ORIGINAL RESEARCH

Oral Health Behaviors and Oral Health-Related Quality of Life Among Dental Patients in China: A Cross-Sectional Study

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Background and Purpose: Oral health plays an important role in overall health. But little is known about the problems with oral health behaviors and oral health-related quality of life (OHRQoL) among dental patients in China. This study aimed to investigate oral health behaviors and OHRQoL, as well as to examine the effects of oral health behaviors and associated factors on OHRQoL among dental patients.

Methods: This cross-sectional study was conducted from June 2022 to July 2022 in the Department of Stomatology of the First Mobile General Hospital of Armed Police, Hebei, China. The five-item short form of the Oral Health Impact Profile (OHIP-5) was used to evaluate OHRQoL. Oral health behaviors were assessed by a 16-items oral health behavior questionnaire, and socio-demographic data were collected by a socio-demographic questionnaire. The *t*-test, one-way ANOVA, and multiple linear regression analysis were used to investigate the associations between the study variables.

Results: 186 participants were included in the study. The average age of the participants was 24.62 years (SD = 10.67). The mean OHIP-5 score was 4.31 (SD =3.35). Oral health-related quality of life differed significantly by smoking history, history of alcohol consumption, work status, economic pressure, self-rated oral health status, daily brushing frequency, dental caries condition, and whether they take the initiative to learn about oral health. Multivariate analysis found that the self-rated oral health status and work status were significantly associated with the OHIP scores. The retired people and those with poor self-rated oral health displayed poor OHRQoL.

Conclusion: In general, dental patients' oral health needs to be improved, the majority of patients reported practicing poor oral health behaviors, among which the retired population and hose with poor self-rated oral health showed poor OHRQoL. OHRQoL in dental patients is a complex issue associated with social and behavioral factors.

Keywords: cross-sectional studies, dental clinics, health behavior, oral health, oral health-related quality of life, OHRQoL

Introduction

Oral health is important for general health.[1] Globally, oral diseases lead to serious health and economic burdens, resulting in a significant reduction in quality of life.[2] Oral diseases such as caries, dental fluorosis, tooth loss, periodontal disease, dental injuries, oral cancer, dental anomalies, craniofacial disorders, and many more have got a negative impact on oral health-related quality of life (OHRQoL).[3] Research has shown that oral health status is associated with OHRQoL in the general population.[4] Oral health is perceived as an essential component of overall quality of life, and OHRQoL refers to a person's perceived health, well-being, and quality of life related to oral conditions and function.[4] OHRQoL is a significant predictor of general health and well-being. Recent research found significant and relevant associations between OHRQoL and oral health knowledge, practice, and self-rated oral health.[5] Studies have shown that age, low income, brushing once a day, and tooth decay are all associated with poor OHRQoL,[6] and more favorable oral health attitudes and behaviors lead to better oral health-

related quality of life among medical students.[7] Socioeconomic disparities and poor oral health habits appear to be part of the major factors responsible for dental extractions.[8] Previous studies showed that the socioeconomic status of the teenagers and their parents' oral health-related beliefs predicted their oral health-related beliefs, which in turn predicted their use of toothbrushes and dental services. Moreover, there was an association between dental service use and untreated caries and missing tooth surfaces in adulthood, and a negative correlation between the number of untreated caries and missing tooth surfaces and OHRQoL.[9] Better health-related behaviors and routine dental attendance have a protective effect on OHRQoL.[10]

At present, the association between sociodemographic factors, clinical dental conditions, oral health behaviors, and OHRQoL has been investigated in adolescents, the elderly, pregnant women, and adult populations,[11–14] while the research on OHRQoL and compliance of oral health behaviors of dental patients in China are sparse, who have a high prevalence of oral diseases, deserve more attention. According to the Fourth National Oral Health Survey (2015–2016) in mainland China,[15] a large proportion (more than 52.8%) of Chinese adults have periodontal disease, and the severity of periodontal disease was positively associated with age.[15] The prevalence of dental caries in 12–15-year-old school adolescents in northeast China was 53.65%,[16] and the prevalence of crown caries among 55 to 74-year-old adults in Guangdong was 79.17%.[17] In contrast to the high prevalence, less than 20% of Chinese adults were knowledgeable about periodontal disease. Furthermore, oral health behaviors and oral health service utilization are not optimistic,[18] only 21.4% of adults (35–44 years old) and 20.7% of older adults (65–74 years old) utilized oral health services in the past 12 months.[19,20] In the 4th National Oral Health Survey, the OHRQoL of the adults in China was fair and was mainly influenced by dental caries, the integrity of dentition, and restoration of lost teeth.[21]

Although oral diseases can be prevented and controlled, there is a great difference in the treatment effect of diseases because people have different levels of knowledge about oral diseases, and their compliance with oral health behaviors varies.[22] An essential element to achieving good oral health is the adoption of efficient and effective oral health behaviors. The value of good oral health behaviors has gained increasing interest in recent years. Studies have shown that oral health behavior affects the oral health status of individuals.[23] To achieve and maintain good oral hygiene, tooth brushing, and flossing, the use of fluoride toothpaste is recommended.[24,25]

Although patient awareness and compliance behaviors play a critical role in both disease prevention and treatment outcomes, little is known about the problems with their oral health behaviors and how they are affected by oral health problems and the associated factors. Here we conducted a study to investigate OHRQoL, oral health behaviors, and associated factors among dental patients. The research questions were "What are the oral health behaviors and oral health-related quality of life of dental patients?" and "Is the oral health-related quality of life influenced by oral health behaviors and other factors?". We hypothesized that patients with favorable socio-economic conditions and healthy oral behaviors had a better oral health-related quality of life compared to patients with less favorable socio-economic conditions and poor oral health behaviors.

For these reasons, two research objectives resulted: 1) The first objective of the study was to assess the current status of dental patients' oral health behaviors and oral health-related quality of life. 2) The second objective of the study was to examine the effects of oral health behaviors and related factors on OHRQoL among dental patients.

Methods
Study Design
A descriptive cross-sectional study design was conducted from June 2022 to July 2022 with 186 patients aged from 18 to 77 years old that attended the Department of Stomatology of the First Mobile General Hospital of Armed Police, Hebei, China. A convenience sample of participants was used. OHRQoL was the outcome of interest. The survey explored oral health behaviors, such as daily brushing frequency, brushing time, brushing method, and OHRQoL measured by OHIP-5- among outpatients in the dental clinic.

