

# Oral health knowledge, attitudes and behaviour of adults in China

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**Objectives:** To describe oral health behaviour, illness behaviour, oral health knowledge and attitudes among 35–44 and 65–74-year-old Chinese; to analyse the oral health behaviour profile of the two age groups in relation to province and urbanisation, and to assess the relative effect of socio-behavioural risk factors on dental caries experience. **Methods:** A total number of 4,398 35–44-year-olds and 4,399 65–74-year-olds were selected by multistage stratified cluster random sampling which involved 11 provinces in China. Data were collected by self-administered structured questionnaires and clinical examinations (WHO criteria). **Results:** 32% of the 35–44-year-olds and 23% of the 65–74-year-olds brushed at least twice a day but only 5% used fluoridated toothpaste; 30% and 17% respectively performed 'Love-Teeth-Day' recommended methods of tooth brushing. A dental visit within the previous 12 months was reported by 25% of all participants and 6% had a dental check-up during the past two years. Nearly 15% of the subjects would visit a dentist if they experienced bleeding from gums; about 60% of the subjects paid no attention to signs of caries if there was no pain. Two thirds of the urban residents and one fifth of the rural participants had economic support for their dental treatment from a third party, either totally or partially. Significant variations in oral health practices were found according to urbanisation and province. At age 35–44 years 43% of participants had daily consumption of sweets against 28% at age 65–74 years. Dental caries experience was affected by urbanisation, gender, frequency, time spent on and method of tooth brushing. Knowledge of causes and prevention of dental diseases was low with somewhat negative attitudes to prevention observed. **Conclusion:** Systematic community-based oral health promotion should be strengthened and preventive-oriented oral health care systems are needed, including promotion of further self-care practices and the use of fluoridated toothpaste.

*Key words:* Adult oral health, caries, periodontal disease, prevention, China

During the past two decades, a dramatic reduction in the prevalence of dental caries has taken place in children and adolescents of most western industrialised countries and this is primarily ascribed to changing living conditions, adoption of healthy lifestyles, improved self-care practices, effective use of fluorides and establishment of preventive oral care programmes<sup>1–7</sup>. In addition, the oral health status among adults has shown improvement in that more individuals are maintaining their natural teeth<sup>8,9</sup>. In parallel to the changing oral disease patterns, oral health awareness, dental knowledge and positive health attitudes of the general public

have grown<sup>10–12</sup>. In contrast, increasing levels of dental caries have been observed in several developing countries, especially in those countries where preventive programmes have not been implemented<sup>13</sup>. In China, a number of surveys on the oral health status of adults were conducted recently in different provinces or local communities. Accordingly, the mean caries experience of 35–44-year-olds was reported at the level of 0.4 to 5.0 DMFT<sup>14–16</sup> and periodontal conditions seem poor in the middle-aged and the elderly<sup>15–17</sup>. Moreover, these local studies indicated that use of oral health services is mostly symptoms-oriented and regular oral hygiene

habits are infrequent. Previous studies on oral health habits, knowledge and attitudes of the adult population have been carried out in urban areas of some provinces<sup>14,18–20</sup>. However, oral health behaviour data of adults are scarce for rural population groups and no systematic data on oral health behaviour, knowledge and attitudes are available at national level. Analysis of oral health behaviour of the population is essential for the specification of oral health messages as well as for the development of behaviour modification strategies relevant to China. The present study was carried out in order to provide nationwide information for the analysis of oral health status and oral health knowledge, attitudes and behaviour of the Chinese population aged 12, 18, 35–44, and 65–74 years. The results from the clinical investigations of oral health conditions and the oral health behaviour profile of children and adolescents have been published separately<sup>15,21</sup>. The objectives of the present report are: to describe the pattern of oral health practices, illness behaviour, oral health knowledge and attitudes among 35–44-year-old and 65–74-year-old Chinese at the national level; to analyse the oral health behaviour profile of the two adult age groups in relation to province and urbanisation; to assess the relative effect of socio-behavioural and risk factors on dental caries experience.

### Study population and methods

This study was part of the 2nd national oral health survey and the methodology has been detailed in previous reports<sup>15,16</sup>. The participants of this comprehensive survey were chosen by multistage cluster sampling and covered individuals within the WHO standard ages 35–44 and 65–74 years. At the first sampling level, 11 provinces being representative of the nation were chosen. Within each province a total number of 400 subjects in each age group was selected at random and participants were identified from three different locations in urban and rural areas. The final sample was balanced by gender and urbanisation and comprised 8,797 participants, i.e. at age 35–44 years, 2,200 individuals from urban and 2,198 from rural areas; and at age 65–74 years, 2,199 individuals from urban and 2,200 from rural areas.

