

# The Results of National Oral Health Survey, Mongolia

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**Objectives:** The aim of this study was to determine the status of oral health in Mongolia.

**Methods:** The studied population was 1754 subjects who were selected from 4 age groups and from 11 regions of Mongolia. We collected data about dentition, gingival health, dental calculus, intervention urgency and denture usage. **Results:** The prevalence of dental caries and mean Decayed, Missed, Filled permanent teeth (DMFt)/ decayed, missed, filled primary teeth (dmft) were 82.9% and 5.9±4.6 among 5 year olds, 80.9% and 2.5±2.2 among 12 year olds, 97.8% and 9.5±5.2 among 35-44 year olds, 99.1% and 19.9±8.1 among 65-74 year olds ( $p<0.001$ ). The prevalence of gingivitis was 4.6%, 21.2%, 36.3%, 11.5% and of calculus 0.5%, 7.1%, 53.1%, 24.2%, respectively above groups. The status of intervention urgency was 16.4%, 21.4%, 43.6%, 37.3% in the prompt treatment and 5.9%, 4.2%, 7.0%, 0.7% in immediate treatment recommended. The percent of people with removable denture among 65-74 year olds was higher than among 35-44 year olds. **Conclusion:** The prevalence of dental caries and their complications were in the high in Mongolia, and most of elderly people did not have their own natural teeth. These data indicate that effort to improve oral hygiene and prevent tooth decay are greatly needed throughout Mongolia.

**Key words:** Dental Caries, Dental Calculus, Gingivitis, Treatment, Denture

## Introduction

Oral health is an essential component of health throughout life. However, millions of individuals suffer from dental caries and periodontal disease, resulting in unnecessary pain, difficulty in chewing, swallowing and speaking, and increased medical costs [1-3]. The World Dental Federation and World Health

Organization (WHO) have indicated that more than 200 diseases are caused by the dental caries [4].

Oral and dental health can be influenced by oral hygiene as well as dietary, biological and demographic factors and dental caries continue to affect a considerable proportion of young children in developing countries like Mongolia [5]. Moreover, the distribution of disease levels shows an increasing

polarization in urban areas of Mongolia, and an increase in dental caries scores in urban areas has been observed. In Mongolia, the first National Survey of Oral Health Status of Children and Adults in Mongolia (2013) and Dental Survey in Mongolia (2014) showed a dramatic increase of caries among children as well as complications in adults in urban and rural areas of the country [6]. Therefore, periodic oral health surveys were recommended by the World Health Organization (WHO).

The aim of this study was to determine the status of oral health in Mongolia. The objectives of this study were to determine the dental caries status, the periodontal status (gingivitis and dental calculus), the dental intervention urgency, and the usage of removable dentures of the Mongolian population.

## Materials and Methods

### 1. Study population

A cross-sectional study was conducted from September 1, 2016 to October 15, 2016. Our total study population consisted of 1754 subjects, who were selected from 6 urban and 5 rural regions. We examined 40 volunteer subjects in the following groups: 5, 12, 35-44 and 65-74 year in every region in the country. The survey team consisted 8 dentists, who were trained for 3 days to do the survey using WHO methodology.

### 2. Data collection

We conducted an oral examination of the all subjects using dental mirror and WHO probe using the 2013 WHO caries diagnostic criteria [7]. Teeth were considered carious (D/d component) if there was visible evidence of untreated dental caries. No radiographs were taken during the study. The missing (M/m) component included teeth with an indication for extraction or teeth previously extracted due to caries, except third molars. The filling (F/f) component included teeth with filled cavities without further decay and teeth crowned due to caries. In collecting and analyzing the data, the upper-case letter in D/d, M/m, and F/f was used for permanent dentition for those greater than 12 years of age and lower-case letter was used for primary dentition of 5 years old children.