Procedure
The study protocol was approved by the College of Nursing, Central South University, Nursing and Behavioral Medicine Research Ethics Review Committee (E202297). All methods were carried out in accordance with relevant guidelines and

regulations (Declaration of Helsinki). Potential participants were approached by two dental nurses, informed of the purpose of the study and what it entailed, and told that their participation was voluntary and that they could terminate their participation at any time. If patients indicated interest, they were provided with a self-administered questionnaire to complete while waiting for their medical appointment. In terms of training and calibration, before conducting the study, the investigators were trained in the questionnaire by our team (two graduate student supervisors and three graduate students who have received systematic training in research) and calibrated to limit examiner variability.

Data collection was made via several self-administered questionnaires in the waiting room. The questionnaires were used to obtain data on socio-demographic characteristics (age, sex, marital status, education level, monthly income, etc. See Table 1). In addition, the OHIP-5 scale was used to assess the impact of perceived oral health on quality of life. During the consultation, the investigator asked the patient the reason for the dental visit, whether they have seen a dentist in the past year and self-assessed oral health status, the type of disease was filled in by the investigators after the oral examination was carried out by an experienced dentist (Table 2). The questionnaire also included items related to oral health behaviors (brushing frequency, brushing methods, frequency of dental visits, etc. See Table 3).

Table 1 Mean OHIP-5 Scores of the Participants in Relation to Socio-Demographic Characteristics

Variables	Number (%)	Score (x± s)	t/F value	P value
Gender			0.610	0.543
Male	146 (78.5)	4.39±3.431		
Female	40 (21.5)	4.03±3.076		
Ethnicity			0.136	0.892
Han Chinese	179 (96.2)	4.32±3.391		
Ethnic Minority	7 (3.8)	4.14±2.340		
Age group (years)			1.504	0.215
18~25	105 (56.5)	4.16±3.073		
26~35	55 (29.6)	4.07±3.558		
36~55	18 (9.7)	5.89±3.104		
≥56	8 (4.3)	4.38±5.344		
BMI classification			0.387	0.680
≤18.5	6 (3.2)	3.50±1.871		
18.5~24.0	125 (67.2)	4.23±3.285		
≥24.0	55 (29.6)	4.58±3.640		
Education level			1.044	0.386
Primary and below	7 (3.8)	3.43±4.036		
Junior secondary	7 (3.8)	5.14±3.891		
Senior secondary	41 (22.0)	3.51±2.976		
College	71 (38.2)	4.45±3.471		
Bachelor's and above	60 (32.3)	4.70±3.310		
Smoking history			2.468	0.015
Yes	75 (40.3)	5.04±3.786		
No	111 (59.7)	3.82±2.942		
History of alcohol consumption			2.370	0.019
Yes	55 (29.6)	5.20±3.664		
No	131 (70.4)	3.94±3.154		
Work status			3.665	0.013
Full-time	76 (40.9)	4.61±3.410		
Unemployed	16 (8.6)	4.94±3.151		
Retired	5 (2.7)	8.20±4.712		
Other	89 (47.8)	3.73±3.111		

(*Continued*)

Table 1 (Continued).

Variables	Number (%)	Score (x± s)	*t/F* value	*P* value
Marital Status			0.469	0.626
Married	71 (38.2)	4.13±3.505		
Unmarried	114 (61.3)	4.40±3.272		
Divorced or widowed	1 (0.5)	7.00±0.000		
Living alone			0.293	0.770
Yes	40 (21.5)	4.45±4.212		
No	146 (78.5)	4.27±3.093		
Sleeping status			2.670	0.072
Good	116 (62.4)	4.09±3.340		
Fair	62 (33.3)	4.40±3.252		
Poor	8 (4.3)	6.88±3.643		
Place of residence			0.339	0.735
Urban	124 (66.7)	4.37±3.453		
Rural	62 (33.3)	4.19±3.167		
Monthly household income (RMB)			0.630	0.597
≤2000	19 (10.2)	4.79±4.131		
2000~5000	36 (19.4)	4.67±3.052		
5000~10,000	96 (51.6)	4.30±3.654		
≥10,000	35 (18.8)	3.71±2.150		
Economic pressure			2.724	0.046
None	71 (38.2)	3.83±2.928		
Lighter	32 (17.2)	3.44±2.850		
Fair	69 (37.1)	5.13±3.788		
Heavy	14 (7.0)	4.71±3.539		

Inclusion and Exclusion Criteria

1. Inclusion criteria: Attendance at a dental clinic; age ≥18 years; clear consciousness, able to make independent judgments and complete the questionnaire; informed consent and voluntary participation in the study.
2. Exclusion criteria: mental disorders or other serious illnesses, unable to cooperate with the completion of the questionnaire.

Sampling

Since there is no survey on oral health literacy for outpatients in the dental clinic, we refer to the survey on oral health literacy of adults,[26] whose incidence of low level of oral health literacy is about 12.4%, $n=u_2\alpha p (1-p) /\delta^2$, so this study takes p=0.124 as the basis for estimating the sample size, n = the desired sample size when the population is greater than 10,000, δ is the allowable error, δ=0.05 is set in this study, take α= 0.05, u= the standard normal deviate, usually set at 1.96 which corresponds to 95% confidence level, the final calculation of the sample content required for this study n≈167, the effective response rate is calculated according to 90%, then the sample size required for this study is 185.

Data Collection

Socio-Demographics Questionnaire

The demographic information of participants includes general demographic information such as age, gender, place of residence, marital status, whether living alone, education level, job status, history of smoking, history of alcohol consumption, sleep status, monthly household income; and clinical characteristics information, such as reasons for consultation, types of diseases, whether visiting the dentist in the past year, self-rated oral health (SROH), etc.