As described in the previous report, oral epidemiological data were collected by clinical examinations according to WHO methodology and criteria<sup>22</sup>. Dental caries experience (DMFT) was registered by calibrated examiners under natural daylight with use of mouth mirrors and WHO standard probes. In addition, structured questionnaires were used for self-administration whereby the participants were asked to provide information on demographic background, oral health knowledge and attitudes, self-care practices, and utilisation of dental services. The questionnaires were filled out by the respondents themselves and the procedure

was supervised by Chinese survey staff, specially trained for this activity. The supervisors had at least tertiary education level and they were carefully instructed in the meaning of questions. Prior to the data collection the questions were pre-tested in comparable groups of adults in order to assess reliability and validity. In each province, one or two senior dentists were in charge of the organisation of clinical examinations as well as the administration of questionnaires. Tests of reliability of answers were carried out in each province from a sub-sample of participants who were given the same questionnaire 20–30 days after completion of the initial questionnaire and consistency rates of at least 70% were achieved.

Processing of data was performed by use of EPI-INFO v5.0 (Chinese version) whereby data were checked for logical errors. The data entry took place in every province and the local staff members were carefully trained on how to use the data input programme. Double data entry was carried out and the files were then transferred to the National Committee for Oral Health in Beijing for central data analysis. The national data file was constructed by the Department for Epidemiology, Peking University, Faculty of Medical Science, Beijing, and the data were finally converted for analysis by means of the Statistical Package for the Social Sciences (SPSS 10.0) in the WHO Collaborating Centre for Community Oral Health Programmes and Research, University of Copenhagen. Bivariate and multivariate analyses of the data on oral health knowledge, attitudes and behaviour were based on frequency distributions. The Chi-square test was used in the statistical evaluation of proportions in the bivariate analyses. Multiple dummy regression analyses were performed for the assessment of the relative effect of behavioural factors on dental caries experience. The dental caries experience index (DMFT) and the components (DT, MT, FT) were dependent variables in the analyses and the t-test was used for statistical evaluation of the regression coefficients.

## Results

### Tooth brushing

At the national level, 85% of 35–44 year-olds and 71% of 65–74 year-olds brushed their teeth at least once a day. As shown in *Table 1*, about half of the middle-aged and one third of the elderly living in urban areas brushed their teeth at least twice a day, while in rural areas this habit was less frequent. Females performed tooth brushing at least twice a day more often than did males (females *vs* males: age 35–44 years: 39%: 26%,  $p < 0.001$ ; age 65–74 years: 26%: 21%,  $p < 0.01$ ). Nearly half the participants in urban areas against about one fifth of the rural participants brushed their teeth in the evening, while for the study population overall the

**Table 1** The percentages of 35–44 and 65–74-year-old Chinese according to frequency of tooth brushing, occasion of brushing, time spent on brushing, and use of toothpaste, in relation to location

	35–44 years			65–74 years		
	Urban (n=2200)	Rural (n=2088)	Total (n=4288)	Urban (n=2135)	Rural (n=1607)	Total (n=3742)
<i>Frequency of tooth brushing</i>						
seldom or no brushing	5	23	14	10	47	29
brushing once a day	46	61	53	52	44	48
brushing at least twice a day	48 ***	16	32	37 ***	10	23
<i>Occasion of tooth brushing</i>						
in the morning	95	92	93	91	93	92
in the evening	54 ***	27	41	46 ***	18	34
after meals	9	6	8	9	4	7
after dessert/sweets	9	6	8	9	4	7
<i>Time spent on brushing teeth</i>						
less than 3 min	93	84	88	79	82	81
3 min or more	8	16 ***	12	21 *	18	20
<i>Use of toothpaste</i>						
non-fluoridated	93	96	94	94	92	93
fluoridated	7 ***	4	6	5 ***	3	4

\*  $p < 0.05$ ; \*\*\*  $p < 0.001$ **Table 2** The distribution (percentage) of 35–44 and 65–74-year-old Chinese according to method of tooth brushing, preference of type of toothbrush and the intervals for exchange of toothbrush, in relation to location

	35–44 years			65–74 years		
	Urban (n=2200)	Rural (n=2088)	Total (n=4288)	Urban (n=2135)	Rural (n=1607)	Total (n=3742)
<i>Method of brushing</i>						
horizontal	41	59 ***	49	51	71 ***	60
LTD-recommended methods	38 ***	21	30	24 ***	8	17
no systematic methods	22	21	21	24	22	23
<i>Preference of type of toothbrush</i>						
big head, hard bristles	25	46 ***	35	38	61 ***	48
big head, soft bristles	30 ***	23	27	21 ***	13	18
small head, hard bristles	13	12	13	14	10	12
small head, soft bristles	25 ***	15	20	22 ***	12	17
pig bristles	3	3	3	4	3	3
colour	4	2	3	1	1	1
<i>Intervals for exchange of toothbrush:</i>						
1–3 months	52 ***	33	43	36 ***	19	29
4–6 months	32	28	30	33	24	30
7–12 months	11	17	14	18	23	20
more than one year	5	23	13	13	35	22