The assessment of gingivitis and dental calculus of all subjects was determined by the simplified Oral Hygiene Index [8]. We examined only the buccal (cheek and lip side) surfaces

of the 6 mandibular anterior teeth (central 6 teeth in lower jaw), cuspid to cuspid. When free or attached gingival margins or papillae of  $\geq 3$  teeth were moderately red or show significant deviations from normal contour or texture, we marked "yes" to the question regarding the presence of gingivitis. We examined the lingual surfaces of the 6 mandibular anterior teeth, cuspid to cuspid. When  $\geq 3$  lingual surfaces were deposited with dental calculus, we marked "yes" to the question regarding dental calculus. When less than 3 teeth had deposits with dental calculus or it was unclear whether dental calculus were present or not, we marked "no".

The dental intervention urgency was determined by the examiner, whose responsibility was to then refer the subject to an appropriate health-care facility. We marked the following urgency categories:

1. No treatment needed
2. Prevention or regular dental visit
3. Prompt treatment (including scaling)
4. Immediate treatment (pain or dental infection)
5. Referred to further examination or treatment of systemic condition

We assessed the presence of removable dentures and recorded the denture status for each jaw using the following categories: no denture, partial denture, complete denture and not recorded.

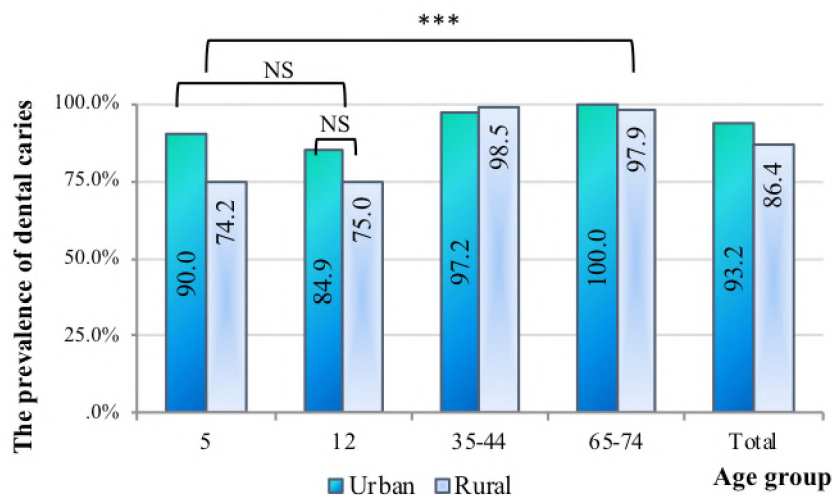
### 3. Statistical analysis

All data were entered was entered into spreadsheets and were analyzed using Statistical Package for Social Sciences (SPSS) software Version 21.0. Data were initially analyzed using descriptive statistics as means with standard deviations. A two-way ANOVA was used compare DMF/dmft-score, the prevalence of dental caries, the prevalence of gingivitis and dental calculus, the dental intervention urgency and the presence of removable denture in lower and upper jaws by age group and region. We analyzed correlation between variables using Pearson correlation coefficient.

## Results

### 1. Dental caries status

The prevalence of dental caries was 93.2% among all urban and 86.4% among all rural subjects, 90.0% and 74.2% in 5-year-



\*\*\*Statistically significant differences between age group and regions ( $p < 0.001$ );  
 NS-no significantly differences between age groups ( $p > 0.05$ ); between regions ( $p > 0.05$ )  
**Figure 1.** The prevalence of dental caries by age groups and regions.

