

# Factors Impacting the Oral Health-related Quality of Life in Chinese Adults: Results from the 4th National Oral Health Survey

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**Objective:** To explore the clinical and socio-demographic factors influencing oral health-related quality of life (OHRQoL) of Chinese adults in the 4th National Oral Health Survey.

**Methods:** Multistage stratified cluster sampling and PPS method were used in sampling and 4720 adults aged 35 to 44 years were recruited. The study subjects completed a structured questionnaire in an interview and underwent a clinical examination. The questionnaire was a Putonghua version of the General Oral Health Assessment Index (GOHAI) and was completed by the interviewer on the site of the 4th National Oral Health Survey. Clinical examination was performed using the criteria recommended by the World Health Organization (WHO).

**Results:** The mean GOHAI score of the subjects was 54.42 (SD 6.01). Result of Poisson regression showed that subjects with a higher household income per capita, had lower DMFT, fewer missing teeth, had no unrepaired missing teeth, or not wearing a partial denture had higher GOHAI scores indicating better OHRQoL.

**Conclusion:** The OHRQoL of the adults in China was fair and was mainly influenced by dental caries, integrity of dentition and restoration of lost teeth. With limited resources and dental manpower in China, higher priority should be given to the prevention and treatment of the main cause leading to losing teeth.

**Key words:** adults, China, oral health related quality of life, the 4th National Oral Health Survey

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Research focussing on health-related quality of life has become an important aspect of epidemiological study in the past 20 years as the mode of medical science has changed from biomedical model to biological-psychological-social medical model. And there is the same trend in the area of oral health. Oral health-related quality of life (OHRQoL) became a hot topic in epidemic studies of oral health area in the past 10 years. However, most of the studies focused on a small number of people and drew conclusions from particular groups of people, which may not apply to others in another location. As a country with a vast territory, the nationwide status of OHRQoL and its influencing factors will provide important information and have a significant meaning in national oral health policymaking in China.

The 4th National Oral Health Survey of China was held in all 31 provinces, autonomous regions and municipalities of the mainland of China from 2015 to

2016. It is the first time that oral health-related quality of life (OHRQoL) has been investigated systematically using the General Oral Health Assessment Index (GOHAI) in the Chinese national survey and valuable data on OHRQoL in Chinese adults were collected.

The objective of the study was to investigate the status of OHRQoL in Chinese adults, and to explore the influencing factors of OHRQoL.

## Materials and methods

Data from the 4th National Oral Health Survey of China (2015-2016), covered five age groups. All 31 provinces, autonomous regions and municipalities of the mainland of China participated. People were selected using multistage stratified cluster sampling. Each province was divided into urban and rural areas; two towns and two counties in each province were randomly selected using the PPS (probability proportional to size sampling) method according to population size. For the next level of sampling, three streets or townships were randomly chosen from every city or county. One residents' committee in each street, or one village in each township, was randomly recruited from the list of residents, and PPS sampling method was also used at each step.

Based on the prevalence of periodontal disease in the 3rd National Oral Health Survey, a target sample of 144 participants in each adult age group was initially set per province, and a total of 4,464 people was set nationally. Among 35 to 44-year-olds, 4,410 subjects participated in clinical examinations and 4,271 completed the questionnaire. A total of 4,271 adults had complete data in all relevant variables and were included in the present analysis.

The study had the approval of the Stomatological Ethics Committee of the Chinese Stomatological Association (Approval no. 2014-003) and individuals signed informed consent forms to participate in the study. The Chinese Putonghua version of the General Oral Health Assessment Index (GOHAI)<sup>1</sup> was used to assess the OHRQoL of the adults. In addition, data on the socio-demographic background and oral health-related behaviour of the subjects were also collected through the questionnaire. Investigators conducted face-to-face interviews with all subjects on site after being trained before the survey on how to conduct interviews and how to answer queries from the subjects.

The clinical examinations were conducted by trained examiners. Disposable plane mouth mirrors attached to an intraoral LED light and CPI probes were used. Clinical examinations were conducted according to the basic methods and criteria recommended by the WHO.

To monitor intra-examiner reproducibility, duplicate examinations were carried out on a 5% random sample of the study subjects throughout the survey.