Table 2 Mean OHIP-5 Scores of the Participants in Relation to Clinical Characteristics

Variables	Number (%)	Score	Variables	Number (%)
Reason for dental Visit			1.348	0.254
Swollen or bleeding gums	94 (50.5)	4.83±3.540		
Physical examination or consultation	33 (17.7)	4.15±3.447		
Loose teeth	5 (2.7)	3.80±2.490		
Bad taste in the mouth	3 (1.6)	4.33±2.082		
Other discomfort	51 (27.4)	3.51±2.969		
Disease Type			0.255	0.937
Caries	33 (17.7)	4.64±3.959		
Periodontitis	64 (34.4)	4.47±2.862		
Oral mucosal disease	4 (2.2)	3.50±1.732		
Missing teeth	19 (10.2)	4.20±3.429		
Fractured tooth	5 (2.7)	4.20±2.490		
Other	61 (32.8)	4.31±3.657		
Visited the dentist in the past year			0.446	0.656
Yes	100 (53.8)	4.21±3.346		
No	86 (46.2)	4.43±3.377		
Self-rated oral health			6.207	<0.001
Poor	28 (15.1)	6.61±4.263		
Fair	129 (69.4)	4.07±3.135		
Good	21 (15.1)	3.24±2.427		
Very good	8 (4.3)	3.00±1.690		

Oral Health Behaviors Questionnaire

After reviewing literature and group discussions, we developed the 16-item oral health care behavior questionnaire based on the 5th edition of the World Health Organization (WHO) Basic Methods for Oral Health Surveys. The 16 items include tooth brushing habits, oral hygiene preventive measures, the usage of oral hygiene products, participation in oral health examinations, oral

Table 3 Mean OHIP-5 Score of the Participants in Relation to Oral Health Behaviors

Variables	Number (%)	Score (x ± s)	t/F value	P value
Daily brushing frequency (times)			3.633	0.028
≤1	29 (15.6)	5.83±4.080		
2	144 (77.4)	4.05±3.207		
≥3	13 (7.0)	3.85±2.304		
Brushing method			0.205	0.893
Brush horizontally	37 (19.9)	4.30±3.503		
Brush vertically	40 (21.5)	3.98±3.158		
Brush in a circle	30 (16.1)	4.57±3.308		
No fixed method	79 (42.5)	4.39±3.443		
Brushing time (minutes)			2.453	0.089
≤1	19 (10.2)	5.42±3.485		
2	110 (59.1)	4.48±3.399		
≥2	57 (30.9)	3.61±3.127		
Flossing or not			0.379	0.685
Never or occasionally	119 (64.0)	4.39±3.299		
1~2 times per week	35 (18.8)	4.46±3.311		
≥3 times per week	32 (17.2)	3.84±3.655		

(Continued)

Table 3 (Continued).

Variables	Number (%)	Score (x ± s)	t/F value	P value
Use toothpicks			1.746	0.177
Never or occasionally	127 (68.2)	4.00±3.268		
1~2 times per week	41 (22.0)	4.98±3.290		
≥3 times per week	18 (9.7)	5.00±3.926		
Rinse mouth after meals			0.658	0.579
Never or occasionally	86 (46.2)	4.13±3.409		
1 time daily	48 (25.8)	4.85±3.537		
2 times daily	30 (16.1)	3.90±2.857		
≥3 times daily	22 (11.8)	4.41±3.418		
Use mouthwash			0.952	0.417
Never or occasionally	158 (84.9)	4.41±3.437		
1 time per day	13 (7.0)	3.08±1.977		
2 times a day	7 (3.8)	3.43±3.101		
≥3 times daily	8 (4.3)	5.13±3.563		
Use fluoride toothpaste			1.021	0.362
Yes	49 (26.3)	4.06±2.794		
No	40 (21.5)	3.83±3.112		
Do not know	97 (52.2)	4.64±3.686		
Regular oral examination			1.484	0.229
Never	122 (65.6)	4.46±3.540		
Once a year	48 (25.8)	4.40±3.207		
Twice a year or more	16 (8.60)	2.94±1.769		
Regular dental cleaning			0.149	0.861
Never	137 (73.7)	4.36±3.476		
Once a year	42 (22.6)	4.10±2.970		
Twice a year	7 (3.76)	4.71±3.450		
Frequency of toothbrush replacement			1.713	0.166
Never	20 (10.8)	3.70±2.716		
Semi-annually	30 (16.1)	4.40±2.920		
2~3 months	105 (56.5)	4.06±3.410		
1 month	31 (16.7)	5.48±3.767		
Whether there is caries			4.257	0.016
Yes	75 (40.3)	4.89±3.689		
No	40 (21.5)	3.03±2.587		
I do not know	71 (38.2)	4.42±3.206		
Whether gums bleed when brushing teeth			0.861	0.463
Never	53 (28.5)	3.91±3.358		
Sometimes (1 time/week)	98 (52.7)	4.33±3.361		
Often (≥3 times/week)	21 (11.3)	4.48±3.683		
Do not know	14 (7.5)	5.50±2.739		
When brushing bleeding or gums are swollen and painful			0.197	0.898
No treatment needed	83 (44.6)	4.14±3.771		
Go back to the dentist when you have time	76 (40.9)	4.49±3.018		
Seek immediate medical attention	11 (5.9)	4.00±2.366		
Take your own medication or other	16 (8.6)	4.56±3.346		

(*Continued*)

Table 3 (Continued).

Variables	Number (%)	Score (x ± s)	t/F value	P value
Reasons for visiting dentist			1.753	0.140
Never	12 (6.5)	2.50±2.393		
Toothache is unbearable and medication is not effective	93 (50.0)	4.41±3.398		
Tooth pain is still tolerable	52 (28.0)	4.96±3.296		
Tooth decay is found in time to see the doctor	21 (11.3)	3.62±3.485		
Regular checkup even without discomfort	8 (4.3)	3.50±3.381		
Take the initiative to learn about oral health			6.278	0.002
Never	34 (18.6)	3.38±3.201		
Occasionally	134 (72.0)	4.81±3.425		
Often	18 (9.7)	2.33±1.680		

hygiene preventive measures, oral health service utilization, and whether to take the initiative to learn about oral health-related knowledge. Tooth brushing habits were evaluated by three questions about daily brushing frequency, brushing method, and brushing time. The usage of oral hygiene products includes dental floss, toothpicks, mouthwash (including two questions about whether to rinse the mouth after meals and the use of mouthwash), and fluoride toothpaste. Participation in oral health examinations was defined by regular oral examination. Oral hygiene preventive measures included regular dental cleaning, and frequency of toothbrush replacement. Oral health service utilization included whether there is caries, whether gums bleed when brushing teeth, measures to deal with bleeding teeth brushing or swollen and painful gums, reasons for visiting dentist, and whether to take the initiative to learn about oral health-related knowledge was defined on by the question, "take the initiative to learn about oral health". The options for the question are shown in Table 3. The oral health behaviors questionnaire was validated using content validity, to determine whether a representative sample of oral health behavior domain to be measured was covered. In order to ensure adequate representativeness of actual observations, seven experts in the field examined research instruments, which were certified by two dentists, two nursing masters, two dental nurse leaders, and a clinical nurse with ten years' experience. To test for the reliability of the study instrument, 20 questionnaires were distributed to respondents. The questionnaire was found to be simple and easy to understand, and it took 5–12 minutes to complete.