**Table 1.** The descriptive results of mean caries (DMF/dmft) scores by age groups and regions

Age group	Caries score	Urban		Rural	
		Mean±SD	95% CI	Mean±SD	95% CI
5 year olds (Primary teeth)	Decayed teeth (dt)	5.4±4.1	5.0-5.8	4.1±3.9	3.7-4.5
	missed teeth (mt)	0.2±0.7	0.0-0.8	0.02±0.1	0.-0.7
	filled teeth (ft)	0.9±1.6	0.6-1.1	0.2±0.8	0.02-0.5
	DMFT	6.4±4.5	5.7-7.1	4.3±4.2	3.6-5.1
12 year olds (Permanent teeth)	Decayed teeth (Dt)	1.8±1.9	1.4-2.2	1.7±1.8	1.3-2.1
	Missed teeth (Mt)	0.1±0.4	0.6-0.8	0.2±0.9	0.5-0.9
	Filled teeth (Ft)	0.7±1.2	0.5-0.9	0.4±0.8	0.2-0.7
	DMFT	2.6±2.1	1.9-3.3	2.3±2.1	1.5-3.0
35-44 year olds (Permanent teeth)	Decayed teeth (Dt)	3.4±3.0	3.0-3.8	2.8±2.9	2.4-3.2
	Missed teeth (Mt)	4.1±4.1	3.5-4.7	6.1±4.6	5.4-6.8
	Filled teeth (Ft)	2.2±2.9	2.0-2.4	0.5±1.1	0.3-0.8
	DMFT	9.7±5.0	9.1-10.3	9.4±5.5	8.7-10.2
65-74 year olds (Permanent teeth)	Decayed teeth (Dt)	2.0±2.5	1.6-2.4	1.5±2.5	1.1-1.9
	Missed teeth (Mt)	18.3±8.6	17.7-18.9	17.4±9.5	16.6-18.1
	Filled teeth (Ft)	1.3±2.4	1.1-1.6	0.1±0.6	0.1-0.4
	DMFT	21.7±7.2	21.0-22.4	18.9±8.9	18.2-19.8

**Table 2.** The two-way ANOVA results of comparing caries (DMF/dmft) scores between regions and age groups

Between	P- value			
	Decayed teeth	Missed teeth	Filled teeth	DMF/dmft
Regions	.083	.001**	.355	.001**
Age groups	.009**	.735	.055	.114
Regions and age groups	.029*	.000***	.000***	.001**

olds, 84.9% and 75.0% in 12-year-olds, 97.2% and 98.5% in 35-44-year-olds, and 100% and 97.9% in 65-74-year-olds, respectively. Figure 1 shows the prevalence of dental caries among all age groups by regions. Almost all adults had dental caries in our study.

We tabulated the dental caries scores of all age groups in Table 1 and 2. These result show that mean M/mt ( $p < 0.01$ ) and DMF/dmft ( $p < 0.01$ ) scores of urban subjects were higher than rural in the all age groups. Adults normally have 28 teeth in their mouth, but our study showed that by age 35-44 they had already lost 4-6 teeth and by ages 65-74 year olds they were missing 17-18 teeth.

## 2. Gingivitis status

Using the criteria in the methods section, the prevalence of gingivitis among all age groups was highest among 35-44 year olds ( $p > 0.05$ ) (Figure 2). The prevalence of gingivitis among every age group was higher in urban subjects than rural ( $p < 0.001$ ). Figure 2 shows that the overall prevalence of

gingivitis among all age groups was 22.8% among all urban subjects and 13.4% among all rural ( $p > 0.05$ ).

## 3. Results of dental calculus

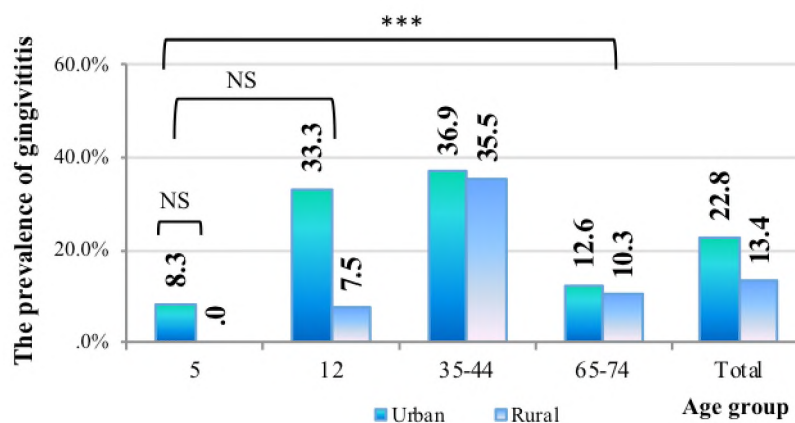
The prevalence of calculus among the age groups in the urban and rural regions is shown in Table 3. The prevalence of calculus increased with age until 35-44 years of age but then declined ( $p > 0.05$ ). The prevalence of calculus among urban children was higher than in rural children, but among adults it was lower ( $p < 0.01$ ).

