.1)	3.6 (3.1)
Cancer history		$P = 0.015$	$P = 0.959$	$P < 0.001$	$P < 0.001$
Yes	52 (3)	14.8 (5.8)	4.4 (4.2)	8.7 (8.0)	1.7 (2.1)
No	1655 (97)	12.7 (5.8)	4.6 (4.4)	4.5 (5.0)	3.6 (3.1)
Depression (HADS)		$P < 0.001$	$P < 0.001$	$P = 0.013$	$P < 0.001$
NO	990 (58)	12.2 (5.8)	5.1 (4.2)	4.4 (5.2)	2.7 (2.4)
Yes	717 (42)	13.6 (5.7)	3.9 (4.5)	5.0 (5.2)	4.6 (3.5)
Anxiety (HADS)		$P = 0.687$	$P = 0.028$	$P = 0.003$	$P < 0.001$
No	885 (51.8)	12.8 (5.8)	4.8 (4.2)	5.0 (5.5)	3.0 (2.3)
Yes	822 (48.1)	12.7 (5.8)	4.4 (4.5)	4.2 (4.8)	4.1 (3.6)
HRQoL (EQ-5D-3L)		$P = 0.001$	$P = 0.028$	$P = 0.537$	$P < 0.001$
Low	576 (34)	14.1 (6.1)	4.5 (4.8)	5.4 (5.2)	4.2 (3.8)
Middle	620 (36)	11.5 (5.2)	4.8 (4.1)	3.4 (4.3)	3.2 (2.6)
High	511 (30)	12.9 (5.8)	4.5 (4.1)	5.3 (5.9)	3.1 (2.4)
Dental care need		$P < 0.001$	$P = 0.023$	$P < 0.001$	$P = 0.084$
Yes	258 (15)	11.1 (5.6)	4.2 (4.1)	2.7 (2.7)	4.2 (3.3)
No	1449 (85)	13.1 (5.8)	4.7 (4.4)	5.0 (5.4)	3.4 (3.0)
SES		$P = 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
High	421 (24.7)	12.1 (4.3)	6.9 (4.2)	2.5 (4.0)	2.6 (2.1)
High-middle	432 (25.3)	13.1 (5.7)	5.2 (4.01)	4.1 (5.04)	3.8 (3.3)
Low-middle	395 (23.1)	13.7 (6.4)	4.3 (4.5)	6.5 (6.1)	3.0 (2.7)
Low	459 (26.9)	12.3 (6.4)	2.30 (3.4)	5.5 (4.6)	4.4 (3.5)

Abbreviations: DMFT, decayed, missing and filled teeth; HADS, Hospital Anxiety and Depression Scale; HRQoL, health-related quality of life

Table 2. Cancer-related characteristics and mean (standard deviation) number of DMFT among female breast cancer patients in Kerman, Iran