\*\*\*  $p < 0.001$ 

most frequent occasion for tooth brushing was in the morning. The majority of the respondents spent less than three minutes on brushing their teeth, however, rural participants of age 35–44 years and urban participants of age 65–74 years tended to spend more time on brushing. In general, the use of fluoridated toothpaste was rare, especially for respondents living in rural areas.

The Chinese 'Love Teeth Day' (LTD) campaign has recommended certain methods of brushing the teeth, i.e. vertical technique, rolling or Bass-method. Such methods were performed more frequently by urban participants whereas the horizontal brushing technique was common in rural areas (Table 2). Toothbrushes with soft bristles were preferred by urban participants

but nearly one third of urban respondents also appreciated big-headed toothbrushes. Toothbrushes with big heads and hard bristles were often used in rural areas and by the elderly. Exchange of toothbrushes at 1–3 monthly intervals was reported more often among the middle-aged, particularly in urban areas. The reason for exchanging the toothbrush was mainly deformation of the bristles rather than a new toothbrush design being available on the market. About 20% of respondents claimed to exchange their toothbrushes regularly and this was more often indicated by urban participants.

The majority of the respondents stated that tooth brushing was carried out in order to prevent dental caries and this was particularly the case in urban areas

**Table 3** The percentages of 35–44 and 65–74-year-old Chinese according to the reason for brushing versus not brushing the teeth in relation to location

	35–44 years			65–74 years		
	Urban	Rural	Total	Urban	Rural	Total
<i>Reasons for brushing teeth:</i>	(n=2200)	(n=2198)	(n=4398)	(n=2199)	(n=2199)	(n=4398)
clean, bright teeth	37	39	38	28	29	28
prevention of caries	60 ***	49	55	53 ***	26	39
prevention of bleeding gums	39	31	35	26	12	19
prevention of oral ulcers	41 ***	27	34	25 ***	10	18
to get rid of foul breath	70	78 ***	74	78 **	74	76
to set good example to others	8	6	7	5	4	5
<i>Reasons for not brushing teeth:</i>	(n=2111)	(n=2174)	(n=4285)	(n=2112)	(n=2173)	(n=4285)
too much bother	7	21 ***	14	9	23 ***	16
too exhausting to brush teeth	14	24 ***	19	8	26 ***	17
no time for brushing	14	37 ***	26	12	29 ***	20
useless, good teeth are hereditary	2	6	4	2	7	5
teeth are not dirty	2	4	3	2	8	5
somebody else will laugh at me	1	1	1	1	2	1
gums bleeding when brushing	7	8	8	6	5	5
no money for brush and toothpaste	1	3	2	1	7	4
no such habit from childhood	2	7	4	4	26 ***	15
don't know of any benefits from brushing	2	5	4	3	12	7

\*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

**Table 4** The percentages of 35–44 and 65–74-year-old Chinese with certain self care practices in oral health, according to provinces and location

Province	Tooth brushing at least twice a day (n=8797)				Use/recommended methods of brushing (n=8030)				Exchange toothbrush regularly (n=8030)			
	35–44 yrs		65–74 yrs		35–44 yrs		65–74 yrs		35–44 yrs		65–74 yrs	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Beijing	54	6	39	8	52	14	27	12	37	8	25	11
Shanghai	45	19	40	5	32	16	15	1	66	37	51	33
Tianjin	53	21	34	14	34	36	23	11	66	37	16	8
Gansu	41	5	27	1	50	27	37	21	31	34	22	47
Shandong	29	6	41	4	40	20	37	9	31	34	11	6
Yunnan	47	21	43	16	33	24	21	6	17	6	20	23
Liaoning	33	11	27	8	42	24	32	14	37	16	20	9
Zhejiang	46	20	31	14	29	16	14	1	24	9	12	5
Hubei	56	20	49	19	40	14	31	11	26	19	30	16
Guangdong	65	27	41	4	30	10	12	3	29	9	9	2
Sichuan	66	24	40	15	38	33	20	7	33	11	23	8
Total	48	16	37	10	38	21	24	8	31	16	22	14

(Table 3). Prevention of foul breath was also a frequent answer, whereas prevention of bleeding gums was reported less often. The dominant reasons for not brushing the teeth were either that “I have no time for brushing”, “it is too exhausting to brush the teeth” or that “brushing bothers me too much” and such answers were more frequent for rural participants. Among elderly rural participants one quarter stated “I had no such habit from childhood”.