## 4. Results of dental intervention urgency

When we studied dental intervention urgency among all subjects and compared age groups and regions as shown in Table 4. Only 19.2% of the urban population and 8.8% of the rural population needed no treatment while 30.6% and 29.0% of them needed prompt treatment.

## 5. Removable dentures

Of 35-44 year old people in the urban environment, 13.5% wore partial dentures while a very small percentage (0.4%)



\*\*\* Statistically significant differences between age group and regions ( $p < 0.001$ );  
 NS- no significantly differences between age groups ( $p > 0.05$ ); between regions ( $p > 0.05$ )

**Figure 2.** The prevalence of gingivitis by age groups and regions

**Table 3.** The prevalence of dental calculus (%) by age groups and regions

Age groups	5	12	35-44	65-74	Total	p-value
Urban	0.8%	7.6%	47.6%	18.4%	19.1%	.001
Rural	0%	6.5%	59.8%	31.3%	24.6%	

Statistically significant differences between age group and regions ( $p < 0.01$ ); between regions ( $p < 0.01$ ); no significantly differences between age groups ( $p > 0.05$ )

**Table 4.** The descriptive results of dental intervention urgency by age groups and regions (%)

Age group	No treatment need		Preventive		Prompt treatment		Immediate treatment		p-value
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	
5	11.2	4.0	61.0	80.3	20.7	11.1	7.1	4.5	.000
12	32.0	10.0	44.9	61.5	23.1	19.5	.0	9.0	
35-44	9.9	1.5	53.6	30.4	34.9	54.4	1.6	13.7	
65-74	25.1	20.0	31.0	49.2	43.1	30.3	.8	.5	
Total	19.2	8.8	47.8	55.2	30.6	29.0	2.4	7.0	

Statistically significant differences between age group and regions ( $p < 0.001$ ); no significantly differences between age groups ( $p > 0.05$ ); between regions ( $p > 0.05$ )

wore complete dentures. In the rural environment, 19.6% wore partial dentures while 1.0% wore complete dentures. The percentages of 65-74 year old people in the urban environment wearing partial dentures was 45.2% while complete dentures were worn by 30.1%. In the rural environment, 23.6% wore partial dentures and 33.8% had complete dentures ( $p < 0.01$ ). The total number of people wearing removable partial and

complete denture in lower jaw among 35-44 year olds was 13.5% in urban area and 12.3% in rural areas ( $p < 0.01$ ) and among 65-74 year olds it was 69.4% and 53.9% ( $p < 0.01$ ), respectively.

When we studied the correlation between all variables and the results are shown in Table 6. There was a positive strong correlation between missed teeth and age group ( $r = 0.7$ ,

**Table 5.** The presence of removable dentures by age groups and regions (%)

Age group	No denture		Partial denture		Complete denture		Not recorded		P- value	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural		
Upper jaws	5	90.5	100.0	9.5	.0	.0	.0	.0	.0	.001
	12	100.0	100.0	.0	.0	.0	.0	.0	.0	
	35-44	86.1	79.4	13.5	19.6	.4	1.0	.0	.0	
	65-74	24.3	42.6	45.2	23.6	30.1	33.8	.4	.0	
	Total	75.0	80.7	17.2	10.8	7.6	8.5	.1	.0	
Lower jaws	5	86.7	100.0	13.3	.0	.0	.0	.0	.0	.001
	12	100.0	100.0	.0	.0	.0	.0	.0	.0	
	35-44	86.5	87.7	13.1	11.3	.4	1.0	.0	.0	
	65-74	30.1	46.2	37.2	26.2	32.2	27.7	.4	.0	
	Total	75.7	83.7	16.1	9.3	8.2	7.0	.1	.0	