Variable	No. (%)	DMFT	Filled teeth	Missing teeth	Decayed teeth
Metastasis		$P < 0.001$	$P < 0.001$	$P = 0.070$	$P < 0.001$
Yes	383 (22)	11.6 (5.9)	3.1 (3.2)	4.2 (5.2)	4.3 (3.2)
No	1324 (78)	13.1 (5.7)	5.1 (4.7)	4.8 (5.2)	3.3 (3.0)
Stage (AJCC)		$P = 0.002$	$P < 0.001$	$P = 0.569$	$P = 0.108$
I	475 (28)	13.0 (5.7)	5.0 (4.6)	4.6 (5.1)	3.5 (3.4)
II	175 (10)	13.1 (5.3)	4.9 (3.9)	4.8 (5.2)	3.4 (2.6)
III	595 (35)	13.3 (5.9)	5.2 (4.7)	4.9 (5.2)	3.2 (2.8)
IV	462 (27)	11.7 (5.8)	3.4 (3.4)	4.3 (5.3)	4.0 (3.1)
Chemotherapy		$P = 0.026$	$P = 0.277$	$P = 0.421$	$P = 0.331$
Yes	1626 (95)	12.9 (5.8)	4.7 (4.4)	4.7 (5.2)	3.5 (3.1)
No	81 (5)	11.4 (5.9)	4.1 (3.3)	4.2 (6.1)	3.2 (2.0)
Radiotherapy		$P = 0.090$	$P = 0.930$	$P = 0.003$	$P = 0.226$
Yes	1327 (78)	12.9 (5.8)	4.6 (4.5)	4.9 (5.4)	3.4 (3.0)
No	380 (22)	12.3 (5.7)	4.7 (4.0)	3.9 (5.4)	3.7 (3.2)
Hormone Therapy		$P < 0.001$	$P < 0.001$	$P = 0.022$	$P = 0.193$
Yes	1009 (60)	13.5 (5.6)	5.0 (4.5)	4.9 (5.6)	3.6 (3.3)
No	698 (40)	11.8 (5.9)	4.1 (4.1)	4.3 (4.5)	3.4 (2.7)
Surgery		$P = 0.798$	$P = 0.368$	$P = 0.558$	$P = 0.823$
Yes	1701 (99)	12.8 (5.8)	4.6 (4.4)	4.6 (5.2)	3.5 (3.1)
No	6 (1)	12.2 (0.4)	2.8 (0.4)	6.2 (0.4)	3.2 (0.4)
Duration (Years)		$P < 0.001$	$P = 0.788$	$P < 0.001$	$P = 0.840$
Within 1	649 (38)	11.9 (4.9)	4.8 (4.4)	3.3 (3.8)	3.8 (2.6)
Within 2	200 (18)	12.9 (5.4)	5.4 (4.8)	5.2 (5.6)	2.4 (2.1)
Within 3	287 (17)	12.3 (6.5)	4.0 (3.8)	4.8 (4.7)	3.5 (3.4)
Within 4	259 (15)	13.9 (5.0)	4.8 (4.0)	5.1 (5.2)	4.0 (2.9)
Within 5	312 (18)	14.1 (7.0)	4.3 (4.6)	6.5 (6.9)	3.4 (3.9)
H&N Radiotherapy		$P = 0.006$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Yes	1250 (73.2)	13.4 (6.0)	3.7 (3.8)	5.0 (5.4)	4.7 (3.9)
No	457 (26.7)	12.5 (5.7)	5.0 (4.5)	4.5 (5.1)	3.1 (2.5)

Abbreviations: DMFT, decayed, missing and filled teeth index; BC, breast cancer; AJCC, American Joint Committee on Cancer; H&N, head and neck

depicts the mean dental health indices for patients with different cancer-related characteristics.

Interestingly, 1202 (70%) participants reported that they had experienced xerostomia during the previous six months. Most of the patients (90%; $n = 1542$) reported at least daily brushing; however, 1404 (82%) reported that they had not regularly had preventive dental visits. Table 3 presents the oral health-related characteristics of the study participants.

According to univariate analysis, there was no significant difference between different SES groups in terms of mean DMFT ($P = 0.039$), though SES was significantly associated with DT ($P < 0.001$), FT ($P < 0.001$), and MT ($P < 0.001$) among the study participants. The highest DMFT (mean: 13.7; SD: 6.4) was observed among patients who were from low-middle SES. The highest number of DT (mean: 4.4; SD: 3.5) was observed among patients from low SES,

while the highest number of FT (mean: 7.0; SD: 4.2) was observed among those who were from high SES. The mean values of the different dental health indices are compared according to SES in Figure 2.

The concentration index was not statistically significant when DMFT was compared with SES rank. However, this index was significant in the cases where DT, MT, and FT were individually plotted against SES rank (Figure 3).

According to multivariable generalized negative binomial modeling (GNBReg), low SES was associated with higher DT compared with high SES (IRR: 1.35; 95% CI: 1.20, 1.51) but not high-middle SES (IRR: 1.14; 95% CI: 0.99, 1.31). Table 4 depicts the association of SES with different dental health indices. On the other hand, being from high and middle SES was associated with higher number of FT, which is in contrast with low SES (IRR: 0.71; CI: 0.63, 0.79; IRR: 0.49; CI: 0.43, 0.58

Table 3. Oral health-related characteristics and mean (standard deviation) number of DMFT among female breast cancer patients in Kerman, Iran