Each questionnaire was checked on site and the necessary information was obtained from the subject concerned if there were missing data or errors in the answers. The questionnaire included 12 items and each question has five response categories: (1 = always, 2 = often, 3 = sometimes, 4 = seldom, and 5 = never). GOHAI is intended to evaluate three aspects of oral health-related quality of life –physical functioning, pain and discomfort, and psychosocial functioning<sup>3</sup>. The GOHAI score ranges from 12 to 60, with a higher score indicating a better reported oral health-related quality of life<sup>3</sup>. Mann Whitney U-tests and Kruskal Wallis one-way ANOVA were used to assess the relationships between the GOHAI scores and the individual socio-demographic and clinical variables. Poisson regression was performed to assess the effects of the socio-demographic and clinical variables to the GOHAI score of the subjects. The independent variables were the subject's age, gender, and years of education, per capita household income, presence or not of gingival bleeding, existence of abnormal mucosa, number of missing teeth, DMFT score, number of teeth with root caries, and teeth with periodontal pocket (PPD) or teeth with PPD  $\geq$  6mm. Education years were categorised into 0 to six, seven to nine, 10 to 12 and  $\geq$  13. Six years of education refers to primary school, nine years of education refers to junior secondary school and 12 years of education to senior secondary. Household income per capita was categorised into three categories: less than 10,000 RMB, 10,000 to 20,000 RMB, and more than 20,000 RMB. Data analyses were performed using the statistics software SPSS 20.0 and the level of statistical significance was set at 0.05.

## Results

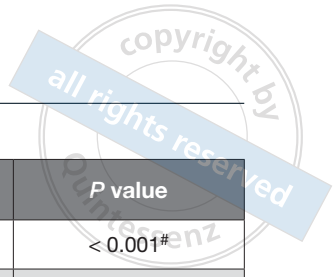
The whole sample involved 4,271 subjects aged 35 to 44. Mean scores for GOHAI and its domains are presented in Table 1. The surveyed adults had a GOHAI score that ranged from 12 to 60, with the average score being 54.42 (SD 6.01). The mean (SE) weighted total GOHAI score was 55.02 (0.02). Gender, per capita household income, education years, abnormal oral mucosa, fixed denture, removable partial denture, irregular denture, unrepaired missing teeth, existence of periodontal pocket and deep periodontal pocket, existence of calculus, DMFT, number of missing teeth, number of teeth with unfilled root caries and existence of teeth with attachment loss had a statistically significant relationship with the GOHAI

**Table 1** Mean GOHAI and its domains in Chinese adults in the 4th National Oral Health Survey (N = 4,271).

	Unweighted			Weighted	
	Mean (SD)	Median (IQR)	Potential range of values	Mean (SE)	Median (IQR)
Total GOHAI	54.42 (6.01)	56.00 (7.00)	12-60	55.02 (0.02)	56.00(6.00)
Physical functioning	13.61 (2.02)	15.00 (2.00)	3-15	13.73 (0.01)	15.00(2.00)
Pain and discomfort	17.64 (2.44)	18.00 (4.00)	4-20	17.79 (0.01)	18.00(3.00)
Psychosocial functioning	23.17 (2.78)	25.00 (3.00)	5-25	23.50 (0.01)	25.00(2.00)

**Table 2** Descriptive analysis of the characteristics of Chinese adults in the 4th National Oral Health Survey (N = 4,271).

Variables	N (%)	Total GOHAI Weighted Mean (SE)	P value
Gender			0.002 <sup>#</sup>
M	2,124 (49.7)	55.33 (5.26)	
F	2,147 (50.3)	54.71 (5.35)	
Household income per capita (¥10,000)			0.002 <sup>*</sup>
< 1.0	1,819 (54.5)	54.83 (5.60)	
1.0-2.0	976 (29.6)	55.25 (5.16)	
> 2.0	519 (15.9)	55.57 (4.76)	
Education years			0.005 <sup>*</sup>
≤ 6	914 (21.1)	54.59 (5.96)	
7-9	1,349 (31.6)	55.30 (5.05)	
10-12	832 (19.5)	55.05 (5.09)	
≥ 13	1,189 (27.8)	55.01 (5.22)	
Abnormal mucosa			0.025 <sup>#</sup>
N	4,091 (95.8)	55.06 (5.30)	
Y	180 (4.2)	54.02 (5.64)	
Full denture			> 0.05 <sup>#</sup>
N	4,235 (99.2)	55.02 (5.31)	
Y	36 (0.8)	55.42 (5.53)	
Implant			> 0.05 <sup>#</sup>
N	4,263 (99.8)	55.03 (5.31)	
Y	7 (0.2)	50.14 (6.84)	
Fixed denture			< 0.001 <sup>#</sup>
N	3,593 (84.4)	55.17 (5.27)	
Y	678 (15.6)	54.22 (5.48)	