Statistically significant differences between age group and regions ( $p < 0.01$ ); and between regions ( $p < 0.01$ ); no significantly differences between age groups ( $p > 0.05$ )



Table 6. The correlation between variables

The variables	Age group	D/dt	M/mt	F/ft	DMF/dmft	Region	Dental caries	Gingivitis	Calculus	Urgent	Upper denture	Lower denture
Age group	1											
D/dt	-.267**	1										
M/mt	.733**	-.236**	1									
F/ft	.098**	-.022	-.070**	1								
DMF/dmft	.665**	.128**	.912**	.131**	1							
Region	-.006	-.101**	.008	-.267**	-.086**	1						
Dental caries	.247**	.247**	.295**	.217**	.156**	.363**	1					
Gingivitis	.107**	-.018	-.031	.061*	-.025	-.120**	.069**	1				
Calculus	.321**	-.040	.056*	.060*	.055*	.066**	.113**	.473**	1			
Urgent	.046	.197**	-.042	.007	.032	.120**	.186**	.113**	.359**	1		
Upper denture	.524**	-.162**	.652**	.006	.603**	-.043	.153**	-.101**	-.058*	-.122**	1	
Lower denture	.483**	-.161**	.634**	-.008	.582**	-.079**	.139**	-.115**	-.086**	-.126**	.853**	1

\*\* . Correlation is significant at the 0.01 level (2-tailed). \* . Correlation is significant at the 0.05 level (2-tailed).

$p < 0.01$ ), between missed teeth and denture ( $r = 0.6$ ,  $p < 0.01$ ); There was a positive medium correlation between the presence of dental calculus and age group ( $r = 0.3$ ,  $p < 0.01$ ), between the presence of calculus and the dental intervention urgency ( $r = 0.4$ ,  $p < 0.01$ ). There was positive weak correlation between age group and the presence of dental caries ( $r = 0.2$ ,  $p < 0.01$ ), and between age group and gingivitis ( $r = 0.1$ ,  $p < 0.01$ ). There was a negative correlation between decayed teeth and age group ( $r = -0.3$ ,  $p < 0.01$ ), between decayed teeth and missed teeth ( $r = -0.2$ ,  $p < 0.01$ ), between decayed teeth and region ( $r = -0.1$ ,  $p < 0.01$ ), and between the filled teeth and missed teeth ( $r = -0.1$ ,  $p < 0.01$ ).

## Discussion

Dental caries are the main oral health problem in industrialized countries like Mongolia, and it affects 60-90% of school-aged children and adults. It is known that oral hygiene plays one of the main roles in caries development [3, 9]. The purpose of our study was to examine oral health status of 4 different age groups, who were selected from 6 of urban regions and

5 of rural regions of Mongolia. Our results showed that the prevalence of dental caries and DMFT-scores, the prevalence of gingivitis and calculus, the results of dental intervention urgency and the utility of removable denture among adults. We did present study as National Oral Health Survey of Mongolia because as recommended in the last version of WHO oral health survey criteria.

Many studies compare dental caries in temporary, mixed and permanent dentition between developing and developed countries [1-3, 5, 9]. When we compared our study results with previous Mongolian and foreign study results, the prevalence of dental caries in Mongolia was higher than USA, China, India and Mongolia [6, 11-15]. The results of these studies likely depend on the socio-economic development of the country, their system of preventive care, and date of the study. Even though there were differences in the prevalence of dental caries between the countries, our mean dmft-score (6.4) was similar to China (4.5) and previous studies in Mongolia (4.7) but higher than India (1.9) among 5 year olds [6, 14-15]. Although the recently dental caries scores have been declining worldwide, the absolute level of disease is still high in some

countries such as Mongolia [16-18].