Oral Health Impact Profile

The five-item short form of the Oral Health Impact Profile was developed by John,[27] and then was translated to Chinese by Lü,[28] the five items were: difficulty in biting or chewing food, has experienced significant pain, feeling uncomfortable about eating, poor taste perception, difficulty in completing daily tasks. The scale describes attitudes on a five-point Likert scale ranging from 0 ("Not at all") to 4 ("very severe"). Total scores range from 0 to 20. The higher the patient's score in a particular area, the greater the impact of the patient's oral problems. The Chinese version of OHIP-5 is a validated instrument, which has tested its construct validity and convergent validity and reported a high internal consistency (Cronbach's a coefficient: 0.868).

Statistical Analysis

The data were analyzed using SPSS statistical software version 24.0 (SPSS, Central south university, China). Descriptive data such as mean ±standard deviation or median (inter-quartile range) for continuous variables and n (%) for categorical variables were calculated. Kolmogorov–Smirnov test was used to check for the normality of the data. The t-test, and one-way ANOVA were used to compare the groups, and a multiple linear regression analysis was conducted to identify factors. Differences were considered statistically significant at $P<0.05$.

Results
Subjects
In total, 200 questionnaires were distributed and 188 copies were collected. After checking and excluding 2 cases of invalid questionnaires, 186 valid questionnaires were recovered, with a valid recovery rate of 93%. The average age of the participants was 24.62 years (SD = 10.67), more than half of them were male (78.5%); 61.3% were unmarried, and 40.9% worked full-time. In addition, more than half of them has no history of smoking (59.7%) or drinking alcohol (70.4%).82.3% were for treatment purposes, and more than half of the patients (50.5%) visit the clinic for swollen and painful gums.

The mean score of OHIP-5 of participants was 4.31 (SD 3.35), with a range from 0 to 15, and the overall scores were normally distributed. Regarding the five items of the OHIP-5, the mean scores of the "have difficulty biting or chewing food" was 0.90 (SD 0.87); the mean scores of the "experiencing significant pain" was 1.48 (SD 1.06); the mean scores of the "feeling uncomfortable when eating" was 1.04 (SD 0.92); the mean scores of the "poor sense of taste" was 0.47 (SD 0.78); the mean scores of the "difficulty completing daily tasks" was 0.41 (SD 0.69).

Mean OHIP-5 scores of the participants in relation to socio-demographic and clinical characteristics are presented in Tables 1 and 2, respectively. Statistically significant ($p<0.05$) was found for smoking history, history of alcohol consumption, work status, economic pressure, and self-rated oral health status. Participants who reported smoking ($p = 0.015$) or drinking ($p = 0.019$) had a higher OHIP-5 score. In addition, participants who had more economic pressure had higher OHIP-5 scores than those with less economic pressure, and the differences were statistically significant ($p = 0.046$). Participants who self-rated oral health as poor or fair had higher OHIP-5 scores than others ($p < 0.001$). All of the surveyed oral health behaviors factors shown in Table 3. As for tooth brushing habits, 77.4% of patients brushed their teeth twice daily, besides, 19.9% used the horizontal brushing method, 21.5% used the vertical brushing method and only 16.1% used rotary method. In addition, more than half of the patients brush for 2 minutes.

Regarding the usage of oral hygiene products, more than half of the patients never or occasionally used dental floss or toothpicks, 46.2% never or occasionally rinsed their mouth after meals. Moreover, most of them never or occasionally used mouthwash, and only 26.3% used fluoride toothpaste, and 73.7% did not apply or did not know about fluoride toothpaste.

As for participation in oral health examinations, 65.6% of patients never had a regular oral examination, 25.8% reported they had a regular oral examination once a year, and only 8.60% of the participants had a regular oral examination twice a year or more.

Furthermore, in terms of oral hygiene preventive measures. The percentage of those who never examined their mouth and never cleaned their teeth was as high as 65.6% and 73.7% respectively. The frequency of replacing toothbrushes was only 56.5% for 2~3 months, 16.1% for once every six months, 10.8% of the patients never replaced their toothbrushes.

Regarding oral health service utilization, 40.3% of the patients self-reported having caries, and approximately one-third of participants did not know whether there is caries. In addition, 71.5% of the patients had bleeding gums when brushing, but only 5.9% of the patients chose to seek medical treatment immediately when brushing bleeding or gum swelling and pain, and 44.6% chose not to deal with it. Among all the participants, half of the reasons for going to the dentist were that the toothache was intolerable and the medication was not effective, 28.0% of the participants chose to go to the dentist when the toothache was still tolerable, 11.3% of the patients went to the dentist when tooth decay was found, only 4.3% of the patients had regular checkup even without discomfort.

With regard to learning about oral health, 18.6% of the patients never took the initiative to learn about oral health, 72.0% of the patients took the initiative to learn about oral health occasionally, and only 9.70% of the patients often took the initiative to learn about oral health.

As Table 3 shows, statistically significant scores ($p<0.05$) were found for daily brushing frequency, whether or not they had dental caries, and whether they took the initiative to learn about oral health. Participants who brushed once or twice daily had higher OHIP-5 scores than those brushed more times daily, and the differences were statistically significant ($p = 0.028$). In addition, participants who never or occasionally took the initiative to learn about oral health had higher OHIP-5 scores than those often took the initiative to learn about oral health ($p = 0.002$).

As Table 4 shows, the factors that were statistically significant in the univariate analysis were used as independent variables in the multiple linear regression analysis with OHIP scores as the dependent variable. Among them, ordered

Table 4 Multiple Linear Regression Analysis of Variables Associated with OHIP of Dental Patients

Independent Variable	β	SE	β'	t	P
(Constant)	7.737	2.074		3.730	<0.001
Smoking history	0.533	0.550	0.078	0.970	0.334
History of Alcohol consumption	0.933	0.600	0.127	1.554	0.122
Economic pressure	0.211	0.238	0.064	0.885	0.377
Self-rated oral health	−0.988	0.385	−0.194	−2.568	0.011
Daily brushing frequency	−0.882	0.506	−0.123	−1.741	0.083
Work (unemployed)	0.654	0.870	0.055	0.751	0.453
Work (retired)	3.345	1.476	0.162	2.267	0.025
Work (other)	−0.401	0.518	−0.060	−0.774	0.440
Dental caries (none)	−1.109	0.630	−0.136	−1.759	0.080
Dental caries (do not know)	0.104	0.543	0.015	0.192	0.848
Take the initiative to learn about oral health	0.245	0.454	0.038	0.540	0.590