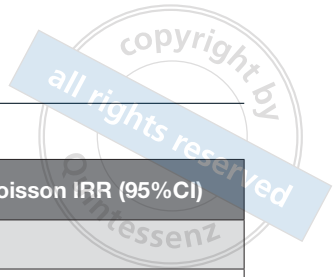


Variables	N (%)	Total GOHAI Weighted Mean (SE)	P value
Partial denture			< 0.001#
N	4,152 (97.2)	55.09 (5.23)	
Y	119 (2.8)	52.28 (7.34)	
Irregular denture			0.002#
N	4,147 (97.2)	55.06(5.28)	
Y	124 (2.8)	53.48 (6.12)	
Unrepaired missing teeth			< 0.001#
N	3,491 (82.3)	55.37(5.08)	
Y	780 (17.7)	53.39 (6.00)	
Deep periodontal pocket			0.009#
N	3,982 (93.2)	55.07 (5.28)	
Y	289 (6.8)	54.28 (5.73)	
Periodontal pocket			0.001#
N	2,031 (47.6)	55.28 (5.14)	
Y	2,240 (52.4)	54.78 (5.46)	
DMFT			< 0.001*
< 5	2,570 (60.2)	55.82 (4.66)	
5-9	1,315 (30.8)	54.30 (5.50)	
≥ 10	386 (9.0)	51.82 (7.16)	
Missing teeth			< 0.001*
0-2	2,462 (57.6)	55.26 (5.09)	
3-4	1,305 (30.6)	55.13 (4.99)	
>5	504 (11.8)	54.49 (5.85)	
Number of teeth with root caries			< 0.001*
0	3,887 (90.2)	55.20 (5.19)	
1	288 (6.6)	53.72(5.95)	
≥ 2	146 (3.2)	52.64 (6.25)	
Bleeding gingival			> 0.05
N	530 (12.5)	55.24 (5.38)	
Y	3,736 (87.5)	54.99 (5.31)	
Attachment loss			< 0.001#
N	2,874 (67.3)	55.26 (5.15)	
Y	1,397 (32.7)	54.51 (5.62)	

#Mann Whitney U test, \*Kruskal Wallis test.

**Table 3** Bivariate and Multivariate linear regression analysis of determinants of GOHAI in Chinese adults in the 4th National Oral Health Survey.

Variables	Bivariate Poisson IRR (95%CI)	Multivariate Poisson IRR (95%CI)
Gender		
F	0.99 (0.98,1.00)*	1.00 (0.99,1.01)
M	1.00 (Reference)	1.00 (Reference)
Household income per capita(10000yuan)		
> 2.0	1.02 (1.00,1.03)*	1.02 (1.01,1.04)*
1.0-2.0	1.01 (1.00,1.02)*	1.01 (1.00,1.02)
< 1.0	1.00 (Reference)	1.00 (Reference)
Education years		
≥ 13	1.01 (1.00,1.02)	0.99 (0.97,1.00)
10-12	1.01 (1.00,1.03)	0.99 (0.98,1.01)
7-9	1.02 (1.01,1.03)*	1.00 (0.99,1.02)
≤ 6	1.00 (Reference)	1.00 (Reference)
Abnormal mucosa		
Y	0.98 (0.96,1.00)	0.98 (0.96,1.01)
N	1.00 (Reference)	1.00 (Reference)
Fixed denture		
Y	0.98 (0.97,0.99)*	1.00 (0.99,1.01)
N	1.00 (Reference)	1.00 (Reference)
Partial denture		
Y	0.94 (0.91,0.99)*	0.96 (0.93,0.99)*
N	1.00 (Reference)	1.00(Reference)
Irregular denture		
Y	0.97 (0.95,0.99)*	1.00 (0.97,1.01)
N	1.00 (Reference)	1.00 (Reference)
Unrepaired missing teeth		
Y	0.96 (0.95,0.99)*	0.98 (0.97,1.00)*
N	1.00 (Reference)	1.00 (Reference)
Deep periodontal pocket		
Y	0.98 (0.96,1.00)*	0.99 (0.97,1.01)
N	1.00 (Reference)	1.00 (Reference)
Periodontal pocket		
Y	0.99 (0.98,1.00)*	0.99 (0.98,1.00)
N	1.00 (Reference)	1.00 (Reference)



Variables	Bivariate Poisson IRR (95%CI)	Multivariate Poisson IRR (95%CI)
Attachment loss		
Y	0.98 (0.98,0.99)*	1.00 (0.99,1.01)
N	1.00 (Reference)	1.00 (Reference)
Number of roots with caries		
≥ 2	0.95 (0.92,0.97)*	0.99 (0.97,1.02)
1	0.97 (0.95,0.99)*	0.99 (0.97,1.01)
0	1.00 (Reference)	1.00 (Reference)
DMFT		
≥ 10	0.91 (.90,0.93)*	0.91 (0.90,0.93)*
5-9	0.97 (0.96,0.98)*	0.97 (0.96,0.98)*
< 5	1.00 (Reference)	1.00 (Reference)
Missing teeth		
≥ 5	0.98 (0.97,0.99)*	0.98 (0.97,1.00)*
3-4	1.00 (0.99,1.01)	1.01 (1.00,1.03)
0-2	1.00 (Reference)	1.00 (Reference)

\*P < 0.05.

score of the adults in bivariate analysis (Table 2). In the final model of Poisson regression, socio-demographic factors including household income per capita, clinical variables including DMFT, use of removable partial denture, unrepaired missing teeth, and number of missing teeth had a significant effect on the adults' GOHAI score (Table 3).