When we determined the prevalence of gingivitis among all age groups. The prevalence of gingivitis was 4.6% among 5 year olds, 21.2% among 12 year olds, 36.3% among 35-44 year olds and 11.5% among 65-74 year olds and the prevalence of calculus 0.4%, 6.8%, 53.7% and 24.7%, respectively. In reviewing the literature, most oral health studies integrate the results of the prevalence of gingivitis and calculus. When we compare our results for periodontal problems among 35-44 year olds, it is higher in Mongolia (45.0%) than in Spain in 2010 (22.0%), than in China in 2002 (23.3%) but lower than in India, 2002 (89.2%). But, among 65-74 year olds periodontal problems in our population (18.2%) were lower than in Spain in 2010 (26.0%), and in India 2002 (79.4%), but higher than China (13.9%) [14-15, 19]. Dental plaque is the most common causative factor of not only dental caries, but also the periodontal problems. Our results indicate that the Mongolian people do not adequately remove dental plaque with their current dental hygiene practices. Because they have lost their natural teeth, the prevalence of gingivitis/calculus among elderly people is lower than among 35-44 years old.

The oral health status is very low in Mongolia; hence we determined how urgently dental interventions were needed. The percentage of intermediate and prompt treatment needs identified during this study was 22.3% among 5 year olds, 25.6% among 12 year olds, 50.6% among 35-44 years olds and 38.0% among 65-74 year olds. In India, the percentage of people needing a lower jaw prosthesis was 24.5% among 35-44 year olds and 64.2% among 65-74 years olds and an upper arch prosthesis was needed in 29.0% and 65.1, respectively [15].

Tooth loss progresses with age in all countries. Our study results had shown that 35-44 year olds had lost  $5.0 \pm 0.2$  of their teeth and 65-74 year olds had lost  $17.9 \pm 0.4$  teeth. However, the percentage of people with removable partial and complete denture was 18.1% among 35-44 years olds and 64.9% among 65-74 years olds in Mongolia while it was only 6.4% and 28.7% in India, respectively. We did not determine percentage of people who had missed teeth and did not have denture; it is limitation of this study. A removable partial denture is often used as a temporary restorative measure for dental arch defects in many developed country, but we did not gather this data so we are unable to compare Mongolia to

other countries in this regard.

There are several limitations in our study. This study was cross-sectional and study subjects and with a small number of rural subjects and an uneven gender distribution. We used only oral examination without any additional measurements, for example tooth drying, coloring test or x-ray. Therefore, we likely made subjective mistakes. One of the strengths of this study is selection of subjects from all over the Mongolia, Uvs province in the west, Dornod province in east, Selenge province in the north region, Dornogovi province from the south region of Mongolia and 6 central districts of Ulaanbaatar city. Another strength, is that we followed WHO caries diagnostic criteria and assessment protocols making our results comparable with other studies. Further research needs to use more objective methods of check to oral health status and needs to determine the leading causative agents and risk factors for dental caries among Mongolian population.

We conclude that the prevalence of dental caries and mean DMFT/dmft-score among all age groups in Mongolia in the "HIGH" stage as determined by WHO criteria and are not different by virtue of urbanization. The percentage people with gingivitis and calculus is higher in Mongolia than in China but lower than in India. There was a need for dental intervention in one in five children 5 years of old, one in four children 12 years of age, half of all of adults 35-44 years old and one a third elderly people. These survey results demand the improvement in preventing dental caries for all age groups. It has been suggested that one way of improving the cost effectiveness of such community-based programs is to target populations that are the highest risk of dental caries.

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## Conflict of Interest

The authors have declared no conflict of interest.

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