Table 4 summarises the differences in tooth brushing habits according to province and location. For the younger age group, participants of the Guangdong and Sichuan provinces had high scores for tooth brushing at least twice a day in both urban and rural areas, while for the elderly, the highest score was observed in Hubei province. In all provinces, statistically significant differences in tooth

brushing habits were found between urban and rural areas ( $p < 0.001$ ). LTD recommended methods of tooth brushing were most frequently reported in the Beijing province, in the province of Gansu for urban 35–44-year-olds and in the provinces of Shandong and Gansu for urban 65–74-year-olds. The differences between urban and rural respondents in performance of the LTD-recommended methods of brushing were statistically significant ( $p < 0.001$ ), except for the Tianjin and Yunnan provinces. In general, the practice of exchanging toothbrushes regularly was more common in urban than rural areas of both age groups but with some variation by province. Finally, the daily use of fluoridated toothpaste showed only minor variation by province but somewhat higher proportions were found for the Guangdong (9%) and Sichuan (12%) provinces.

### Other self care practices

A few respondents declared that they regularly made use of dental floss (4%) and regular use of toothpicks after meals was reported by 36%. Moreover, 14% of the participants answered that they regularly rinsed their mouth with tea, 8% with salt water and 1% with fluoridated water.

### Oral health knowledge and attitudes

In all, 47% of the adults reported that they received oral health information from radio or television programmes while 30% were informed from reading newspapers or magazines. Posters in hospitals or instruction from dentists were indicated as sources of information by 15% and 21%, respectively. Furthermore, oral health education in school and local health campaigns were mentioned by 10% of the participants. All sources of oral health information were reported more often in urban areas than in rural areas ( $p < 0.001$ ).

Among all adults, 56% held the attitude that tooth loss is natural and inevitable. High proportions of respondents stated that they had never heard about dental plaque (35–44 years: 74%, 65–74 years: 92%); in all, 67% knew about the harmful effect of sugars in relation to dental caries while 16% answered that dental plaque is the main cause of periodontal disease. With respect to prevention of dental diseases, 5% of

the participants responded that fluoride may prevent dental caries while 86% had no knowledge about fluoride; 16% indicated that tooth brushing and flossing can prevent gingivitis/periodontal disease and 78% answered “don’t know” to this question. In addition, 62% claimed that mouth rinsing is a most effective method of tooth cleaning. Finally, 61% of the respondents declared that dental check-ups at least once a year was a good idea.

### Utilisation of dental services

Table 5 illustrates the utilisation of dental services according to age and location. In urban areas, 68% of 35–44 year-olds and 83% of 65–74 year-olds had made at least one dental visit during their lifetime whereas significant proportions of rural participants in both age groups had never seen a dentist. About one quarter of the adults had seen a dentist within the past 12 months and visits were somewhat more frequent among urban than rural respondents. Also, a recent dental visit was more often found among females (26%) than males (19%) ( $p < 0.001$ ). Preventive dental visits were infrequent but were relatively more common among urban participants; no difference in use of preventive dental services was noted according to gender. In 35–44-year-olds, the need for dental fillings was the main reason of the last dental visit for participants living in urban areas whereas toothache was

**Table 5** The percentages of 35–44 and 65–74-year-old Chinese according to how many times they had seen a dentist, time since last dental visit, preventive services received within the past two years, and reason for last dental visit, in relation to location

	35–44 years			65–74 years		
	Urban	Rural	Total	Urban	Rural	Total
<i>Number of times having seen a dentist during lifetime</i>	(n=2003)	(n=2069)	(n=4072)	(n=1830)	(n=1960)	(n=3790)
never	32	53 ***	43	17	43 ***	30
1–2 times	25	23	24	19	19	19
3 or more times	42 ***	25	33	64 ***	39	51
<i>Time since last visit to the dentist</i>						
less than 1 year	28 ***	23	26	29 ***	16	23
1–2 years ago	23	18	21	26	21	23
3 or more years ago	49	59	54	46	64	54
<i>Preventive services received during the past two years</i>	(n=927)	(n=673)	(n=1600)	(n=1097)	(n=664)	(n=1761)
check-up of teeth	8 ***	3	6	10 ***	1	6
caries prevention measures	11 ***	4	8	6 ***	1	4
scaling of teeth	14 ***	5	10	7 ***	1	5
<i>Reason for last dental visit</i>	(n=1321)	(n=966)	(n=2287)	(n=1507)	(n=1091)	(n=2598)
check-up	2	2	2	2	–	1
scaling	5	2	4	2	–	1
filling	31 ***	18	25	16	6	11
extraction	24	27	25	30	35	32
toothache	19	31 ***	24	22 ***	21	22
getting a new denture	6	8	7	17	28 ***	21
repair of denture	1	1	1	7	6	6
tooth trauma	1	1	1	–	–	–
gum bleeding, swollen, purulence	6	6	6	4	2	3
problem with my wisdom tooth	4	3	4	1	1	1