Notes: R^2=0.190, adjusted R^2=0.139, F=3.720, p<0.000, covariate VIF values under all independent variable categories are less than 5. Work status assignment: 1-full time, 2-part time, 3-unemployed; 4 -retired; 5-other; whether caries was present or not assigned: 1-yes, 2-no, 3-do not know. Smoking history: 0 - no; 1 - yes; drinking history: 0 - no; 1 - yes; financial stress: 1 - no, 2 - less, 3 - average; 4 heavier; self-rated oral health status: 1-poor, 2-fair, 3-good, 4-very good; daily brushing frequency: 1–1 time per day, 2–2 times a day, 3-more times a day; active knowledge about oral health: 1-never, 2-sometimes, 3-frequently. Smoking history was controlled by having a history of smoking, smoking history was controlled by having a history of drinking, working full-time was controlled, economic pressure was controlled by none, self-assessed oral health was controlled by poor, brushing times per day was controlled by 1 time, whether there was dental caries was controlled by yes, and active knowledge about oral health was controlled by never.

categorical variables were assigned values and substituted, unordered multi-categorical variables were dummy variables and continuous variables were substituted with original values. α in = 0.05, α out = 0.10, and the conditional likelihood ratio forward stepwise method was used. The final model included the following variables: smoking history, history of alcohol consumption, economic pressure, self-rated oral health, daily brushing frequency, work status, dental caries status, and whether or not to take the initiative to learn about oral health. Self-rated oral health and work status were found to be significantly associated with the OHIP scores (p <0.05).

Discussion

This study examined the oral health behaviors and oral health-related quality of life and its associations among 186 outpatients in the dental clinic in Hebei, China. Overall, these individuals' oral health status was not good; less than 20% rated their oral health as good or very good, and the pain was reported by 80.64% of patients. Answering our general objective; we cannot confirm that patients with with favorable socio-economic conditions and healthy oral behaviors have a better oral health-related quality of life.

Among the reasons for patients attending the outpatient dental clinic, gingival swelling and pain or bleeding accounted for 50.5%, which was less than the study by He et al,[29] and other discomforts such as loose teeth and oral odor accounted for 31.7%, while physical examination or consultation accounted for only 17.7%, which was much lower than the percent of 71.6% of adults in the United States,[30] and lower than the results of the American HIV outpatient clinic survey, whose research shows that 79.0% for routine check-ups,[31] indicating that the patient's awareness of oral checkups and consultations were not strong enough, which might exacerbate their oral health status if there is no early intervention.

Among the disease types, 64 patients with periodontitis were diagnosed in the outpatient clinic, accounting for 34.4%, 17.7% for caries, and 10.2% for tooth loss. As one of the main oral diseases, periodontitis, research shows that about 52.8%-69.3% of adults in China suffer from periodontal disease of different degrees,[15] and the frequency of subjects with severe periodontitis (stage III or IV) was between 10.6% to 43.5% among them. Past studies have linked periodontal disease with other non-infectious systemic diseases,[32] and a recent review suggests an association between periodontal disease and Alzheimer's disease. The treatment of periodontal disease could be a way to explore Alzheimer's disease

prevention.[33] Periodontal disease is negatively correlated with oral health-related quality of life,[34] therefore, more attention should be paid to the prevention and treatment of periodontal disease.

Regarding OHRQoL, the mean score and its standard deviation of OHIP-5 of patients attending dentistry clinics (4.31, 3.35) indicate that have relatively worse OHRQoL than those Spanish-speaking dental patients in USA (3.7, 4.0).[35] Poor OHRQoL, as

identified by an OHIP-5 score of 3 or higher on at least two of the five items,[36] account for 63.4%, and only 9.68% (18/186) had a total score of 0, which means there are no symptoms of discomfort in the oral cavity. The highest scores were found for the entry of having experienced significant pain, with 80.64% of patients reporting pain, 33.3% for mild pain, 30.6% for moderate pain, and 4.3% and 1.1% for more severe and very severe pain, respectively; 64.51% of patients had difficulty biting or chewing food, and 68.28% of patients reported feeling uncomfortable eating; while the overall scores for the entries of difficulty completing daily tasks and poor taste sensation were low, indicating that oral health conditions have less impact on taste and daily tasks.

This study showed that participants who reported smoking or drinking had a higher OHIP-5 score, which is consistent with the findings of Baskar doss et al.[37] Previous studies have confirmed that smoking is a risk factor for periodontal disease, and some studies have shown that traditional cigarettes have a more severe impact on oral mucosal lesions than e-cigarettes,[38] but it is worth noting that e-cigarettes are also a risk factor for oral health (OR= 1.78, 95% CI: 1.39–2.30; P<0.001),[39] which is also capable of damaging tooth enamel and leading to deterioration of periodontal health,[40] and smoking is prone to various periodontal problems such as increased alveolar depth, alveolar bone loss, calculus formation, oral lesions, ulcers, halitosis, and tooth staining,[41] and the formation of tobacco plaque facilitates the attachment of more calculus and soft tartar The formation of tobacco plaque facilitates the adhesion and deposition of more calculus and tartar, and the large amount of toxic and harmful components in tobacco can also directly stimulate local periodontal tissues, thus leading to gingival recession; alcohol consumption may cause changes in the oral microenvironment, resulting in dysbiosis of the oral flora, thus causing periodontitis and gum disease,[42,43] and has been shown to have synergistic carcinogenic effects with smoking.

The present study showed that OHRQoL was associated with work status and economic pressure, and the retired population scored higher than other populations in terms of OHIP-5. It may be explained by the fact that the retired population is more likely to experience social isolation, reduced social participation, oral debility, and a limited income. Although active aging[44] and social participation of the retired population is being promoted at home and abroad, it is undeniable that the social participation of the retired population in China is low due to the constraints of individual physical and mental health status,[45,46] the self-perception of being old, socioeconomic level, and social security environment, which all hinder the social participation of the retired population, in addition, a study showed that about 84.28% had not participated in community activities,[46] and the percentage of those who are interacting with friends is about 37.4%, while the potion of participating in a community-related only account for 1.5%.[47] In addition, data from China showed that 59% of the retired population did not think they had enough pension reserves to sustain their retirement,[48] and limited financial resources may also be one of the reasons why the level of oral health of the retired population is poorer. Moreover, oral frailty may also be one of the factors affecting the oral health of the retired population,[49,50] as one of the common geriatric syndromes is about 16% to 24%.[50,51] Oral frailty refers to the decline in oral function, accompanied by a decline in cognitive and physical functions, accompanied by a decrease in oral health interest, and a decline in physical and mental reserve capacity caused by various oral conditions (number of teeth oral hygiene, oral function, etc.).[52] Oral frailty is associated with the loss of oral function and increased care needs.[51] It is noteworthy that age did not show statistical significant in this study, which is considered to be related to the small sample size and lack of sample representativeness in the higher age groups, and in the future, consideration may be given to increasing the sample size of this population or conducting a survey on oral health status specifically for retired elderly people.