Variable	No. (%)	DMFT	Filled Teeth	Missing Teeth	Decayed Teeth
Daily brushing		$P=0.001$	$P<0.001$	$P<0.001$	$P<0.001$
Yes	1542 (90)	12.6 (5.6)	5.0 (4.3)	4.4 (5.1)	3.2 (2.7)
No	165 (10)	14.4 (7.4)	0.9 (2.9)	6.9 (5.8)	6.5 (4.1)
Fluoride mouthwash		$P=0.681$	0.012	$P<0.001$	$P=0.781$
Yes	228 (14)	12.9 (4.6)	5.7 (3.8)	3.4 (4.5)	3.9 (3.1)
No	1479 (86)	12.8 (5.9)	4.5 (4.4)	4.8 (5.3)	3.5 (3.0)
Floss		$P<0.001$	$P<0.001$	$P<0.001$	$P<0.001$
Yes	469 (27)	14.3 (5.1)	7.4 (4.2)	3.4 (4.1)	3.5 (3.2)
No	1238 (73)	12.2 (5.9)	3.6 (4.0)	5.1 (5.5)	3.5 (3.0)
Toothpaste		$P<0.001$	$P<0.001$	$P<0.001$	$P<0.001$
Yes	1525 (90)	12.5 (5.6)	4.9 (4.1)	4.4 (5.1)	3.2±0.1
No	182 (10)	15.0 (7.0)	2.6 (5.5)	6.4 (5.8)	6.0 (4.2)
Sugar consumption		$P=0.543$	$P<0.001$	$P=0.004$	$P<0.001$
At least 1 per week	84 (5)	12.4 (7.3)	1.7 (2.4)	5.4 (5.9)	5.3 (3.4)
Once a day	214 (13)	12.8 (5.7)	3.7 (3.1)	5.8 (5.1)	3.2 (2.4)
Several times a day	1409 (82)	12.8 (5.7)	5.0 (4.5)	4.4 (5.1)	3.4 (3.1)
Xerostomia		$P<0.001$	$P=0.071$	$P=0.289$	$P=0.001$
Yes	1202 (71)	12.4 (5.8)	4.6 (4.6)	4.5 (5.1)	3.3 (2.8)
No	491 (29)	13.7 (5.7)	4.8 (3.8)	4.9 (5.5)	4.0 (3.5)

Abbreviation: DMFT, decayed, missing and filled teeth index.

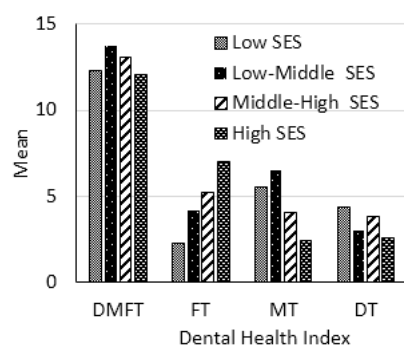


Figure 2. The socioeconomic gradient of dental health indices among female breast cancer patients in Kerman, Iran. Abbreviations: SES, socioeconomic status; DMFT, decayed, missing, and filled teeth; FT, filled teeth; MT, missing teeth; DT, decayed teeth

more details are presented in [Table S1](#)).

Discussion

This study aimed to investigate the relationship between the SES of Iranian female BC patients and their dental health. We found that SES was not associated with DMFT, as a summary measure, among Iranian female BC patients. We also showed that SES has a significant direct relationship with the number of FT in this population. Although a reverse association was observed between SES and the number of MT, no significant difference was observed between the highest and lowest socioeconomic levels. We found that in the case of the number of DT, there were no meaningful differences between patients

who were from the highest SES level and those who were from middle-low or high-middle SES levels, but the patients with the lowest SES had the highest number of DT. A significant difference was observed between the social classes of participants in terms of dental health indices.