\*\*\*  $p < 0.001$

**Table 6** The percentages of 35–44 (n=4072) and 65–74-year-old (n=3790) Chinese who saw the dentist within the past year and had scaling of teeth during the previous two years according to province and location

Province	Saw a dentist within the last year				Scaling of teeth during the previous two years			
	35–44 yrs		65–74 yrs		35–44 yrs		65–74 yrs	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Beijing	41	25	29	20	28	6	10	3
Shanghai	32	24	25	24	7	6	3	0
Tianjin	42	32	36	32	6	4	5	0
Gansu	24	13	32	6	15	1	14	0
Shandong	19	14	32	10	5	5	7	2
Yunnan	25	23	29	16	10	9	7	1
Liaoning	27	17	27	12	16	3	4	3
Zhejiang	26	23	26	15	9	4	9	4
Hubei	22	28	37	19	9	8	8	4
Guangdong	33	33	26	20	21	10	6	0
Sichuan	21	38	21	10	22	10	4	0
Total	28	23	29	16	14	5	7	1

**Table 7** The percentages of 35–44 and 65–74-year-old Chinese who reported the source of dental care and payment method for dental care, according to location

	35–44 years			65–74 years		
	Urban	Rural	Total	Urban	Rural	Total
<i>Receiving dental care from</i>	(n=1656)	(n=1340)	(n=2996)	(n=1946)	(n=1581)	(n=3527)
province dental hospital	10 ***	7	36	65	7	39
county dental hospital or clinic	32 **	28	30	37 ***	20	30
county hospital "Five sense organs dept."	11	11	11	8	8	8
rural county hospital dental dept.	6	39 ***	21	7	44 ***	23
urban private dental office	5	4	5	11 ***	4	8
rural private dental office	1	12 ***	6	1	18 ***	8
rural general medical practitioner	1	3	2	1	3	2
dentist without licence	2	4 **	3	3	11 ***	7
<i>Payment method for dental care</i>	(n=2198)	(n=2196)	(n=4394)	(n=2195)	(n=2187)	(n=4382)
payment arranged by employer	11	4	7	32	7	19
employer pays part of costs	44 ***	12	28	30 ***	7	18
half of costs paid by patient	11	5	8	6	3	5
costs paid by patient	30	79 ***	55	28	83 ***	55
paid by health insurance	5 ***	1	3	5 ***	1	2

\*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

often reported in rural areas. The need for tooth extraction was another frequent indication of a dental visit in both urban and rural areas. For individuals aged 65–74 years, toothache and tooth extraction were the primary reasons of the last dental visit in both areas, and the need for dentures was often reported as well. The difference between genders as regards the reasons for the last dental visit was small.

The variation across provinces in the use of professional dental services by Chinese adults is demonstrated in *Table 6*. Relatively higher proportions of participants in Beijing and Tianjin had seen a dentist within the past year. Moreover, nearly one third of the urban 35–44 year-olds in Beijing had received scaling of teeth during the previous two years.

### Source and payment of dental service

*Table 7* presents the findings as regards the sources and

the payment method for dental care. In urban areas, the province dental hospital was the most frequently used facility while the county hospital dental department was used in most in rural areas. Dentists without licence and general medical practitioners were occasionally the dental care source in rural areas. More than half of the urban participants had third party payment for their dental care, either totally or partly. In contrast, dental care expenditures were mainly covered by the patients themselves in rural areas. About 5% of participants had dental service on health insurance and this was found almost only in urban areas.

### Illness behaviour

*Table 8* shows how Chinese adults tend to react in the case of bleeding from the gums or symptoms of dental caries. The most frequent response to bleeding gums was that brushing the teeth would be intensi-

**Table 8** The percentages of 35–44 and 65–74-year-old Chinese who reported certain actions when having bleeding from gums or symptoms of caries, according to location (n=8797)