Self-rated oral health is a comprehensive evaluation of the oral health of the study subjects based on their health and overall subjective feelings, and this study showed that 15.1% of patients had poor self-rated oral health, 129 (69.4%) had fair self-rated oral health, and 19.4% had good and very good self-rated oral health. Which is consistent with the findings of Cho et al on North Korean defectors.[53] Overall, the better the self-rated oral health status, the lower the oral health

impact score. It can be used as a screening indicator to measure the oral health status of the general population and can be combined with objective indicators such as the oral health index for in-depth study in the future.

This study shows that the oral health behaviors of dental patients are not optimistic. Proper brushing, appropriate use of dental care products, and regular dental checkups are the main ways to maintain oral health. Our study shows that 84.4% of patients can brush their teeth twice a day or more, and 73.2% of patients can change their toothbrushes two or three months or every month, which is consistent with Ueno et al[54] on Japanese adults, whose study showed that 93.1% of patients insisted on brushing their teeth every day, and higher than a survey among adult Nigerians,[55] of which the percentage of people who can brush their teeth twice is between 42.6% and 56.5%.

Oral health care products, except for the most basic toothbrush and toothpaste, flossing, mouthwash, and fluoride toothpaste have low awareness and usage rates, and the Chinese Residents' Oral Health Behavior Guide for Healthcare Professionals recommends a comprehensive oral cleaning behavior that includes brushing, rinsing, and flossing to maximize plaque removal and control plaque growth.[56,57] Flossing is the use of threads made of synthetic fibers to clean plaque and food debris from the adjacent surfaces of teeth and interdental spaces, and the use of fluoride toothpaste is one of the important ways to prevent caries.[58] However, only 36% of the participants floss their teeth, which is higher than the percentage of 9.9% in a previous national cross-sectional study,[15] but still much lower than the percentage of 71.91% in America.[30] It is worth noting that the results of the third national oral epidemiological survey in China showed that the caries rates of children, adults, and the elderly were 66.0%, 61.0%, and 75.2%, respectively,[15] so, it is necessary to carry out oral health education and promotion as soon as possible.

An interesting finding in our study was the fact that more than half of the participants using toothpaste were unaware of the fluoride content of their dentifrice. Only 26.3% of patients know and use fluoride toothpaste. This is less than satisfactory and should be addressed urgently. Using the fluoride content of water and dentifrices as a guide, people must determine how much fluoride they require. Lack of knowledge could result in more cases of fluorosis in endemic regions and worse cases of caries in areas with inadequate fluoride levels.

In addition, 65.6% of patients never have regular oral checkups, 73.7% never have regular dental cleanings, and most patients do not think they need to deal with bleeding teeth or swollen gums when brushing (44.6%) or choose to delay seeking treatment (40.9%), and similarly, half of the reasons for visiting the dentist are due to the ineffectiveness of medication for intolerable toothache, and 28.0% of patients choose to visit the dentist while only 4.3% of the patients had regular checkups even without discomfort. Therefore, there is a long way to go to improve the oral health literacy of the public, and we can consider using dental outpatient education as an entry point, combining model demonstration, science animation explanation, role play, etc. based on traditional health education to make the education more vivid and intuitive, and to promote good oral health behavioral habits of patients.

According to our research, some socio-demographic characteristics examined namely smoking history; alcohol consumption history; work status; economic pressure; self-rated oral health were significantly related to oral health impact. Accordingly, we suggest that efforts at promoting oral hygiene should focus on retired persons and persons who rated poor oral health as they are more likely to have poor oral health behaviors. In summary, this study shows that the oral health behaviors of patients in the dental clinic department need to be improved, and the oral health behavior of patients is not optimistic, especially regarding the knowledge and use of oral health care products, the basic oral hygiene habits.

This survey has some limitations. Cross-sectional studies are a snapshot of a specific condition at a specific time point, and causal relationships cannot be concluded. Further longitudinal studies or clinical trials may be required to extend the findings reported here. Although the sample size meets the power analysis, this study only conducted a questionnaire survey and adopted a nonprobability convenience sample of patients in one hospital in Hebei province, and because of the vast area of China and the large differences in economic and medical levels in different places, the representativeness and generalizability might be limited. Moreover, oral health behaviors were assessed based on a self-report questionnaire, and it may be overestimated or non-reflective of actual behaviors due to recall biases and social desirability. In addition, the mean age of our study (24.62) indicated a very young population, providing probable bias in results. This made our results nonconclusive because younger people tend to have an easier access to oral health-related knowledge, work full time with a better financial income, and their incidence of dental patients is lower because it increases with age. Therefore, the survey findings must be interpreted with caution.

Conclusion

The OHRQoL of dental patients is unsatisfactory, with the need for improved oral health behaviors. Since the high prevalence of the dental disease among adults in China, the importance of oral health knowledge and oral health behaviors cannot be overstated. Professional oral health management should be conducted, to reinforce and strengthen healthy behavioral patterns, particularly with regard to good oral hygiene habits. In addition, health education for health care professionals such as obstetricians, gynecologists, and family doctors should be strengthened to make them an important part of oral health care for patients. This study provides insight into the social and behavioral factors associated with oral health-related quality of life among dental patients in China, it will be necessary to confirm these associations through prospective research.

Disclosure

The authors declare no conflict of interest.