We found that the DMFT values were relatively similar across all four SES levels. This finding may be evidence of a homogenous pattern of inadequate oral health behaviors, which may be a result of low oral health literacy across almost all of the subgroups of female BC patients in the study setting, as in other regions in Iran.²⁴ Moreover, the estimated DMFT value was meaningfully higher than estimates in more developed regions.²⁵

In reality, the association between SES and dental health is something more than just a financial issue. Some studies have categorized this association into three aspects, including the financial aspect, behavior-related aspect, and psychological aspect.²⁶ Regarding the financial aspect, less affluent people tend to visit dental clinics less than more affluent people because of having problems with the associated costs.²⁷ Regarding the behavioral issues, studies suggest that those in lower socioeconomic groups tend to have fewer healthy habits and behaviors; they smoke more, exercise less, and have poorer diets. These factors, however, are not sufficient to account for the relationship between social class and health.²⁸ Moreover, people with lower SES experience more psychological distress than those with higher SES.

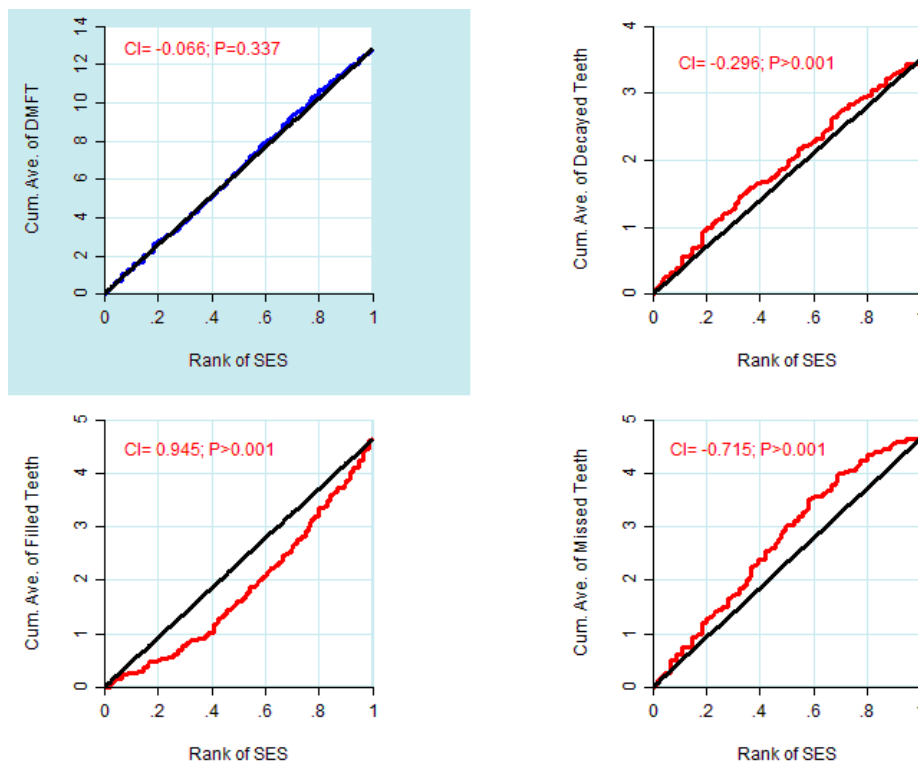


Figure 3. Concentration index curves for dental health indices among female breast cancer patients in Kerman, Iran. Abbreviations: Cum. Ave., cumulative average; SES, socioeconomic status; BC, breast cancer; CI, concentration index

Table 4. Adjusted* association of socioeconomic status with dental health indices among female patients with breast cancer in Kerman, Iran

Variables	Decayed Teeth	Missing Teeth	Filled Teeth	DMFT
SES				
High	Ref.**	Ref.	Ref.	Ref.
High-Middle	1.14 (0.99, 1.31)	1.19 (1.02, 1.38)	0.71 (0.63, 0.79)	0.91 (0.86, 0.96)
Middle-Low	1.11 (0.98, 1.27)	1.38 (1.16, 1.63)	0.70 (0.61, 0.80)	0.90 (0.84, 0.96)
Low	1.35 (1.20, 1.51)	1.06 (0.88, 1.27)	0.49 (0.43, 0.58)	0.75 (0.70, 0.81)

Abbreviations: DMFT, decayed, missing, and filled teeth; SES, socioeconomic status; ref, reference category.

*Adjusted for age, residency, marital status, employment status, time from breast cancer diagnosis, health-related quality of life, anxiety, depression, education, cigarette smoking, tumor metastasis, tumor stage, chemotherapy, head and neck radiotherapy, radiotherapy, xerostomia, fluoride mouth washing, daily brushing, toothpaste consumption, floss use, and frequency of sugar consumption.