	35–44 years (n=4398)			65–74 years (n=4399)		
	Urban	Rural	Total	Urban	Rural	Total
<i>If gums are bleeding what do you do</i>						
stop brushing	11	14 **	13	13 ***	9	11
pay more attention to gums when brushing	25 ***	18	22	16 ***	9	13
brush more frequently	33	37 *	35	29	26	27
go to see a dentist	18 ***	13	15	19 ***	7	13
ignore bleeding	27	27	27	18	22 **	20
never had this problem	20	25 ***	23	38	40	39
don't know what to do	16	19 **	18	16	27 ***	22
<i>If having signs of tooth decay what do you do</i>						
don't care if no pain	52	61 ***	56	55	69 ***	62
take pills for pain relief	30	40 ***	35	32	46 ***	39
just try to cope with the problem	28	37 ***	32	28	51 ***	40
go and see a dentist only when in pain	45 **	41	43	54 ***	36	45
go and see a dentist immediately for filling	19 ***	9	14	13 ***	3	8
go and see a dentist for extraction of tooth	9 *	7	8	7	6	7
brush teeth more often when having pain	13	14	13	12	10	11

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ **Table 9** The percentages of 35–44 and 65–74-year-old Chinese reporting daily consumption of tea, alcohol, and cigarettes, and frequency of eating sweets, in relation to location

	35–44 year olds			65–74 year olds		
	Urban	Rural	Total	Urban	Rural	Total
<i>Do you have following daily habits</i>	(n=2200)	(n=2198)	(n=4398)	(n=2199)	(n=2200)	(n=4399)
drink tea	62 **	57	60	62 **	57	60
drink alcohol	31	40 ***	35	27	35 ***	31
smoking cigarettes	33	40 ***	37	30	43 ***	36
chewing tobacco	1	2 **	1	1	1	1
<i>Frequency of eating sweets</i>	(n=1876)	(n=1822)	(n=3698)	(n=1924)	(n=1873)	(n=3797)
once a day	32 ***	18	25	23 ***	11	17
2 times or more per day	23 ***	13	18	15 ***	8	12

\*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ 

fied. However, several participants reported that they never had such symptoms or that they did not know what to do about this problem. Further, about half the young adults and nearly two thirds of the elderly answered that they would not pay attention to signs of tooth decay unless in pain. Four out of ten participants would seek help from a dentist only when in pain.

### Lifestyles

In the 35–44-year-olds, about four out of ten participants consumed sweets on a daily basis whereas the figure was lower among the 65–74-year-olds (Table 9). For both age groups, the frequency of eating sweets was higher in urban than rural areas. Daily consumption of tea was indicated by 6 out of 10 respondents and also somewhat more often in urban than rural areas. One third of the Chinese adults reported being regular smokers and another one third reported drinking alcohol daily. These habits were relatively more frequent in rural areas. However, the differences in lifestyles between genders were most pronounced. In

all, 62% of men against 11% of women were smokers ( $p < 0.001$ ); 55% of men regularly had alcohol compared with 11% of women ( $p < 0.001$ ).

### Multivariate analysis of dental caries

Table 10 shows the results of the multivariate regression analyses of dental caries experience and the regression analyses were carried out for the index components separately. The most important factors for caries experience were urbanisation, gender, frequency of dental visits, tooth brushing habits, time spent on tooth brushing and methods of brushing.

### Discussion

The present study is a part of the second national oral health survey and intended to provide systematic information about the oral health behaviour of adults living in rural and urban areas of China. The oral health behaviour profile of the child population has been analysed in previous local<sup>23–25</sup> and national<sup>21</sup> studies, however, nationwide information on the adult popula-

**Table 10** Multivariate analysis of dental caries experience (DMFT) and index components by socio-behavioural factors in Chinese adults (n=7862)

	D	M	F	DMF
<i>Age</i>				
65–74 years	1.00 ***	2.20 ***	0.01	3.22 ***
35–44 years	–	–	–	–
<i>Gender</i>				
female	–0.46 ***	0.03	0.15 ***	0.64 ***
male	–	–	–	–
<i>Urbanisation</i>				
urban	–0.34 **	–0.46 *	0.29 ***	0.41 *
rural	–	–	–	–
<i>Education</i>				
illiterate	0.53 **	–0.02	–0.43 ***	0.09
primary school	0.25	0.05	–0.31 ***	–0.01
secondary school	0.08	–0.43	–0.15 *	–0.50
high school	0.03	–0.30	–0.18 **	–0.45
higher education	–	–	–	–
<i>Number of times having seen a dentist</i>				
3 times or more	–0.03	1.53 ***	0.59 ***	2.09 ***
1–2 times	–0.16	0.75 **	0.14 **	0.73 **
never seen a dentist	–	–	–	–
<i>Frequency of tooth brushing</i>				
brushing at least twice a day	–0.14	–1.01 ***	0.05	–1.10 ***
brushing once a day	0.09	–0.36	0.01	–0.26
seldom or no brushing	–	–	–	–
<i>Time spent on tooth brushing</i>				
3 minutes or more	–0.33	–1.32 ***	–0.03	–1.68 ***
less than 3 minutes	–0.30	–1.79 ***	–0.001	–2.09 ***
don't remember	–	–	–	–
<i>Use of toothpaste</i>				
fluoridated	–0.20	0.33	0.08	–0.21
non-fluoridated	–	–	–	–
<i>Methods of brushing</i>				
LTD-recommended	–0.11	0.04	–0.02	–0.08
horizontal	–0.12	0.34	–0.18 ***	0.04
no systematic	–	–	–	–
<i>Frequency of eating sweets</i>				
2 times or more/day	–0.07	–0.22	–0.09 *	–0.38
1 time/day	–0.03	–0.25	0.03	–0.24
no sweets	–	–	–	–