References

1. Fiorillo L. Oral health: the first step to well-being. *Medicina*. 2019;55(10):676. doi:10.3390/medicina55100676
2. Peres MA, Macpherson LMD, Weyant RJ, et al. Oral diseases: a global public health challenge. *Lancet*. 2019;394(10194):249–260. doi:10.1016/S0140-6736(19)31146-8
3. Mulla M. Impact of oral diseases and conditions on oral health-related quality of life: a narrative review of studies conducted in the Kingdom of Saudi Arabia. *Cureus*. 2021;13(9). doi:10.7759/cureus.18358
4. Koistinen S, Olai L, Ståhlnacke K, et al. Oral health-related quality of life and associated factors among older people in short-term care. *Int J Dent Hyg*. 2020;18(2):163–172. doi:10.1111/idh.12424
5. Zheng SG, Zhao LL, Ju NT, et al. Relationship between oral health-related knowledge, attitudes, practice, self-rated oral health and oral health-related quality of life among Chinese college students: a structural equation modeling approach. *Bmc Oral Health*. 2021;21(1). doi:10.1186/s12903-021-01419-0
6. Amilani U, Jayasekara P, Carter HE, et al. Key factors associated with oral health-related quality of life in Sri Lankan adolescents: a cross sectional study. *Bmc Oral Health*. 2021;21(1). doi:10.1186/s12903-021-01569-1
7. Vigu AL, Stanciu D, Lotrean LM, et al. Complex interrelations between self-reported oral health attitudes and behaviors, the oral health status, and oral health-related quality of life. *Patient Prefer Adherence*. 2018;12:539–549. doi:10.2147/PPA.S159621
8. Gbolahan OO, Fasola AO, Aladelusi TO. Attitude and behavior to oral health of 456 patients who presented for tooth extraction at 2 health facilities in Southwestern Nigeria. *J Patient Exp*. 2019;6(2):157–163. doi:10.1177/2374373518788851
9. Broadbent JM, Zeng J, Page LAF, et al. Oral health-related beliefs, behaviors, and outcomes through the life course. *J Dent Res*. 2016;95(7):808–813. doi:10.1177/0022034516634663
10. Almoznino G, Aframian DJ, Sharav Y, et al. Lifestyle and dental attendance as predictors of oral health-related quality of life. *Oral Dis*. 2015;21(5):659–666. doi:10.1111/odi.12331
11. Hajek A, Konig HH. Oral health-related quality of life, probable depression and probable anxiety: evidence from a representative survey in Germany. *Bmc Oral Health*. 2022;22(1). doi:10.1186/s12903-022-02047-y
12. Park MS, Ryu SA. Degree of dry mouth and factors influencing oral health-related quality of life for community-dwelling elders. *J Korean Acad Nurs*. 2010;40(5):747–755. doi:10.4040/jkan.2010.40.5.747
13. Aarabi G, Walther C, Kretzler B, et al. Association between migration and oral health-related quality of life: results from a nationally representative online survey. *Bmc Oral Health*. 2022;22(1). doi:10.1186/s12903-022-02337-5
14. Gil-Montoya JA, Leon-Rios X, Rivero T, et al. Factors associated with oral health-related quality of life during pregnancy: a prospective observational study. *Qual Life Res*. 2021;30(12):3475–3484. doi:10.1007/s11136-021-02869-3
15. Jiao J, Jing WD, Si Y, et al. The prevalence and severity of periodontal disease in Mainland China: data from the Fourth National Oral Health Survey (2015–2016). *J Clin Periodontol*. 2021;48(2):168–179. doi:10.1111/jcpe.13396
16. Li J, Zhang K, Lu Z. Prevalence and factors contributing to dental caries in 12–15-year-old school adolescents in northeast China. *BMJ Open*. 2021;11(11):e044758. doi:10.1136/bmjopen-2020-044758
17. Huang X, Liang Y, Fan W, et al. Relationship between Chinese Baijiu consumption and dental caries among 55- to 74-year-old adults in Guangdong, southern China: a cross-sectional survey. *BMC Geriatr*. 2021;21(1):506. doi:10.1186/s12877-021-02453-x
18. Zhu L, Petersen PE, Wang HY, et al. Oral health knowledge, attitudes and behaviour of adults in China. *Int Dent J*. 2005;55(4):231–241. doi:10.1111/j.1875-595X.2005.tb00321.x
19. Xu MR, Cheng ML, Gao XL, et al. Factors associated with oral health service utilization among adults and older adults in China, 2015–2016. *Community Dent Oral Epidemiol*. 2020;48(1):32–41. doi:10.1111/cdoe.12497

20. Ou X, Zeng L, Zeng Y, et al. Health behaviors and tooth retention among older adults in China: findings from the 4th Chinese national oral health survey. *BMC Oral Health*. 2022;22(1):285. doi:10.1186/s12903-022-02283-2

21. Zhi QH, Zhou Y, Tao Y, et al. Factors impacting the oral health-related quality of life in chinese adults: results from the 4th national oral health survey. *Chin J Dental Res*. 2018;21(4):259–265.

22. Uguru N, Onwujekwe O, Uguru C, et al. Oral health-seeking behavior among different population groups in Enugu Nigeria. *PLoS One*. 2021;16(2): e0246164. doi:10.1371/journal.pone.0246164

23. Xiang B, Wong HM, Perfecto AP, et al. The effectiveness of behavioral interventions to improve oral health in adolescents at different periods of follow-up: a systematic review and meta-analysis. *Patient Educ Couns*. 2020;103(4):725–733. doi:10.1016/j.pec.2019.11.030

24. Krausch-Hofmann S, Palmers E, Declerck D, et al. Development of practice guidelines for daily oral care in care-dependent older adults to complement the InterRAI suite of instruments using a modified Delphi approach. *Int J Older People Nurs*. 2021;16:1. doi:10.1111/opn.12351

25. Kramer SM. Oral Health (Clinical Guideline in Eb). *Acta Derm Venereol*. 2020;100:28.

26. Blizniuk A, Ueno M, Zaitsu T, et al. Association of oral health literacy with oral health behaviour and oral health status in Belarus. *Community Dent Health*. 2015;32(3):148–152.