**Reference category is high socioeconomic status.

However, it should be mentioned that there are some interrelationships between these three factors, and they are not completely separable.

In this study, in line with some previous studies^{29,30} a significant association was observed between SES and DMFT. However, as DMFT is a sum of the number of filled, decayed, and MT, we think the interpretation of such a significant association may not be adequately informative, especially in terms of equality in oral healthcare utilization. Let us take the example of a female BC survivor who is from the middle SES level and has recently been exposed to the very high costs of BC treatment. Now, she has no choice but to extract five DT because she is experiencing economic hardship due to her cancer diagnosis and treatment. Now, if this woman were of a high SES, she would have the opportunity to select

whether she wanted to extract or fill her DT. Obviously, she would select to fill her five DT. In terms of DMFT, both survivors have a DMFT of five, which is rather misleading.³¹ Therefore, we refrain from interpreting the observed association between SES and DMFT in our data.

According to the study results, SES has a significant, direct relationship with the number of FT among Iranian female BC patients, as patients of lower SES had fewer FT. In Iran, no additional oral healthcare services are available for cancer patients, and the costs of oral healthcare services are generally not covered by the insurance companies. Patients who are from lower SES may be more prone to ignore their DT or to ignore filling these teeth even if they do refer to the oral healthcare centers.^{32,33} They also may be less literate about their dental health,³³ and contextual issues such as oral health

literacy and oral healthcare access have been mentioned as determining factors in dental health.^{29,34}

We observed that the number of extracted (missing) teeth was not significantly different between patients from the highest and lowest SES. To interpret this finding appropriately, we need to simultaneously consider the study results regarding the number of DT, where the highest number of DT were observed among patients from the lowest SES level. According to these results, it seems reasonable to believe that patients with higher SES sought services to fill their DT, those of middle SES sought to extract their DT, and those from the lowest SES mostly ignored seeking dental healthcare services. As patients from the middle SES may have relatively adequate oral health literacy and consequently seek low-cost services such as tooth extraction as they are unable to meet the costs of tooth filling services, one can generalize this scenario or a worse version of the scenario to the patients from low SES.³⁵ Accordingly, although an increase in oral health literacy among these patients may help them seek low-cost dental care services, it may not necessarily be effective in promoting the utilization of tooth filling services. Further studies to design and identify the most effective intervention to promote dental healthcare services among BC survivors are highly recommended.

Strengths and Limitations

The main limitation of our study was its cross-sectional nature. Because of this limitation, we were unable to investigate the temporal association of SES with the dental health indices. Therefore, further case-control studies are recommended to evaluate this association. Besides, excluding patients with the worst general conditions might have led to selection bias since general status might be related to SES. Also, lack of training and clinical calibration of the dental examiner might have introduced measurement bias. On the other hand, we studied a large representative community-based sample of over 1700 female BC patients in a low-resource setting, meaning that the study results are generalizable to BC patients in low and middle-income countries.

Conclusion

In summary, female BC patients in Iran are experiencing lower levels of dental health, regardless of their SES, and most of them are in urgent need to receive dental healthcare services. As female BC survivors in Iran who are from different socioeconomic classes are seeking different and mostly inadequate or unsuitable dental healthcare services, tailored interventional programs are needed to address the dental healthcare needs of each socioeconomic class appropriately.

Authors' Contribution

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Resources: Jafar Hassanzadeh, Arash Shahravan.

Software: Pardis Javadian.

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Competing Interests

The authors have declared that no conflict of interest exists.

Consent for publication

Not applicable.

Data Availability Statement

The datasets generated and/or analyzed during the current study are not publicly available based on the Institutional review board statement but are available from the corresponding author upon reasonable request.

Ethical Approval

This study has been approved by the Ethics Committee of the Shiraz University of Medical Sciences (approval code is: IR.SUMS.MED.REC.1400.444) and has been conducted in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki, its later amendments, or comparable ethical standards. All participants provided informed written consent to participate in the study.

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Informed Consent

All participants provided informed written consent to participate in the study.

Supplementary Files

Supplementary file 1 contains Table S1.

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