Subjects with a higher household income per capita, lower DMFT, fewer missing teeth, who were without unrepaired missing teeth or without a removable denture tended to have a higher GOHAI score.

**Discussion**

GOHAI and OHIP-14 are well established instruments in OHRQoL studies and are widely used in studies in adults. However, OHIP-14 places greater emphasis on psychological and behavioural outcomes, while GOHAI is better than OHIP-14 in detecting the common outcomes of oral disorders such as functional limitation<sup>4</sup>. In the nationwide survey, the GOHAI was chosen for this study as the functional impacts of oral disorders would be of greater concern.

The study found that OHRQoL of Chinese adults was mainly influenced by the most prevalent oral health

disease, i.e. dental caries. Although almost all the clinical variables measuring adults' oral health status was associated with their GOHAI score in bivariate analysis, only having unrepaired missing teeth, using a partial denture, number of missing teeth and DMFT remained in the final multivariate analysis model.

There is a negative association of DMFT and the GOHAI score in the study. Adults with a higher DMFT score had a lower GOHAI score than the others with lower DMFT. The trend is accordant with other studies in the area<sup>5,6</sup>. A higher DMFT score means more teeth with dental caries, which may affect a person's normal function of oral cavity and dentition, leading to an effect on their oral health-related quality of life.

Having missing teeth was negatively related to the GOHAI score in the study. Missing teeth in a posterior area may influence one's chewing ability, while missing anterior teeth may affect one's appearance or pronunciation. Impaired function of dentition led to lower GOHAI scores. Dental caries and periodontal disease were the main reason for missing teeth in adults<sup>7,8</sup>, and prevention and treatment of these diseases may increase the oral health-related quality of life for Chinese adults.

In the study, we found that adults with unrepaired missing teeth had a lower GOHAI score than those

who did not. Unrepaired missing teeth means functional limitation and can lead to a poor oral health-related quality of life<sup>9</sup>. Another finding was that adults wearing a partial denture had a lower GOHAI score than those who were not. The finding was contradictory to some studies related to partial denture and OHRQoL<sup>10,11</sup>. However, the patients in those studies were older than the subjects in our survey and their expectations of prosthodontic treatment may be lower than those of younger people. Other studies also found that wearing a denture to substitute losing teeth may not necessarily improve a person's OHRQoL, and that only patients who are satisfied with their dentures have a better OHRQoL<sup>12</sup>. Unsatisfied denture wearers may have a worse OHRQoL because of problems related to partial dentures.

Social economic variables such as household income per capita were found to be related to GOHAI scores. Subjects earning more than 20,000 RMB household income per capita had the highest GOHAI, while those with less than 10,000 RMB household income per capita had the lowest. It is a common phenomenon that more deprived people had a lower oral-health related quality of life than less deprived people as they may have access to fewer oral health-related resources. The finding is reasonable and agreed with other studies<sup>13,14</sup>. On the contrary, levels of education did not relate to the GOHAI score in the final multivariate model. Government policy-makers need to give more priority to people with less wealth in the distribution of dental resources.

## Conclusion

In summary, adults aged 35 to 44 years who took part in the 4th National Oral Health Survey had a fair OHRQoL and their average GOHAI was 54.42. Dental caries and loss of teeth were the major impactors of adults' OHRQoL. With limited resources and dental manpower in China, higher priority should be focused on the prevention and treatment of major oral health diseases, i.e. dental caries and periodontal disease.

## Conflicts of interest

The authors reported no conflicts of interest related to this study.

## Author contribution

Drs Qing Hui ZHI, Yan ZHOU and Ye TAO participated in data analysis and manuscript preparation; Drs Xing WANG, Xi Ping FENG, Bao Jun TAI, De Yu HU, Huan Cai LIN, Bo WANG, Yan SI, Chun Xiao WANG, Shu Guo ZHENG, Xue Nan LIU, Wen Sheng RONG, Wei Jian WANG trained the investigators, designed and supervised the survey; Dr Huan Cai LIN participated in study design and manuscript revision.

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