27. John MT, Miglioretti DL, LeResche L, et al. German short forms of the oral health impact profile. *Community Dent Oral Epidemiol*. 2006;34 (4):277–288. doi:10.1111/j.1600-0528.2006.00279.x

28. Lü H, He FM. Reliability and validity of the Chinese version of the 5-item oral health impact profile (in Chinese). *Hua Xi Kou Qiang Yi Xue Za Zhi*. 2020;38(2):145–148. doi:10.7518/hxkq.2020.02.006

29. He J, Yuan B, Zhou S, et al. Socio-demographic factors, dental status, oral health knowledge and attitude, and health-related behaviors in dental visits among 12-year-old Shenzhen adolescents: a multilevel analysis. *BMC Oral Health*. 2022;22(1):102. doi:10.1186/s12903-022-02110-8

30. Su S, Lipsky MS, Licari FW, et al. Comparing oral health behaviours of men and women in the United States. *J Dent*. 2022;122:104157. doi:10.1016/j.jdent.2022.104157

31. Trevillyan JM, Chang JJ, Currier JS. Prevalence of dental symptoms and access to dental care in an American HIV outpatient clinic. *Oral Dis*. 2018;24(5):866–867. doi:10.1111/odi.12725

32. Carrizales-Sepúlveda EF, Ordaz-Farías A, Vera-Pineda R, et al. Periodontal disease, systemic inflammation and the risk of cardiovascular disease. *Heart Lung Circ*. 2018;27(11):1327–1334. doi:10.1016/j.hlc.2018.05.102

33. Borsa L, Dubois M, Sacco G, et al. Analysis the link between periodontal diseases and alzheimer's disease: a systematic review. *Int J Environ Res Public Health*. 2021;18(17):9312. doi:10.3390/ijerph18179312

34. Wong LB, Yap AU, Allen PF. Periodontal disease and quality of life: umbrella review of systematic reviews. *J Periodontal Res*. 2021;56(1):1–17. doi:10.1111/jre.12805

35. Simancas-Pallares M, John MT, Enstad C, et al. The Spanish language 5-item oral health impact profile. *Int Dent J*. 2020;70(2):127–135. doi:10.1111/idj.12534

36. Wide U, Hakeberg M. Oral health-related quality of life, measured using the five-item version of the Oral Health Impact Profile, in relation to socio-economic status: a population survey in Sweden. *Eur J Oral Sci*. 2017;126(1):41–45. doi:10.1111/eos.12393

37. Baskaradoss JK. Relationship between oral health literacy and oral health status. *BMC Oral Health*. 2018;18(1):172. doi:10.1186/s12903-018-0640-1

38. AlQobaly L, Abed H, Alsahafi Y, et al. Does smoking explain the association between use of e-cigarettes and self-reported periodontal disease? *J Dent*. 2022;122:104164. doi:10.1016/j.jdent.2022.104164

39. Huilgol P, Bhatt SP, Biligowda N, et al. Association of e-cigarette use with oral health: a population-based cross-sectional questionnaire study. *J Public Health*. 2019;41(2):354–361. doi:10.1093/pubmed/fdy082

40. Yang I, Sandeep S, Rodriguez J. The oral health impact of electronic cigarette use: a systematic review. *Crit Rev Toxicol*. 2020;50(2):97–127. doi:10.1080/10408444.2020.1713726

41. Ahmed N, Arshad S, Basheer SN, et al. Smoking a dangerous addiction: a systematic review on an underrated risk factor for oral diseases. *Int J Environ Res Public Health*. 2021;18(21):11003. doi:10.3390/ijerph182111003

42. Liao Y, Tong XT, Jia YJ, et al. The effects of alcohol drinking on oral microbiota in the Chinese population. *Int J Environ Res Public Health*. 2022;19(9):5729. doi:10.3390/ijerph19095729

43. Zupo R, Castellana F, De Nucci S, et al. Beverages consumption and oral health in the aging population: a systematic review. *Front Nutr*. 2021;8:762383. doi:10.3389/fnut.2021.762383

44. Eronen J, Paakkari L, Portegijs E, et al. Health literacy supports active aging. *Prev Med*. 2021;143:106330. doi:10.1016/j.ypmed.2020.106330

45. Liu H, Wu B, Feng Z. Social participation and self-perception of being old in China. *Int J Aging Hum Dev*. 2020;91(3):219–234. doi:10.1177/0091415019875456

46. Sun J, Lyu S. Social participation and urban-rural disparity in mental health among older adults in China. *J Affect Disord*. 2020;274:399–404. doi:10.1016/j.jad.2020.05.091

47. Ma X, Piao X, Oshio T. Impact of social participation on health among middle-aged and elderly adults: evidence from longitudinal survey data in China. *BMC Public Health*. 2020;20(1):502. doi:10.1186/s12889-020-08650-4

48. Chen D, Petrie D, Tang K, et al. Retirement saving and mental health in China. *Health Promot Int*. 2018;33(5):801–811. doi:10.1093/heapro/dax029

49. Hakeem FF, Bernabé E, Sabbah W. Association between oral health and frailty: a systematic review of longitudinal studies. *Gerodontology*. 2019;36(3):205–215. doi:10.1111/ger.12406

50. Tanaka T, Takahashi K, Hirano H, et al. Oral frailty as a risk factor for physical frailty and mortality in community-dwelling elderly. *J Gerontol a Biol Sci Med Sci*. 2018;73(12):1661–1667. doi:10.1093/gerona/glx225

51. Tanaka T, Hirano H, Ohara Y, et al. Oral Frailty Index-8 in the risk assessment of new-onset oral frailty and functional disability among community-dwelling older adults. *Arch Gerontol Geriatr*. 2021;94:104340. doi:10.1016/j.archger.2021.104340

52. Dibello V, Lozupone M, Manfredini D, et al. Oral frailty and neurodegeneration in Alzheimer's disease. *Neural Regen Res*. 2021;16 (11):2149–2153. doi:10.4103/1673-5374.310672

53. Cho HA, Im AJ, Sim YR, et al. The association between oral health literacy and oral health behaviors in North Korean defectors: a cross-sectional study. *Bmc Public Health*. 2020;20:1. doi:10.1186/s12889-020-08550-7

54. Ueno M, Takeuchi S, Oshiro A, et al. Relationship between oral health literacy and oral health behaviors and clinical status in Japanese adults. *J Dent Sci*. 2013;8(2):170–176. doi:10.1016/j.jds.2012.09.012

55. Olusile AO, Adeniyi AA, Orebanjo O. Self-rated oral health status, oral health service utilization, and oral hygiene practices among adult Nigerians. *BMC Oral Health*. 2014;14:140. doi:10.1186/1472-6831-14-140

56. Oral Health Behavior Guide for Chinese Residents. Manual for health care providers (in Chinese). *Oral Care Product Industry*. 2016;26(05):55–61.

57. Sambunjak D, Nickerson JW, Poklepovic Pericic T, et al. WITHDRAWN: flossing for the management of periodontal diseases and dental caries in adults. *Cochrane Database Syst Rev*. 2019;4(4):Cd008829. doi:10.1002/14651858.CD008829.pub3

58. Walsh T, Worthington HV, Glenny AM, et al. Fluoride toothpastes of different concentrations for preventing dental caries. *Cochrane Database Syst Rev*. 2019;3(3):Cd007868. doi:10.1002/14651858.CD007868.pub3