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ 

tion is urgently needed for planning and evaluation of oral health care. The health care system in China is currently in transition and population-directed oral health promotion programmes are to be implemented at community level. Therefore, in the actual study emphasis was given to describe the level of oral health knowledge, attitudes and behaviour of Chinese adults in different settings and regions of the country, and attempts were made to assess the impact of the national mass oral health education programme, i.e. the 'Love Teeth Day' campaign<sup>25,26</sup>.

The multistage cluster sampling procedure was applied for random selection of participants. Compared to the distribution of the total population relatively more urban than rural respondents took part in the survey, meanwhile, it was shown in the epidemiologi-

cal part of the study that the results from the sample may be considered representative of the general population<sup>15,16</sup>. Due to intensive administrative and technical arrangements for the survey, sufficiently high response rates were obtained for both age groups and in urban and rural sites of the study. The questionnaire developed for the data collection was based on a highly structured design which provides for control of reliability. In addition, the questionnaire was evaluated for optimal construct and face validity of variables by an expert panel of oral health researchers of the Chinese National Committee for Oral Health (NCOH). A test-retest assessment was carried out in a sub-sample of the participants in each province whereby initial answers to the questionnaire were compared with those obtained after one month; the consistency rate of the

two sets of responses was high. The supervisors were carefully trained in collection of data and the meaning and wording of questions were explained so that potential information bias could be avoided. Despite the many efforts to ensure data control the data collection method may have certain limitations<sup>27</sup>. For example, some participants may have given socially acceptable responses by overestimating the frequency of dental visits or tooth brushing practices, or participants may have underestimated negative behaviour such as consumption of sugar. Moreover, some over-reporting may have occurred with respect to the answers on knowledge and attitudes towards dental care.

The Love-Teeth-Day campaign (LTD) is a mass oral health education programme established to increase public awareness about oral health and further to encourage the implementation of community-based oral health education at province level<sup>25,26</sup>. The LTD campaigns have been designed to transmit essential oral health messages to the public such as the importance of regular dental visits, tooth brushing at least twice a day, performance of systematic methods of brushing, as well as the use of standard toothbrushes and fluoridated toothpaste. The present study revealed that only about one third of the Chinese adults brushed their teeth at least twice a day and this figure is remarkably lower than that which was observed for children and adolescents participating in the same survey<sup>21</sup>. Also, self-care practices are low as compared to the findings of studies carried out in industrialised western countries<sup>8,9,11</sup> and in Hong Kong<sup>18</sup>. Meanwhile, the proportion of Chinese adults brushing their teeth twice a day or more is close to results reported from Eastern Europe<sup>28,29</sup>.

In this national survey the proportion of urban Chinese who reported tooth brushing twice a day is in agreement with previous local investigations of oral self-care habits conducted in urban areas of China<sup>14,19,25</sup>. For both the adult age groups studied, significant differences were revealed between urban and rural populations in all aspects of oral hygiene practices. For example, regular tooth brushing was three times more frequent in urban than in rural areas and similar distinct patterns were found as regards methods of brushing, preferences for types of toothbrushes and traditions in exchange of brushes. Moreover, the answers to the questions on reasons for brushing or not brushing the teeth indicate that there are different health cultures across urban and rural people in China and this factor may help explain the variations in oral health lifestyles by province.

It is worth noting that more than half of the respondents brushed their teeth using traditional horizontal methods rather than those recommended by the LTD campaign; in general, people spent only a short time on brushing, and relatively few adults cleaned their teeth in the evening. Moreover, it was common

to use the same toothbrush for several months, e.g. one quarter of young adults and four out of ten elderly used the same toothbrush for more than six months. Several respondents claimed that brushing the teeth is a practical burden or that it is not worth investing time into such practice, and tooth brushing appeared to be motivated by broad social values rather than being performed for prevention of dental disease.

In past years the LTD campaigns have focussed on the importance of using fluoridated toothpaste instead of the locally produced non-fluoridated toothpastes. Meanwhile, as found in other studies in China<sup>14</sup> the use of fluoridated toothpaste is still infrequent amongst adults and much lower than that observed in the children and adolescents surveyed<sup>21</sup>. The low use of fluoridated toothpaste may partly be ascribed to the limited availability of such products but compliance to traditional practices should also be considered.

In China oral health care is primarily provided by the public health service; oral health services are hospital-based and passive as they first of all seek to respond to people's demand for dental treatment<sup>30</sup>. The hospital service covers patients of all ages, but some adults also have access to dental care through factory health services. In addition, some private dental practices have been established in recent years. The number of dental personnel is low relative to the population size, so that the dentist to population ratio is about 1:100,000. In addition to the university-trained dentists, an unknown number of unlicensed middle-level dentists are working, particularly in rural areas. Dental care is offered on a fee-for-service basis; the fees for restorative services are approximately twice those for tooth extraction and ten times higher than those for prevention. Reimbursement systems exist for some industrial employees but even in that group prosthetic services must be paid for by the patients themselves.

As regards dental visiting habits, the results of the present study are concordant with the structure of oral health services in China. About one third of the participants had never seen a dentist and only a quarter had paid a dental visit within the past 12 months. The most frequent reasons for visits were toothache, perceived need for tooth extraction, and prosthetic treatment. As expected, the use of oral health services was somewhat lower in rural than urban areas with significantly more rural participants having never seen a dentist during their lifetime. This pattern was observed in all provinces included in the survey; urban areas of Beijing had relatively high proportions of respondents having seen a dentist within the past year whereas the rural areas of Gansu had low scores. The findings are in agreement with previous reports from Wuhan<sup>14,30</sup> and Guangdong<sup>20</sup> showing that the dental visiting behaviour of Chinese adults has a symptomatic rather than preventive orientation. Further, the study confirms that the majority of

Chinese adults are served in dental care at hospitals located in urban or rural areas. Half the adults responded that they paid the costs of treatment themselves; this answer was particularly frequent in rural areas while urban participants often reported that employers paid part of their dental care costs. The information provided by the study on illness behaviour revealed the following pattern. In the case of bleeding from gums, more than half of young adults and four out of ten elderly claimed they would practice more intensive cleaning but considerable proportions of the participants also declared that they tend to ignore such problem. As regards signs of tooth decay, the majority of adults stated that they do not care unless they develop pain; the principal responses to pain were the use of painkillers, seeking a dentist for care, or just trying to cope with the problem. Self-treatment was somewhat more common in rural areas whereas people in urban areas more often consulted a dentist.

Recently, the LTD campaign has focussed on other oral health risk behaviours such as dietary habits, alcohol and use of tobacco. This study showed that in both age groups about one third of the adults consumed alcohol every day and another one third reported smoking cigarettes on a daily basis. The consumption of alcohol and cigarettes was somewhat higher in rural than urban areas; chewing tobacco was infrequent in both areas. Meanwhile, gender was the most important factor in variation of lifestyles. Moreover, the consumption of sweets was relatively high in urban areas as half of young adults and four out of ten elderly claimed to eat sweets at least once a day. In contrast to the findings of the corresponding survey of children and adolescents<sup>21</sup> the multivariate analysis indicated no association of consumption of sweets with dental caries experience in adults. Tooth brushing habits had some positive effect on caries experience while the impact of use of fluoridated toothpaste was not significant. Controlling for other factors, the total DMF score was high for women and urban residents. In addition, the analysis showed that women and urban residents had fewer teeth in need of dental care, i.e. dental treatment needs were often met as compared to the situation for men and rural people. A significant effect of educational background was observed since illiterate people and those with low education had relatively a high D-component and a low F-component. Finally, the multivariate analysis confirmed several previous reports<sup>14,19,30</sup> of symptomatic rather than preventive orientation of dental visiting behaviour in adult Chinese. In particular, the M-component was three times higher for participants who had seen a dentist than among persons who had never seen a dentist in their lifetime.

In conclusion, the health authorities established the national 'Love-Teeth-Day' mass campaign in order to

stimulate the development of oral health awareness, dental attitudes and personal skills among Chinese adults. Apparently, the mass communication strategy has not been sufficient since the present survey of adults shows that regular oral hygiene habits, use of fluoride toothpaste and dental attendance rates are rather low, particularly in rural areas. Dental visits were mostly prompted by symptoms or problems related to teeth and seldom for preventive reasons. In addition, the study confirmed the effect on dental caries experience of basic socio-behavioural risk factors. Thus, the Chinese mass communication programme (LTD) should be strengthened by establishing community-based oral health promotion at district and local levels.

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