# Oral Health Status of Disabled Children and Adolescents in China

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**Objective:** *To investigate the dental caries status and periodontal status of disabled children and adolescents aged 0 to 18 years in China and provide suggestions for future policies.*
**Methods:** *The cross-sectional survey included disabled children and adolescents aged 0 to 18 years in welfare institutions across 10 provinces in eastern, central and western regions in China, between November 2013 and May 2015. Oral health examination included dental caries status and periodontal status. The mean score for decayed, missing and filled teeth (dmft/DMFT) due to caries in primary/permanent dentition, gingival bleeding rate and calculus rate were recorded and statistically evaluated. Data analysis was performed using SPSS 24.0 software (IBM, Armonk, NY, USA), and the level of statistical significance was $P < 0.05$.*
**Results:** *The mean dmft/DMFT values of for groups aged 0 to 5, 6 to 12 and 13 to 18 years were 1.48 ± 3.00, 2.19 ± 2.94 and 1.78 ± 2.93, respectively. The mean scores for the groups aged 0 to 5 ($P < 0.05$) and 13 to 18 years ($P < 0.01$) showed a significant difference among different disability types. A significant difference between sexes was found only in the group aged 0 to 5 years ($P < 0.05$). Gingival bleeding rates were 13.70% for the group aged 0 to 5 years, 24.81% for the group aged 6 to 12 years and 42.06% for the group aged 13 to 18 years, and calculus rates were 5.48%, 22.41% and 47.62% for the three age groups, respectively. The gingival bleeding rate for all three age groups showed a significant difference between different disability types ($P < 0.01$), whereas calculus rates a showed significant difference only in the groups aged 6 to 12 and 13 to 18 years ($P < 0.01$).*
**Conclusion:** *The prevalence of dental caries, gingival bleeding and calculus in disabled children and adolescents in China is high. Disability type was strongly associated with oral health status. Specially designed oral health education and training are necessary for clinical professionals and caregivers.*
**Key words:** *calculus, China, dental caries, disabled children and adolescents, gingival bleeding*
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Oral health plays an important role in function and aesthetics, as well as growth and development for children and adolescents. According to the Second National Sampling Survey of China on Disabled Population conducted in 2006, there were 2.46 million disabled children and adolescents aged 6 to 14 years, accounting for 2.96% of the total disabled population[1]. In general, children with disabilities suffer from worse oral conditions and higher incidence of untreated caries, gingivitis and periodontal disease than those of the non-disabled population[2-6].

Dental caries is the most common oral disease among children and adolescents in the world, affecting eating function and patterns, development of permanent dentition and general health in the long term[7].

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**Table 1** Demographic characteristics of disabled Chinese children and adolescents aged 0 to 18 years.

| Variable | | n | % |
|---|---|---|---|
| Sex (n = 1355) | Male | 828 | 61.1 |
| | Female | 527 | 38.9 |
| Age, y (n = 1379) | 0–5 | 157 | 11.4 |
| | 6–12 | 589 | 42.7 |
| | 13–18 | 633 | 45.9 |
| Disability type (n = 1306) | Visual | 243 | 17.6 |
| | Hearing | 316 | 22.9 |
| | Verbal | 124 | 9.0 |
| | Physical | 94 | 6.8 |
| | Intellectual | 513 | 37.2 |
| | Mental | 16 | 1.2 |

Periodontal disease is also one of the most prevalent oral health diseases worldwide, affecting not only the oral cavity but also systematic chronic diseases like infective endocarditis and diabetes mellitus[8].

China is the largest developing country in the world and has made great efforts regarding social and economic growth and development in the past decade, yet the oral health status of disabled children and adolescents has still lacked multiregional data up to now. The aim of this study was to investigate the dental caries and periodontal health status of disabled children and adolescents in China aged 0 to 18 years in order to provide suggestions for future policies and actions to better benefit this population.

## Materials and methods

Ethical approval (approval no. PKUSSIRB-20130069) was obtained from the Institutional Review Board of Peking University Hospital of Stomatology. Written informed consent was obtained from the children's guardians before the survey.

### *Study design*

Disabled children and adolescents aged from 0 to 18 years were recruited as participants in this study. The sample size was estimated based on calculation formulae. The prevalence of dental caries was estimated as 50% based on the reference[9]. The 95% confidence interval (CI) was set at 10% with two sides. To account for the stratification factor and an anticipated response rate of 90%, the minimum sample size was 954. A convenience sampling method was adopted for this survey. All the participants who met the criteria for disability were selected from 25 special education schools or welfare institutions in 10 provinces/autonomous regions, namely Guangdong, Guangxi, Heilongjiang, Liaoning, Xinjang, Gansu, Shanxi, Anhui, Fujian and Guizhou.

### *Clinical examination*

The oral examination included dental caries experience and periodontal health status. Dental caries experience was measured using the decayed, missing and filled teeth (dmft/DMFT) index according to World Health Organisation (WHO) criteria[10]. For periodontal status, gingival bleeding and calculus status were recorded. An artificial light source, planar mouth mirror and Community Periodontal Index probe were used for oral examination. The disability type was also recorded according to the criteria in the Second National Sampling Survey of China on Disabled Population.

Before the study, all examiners were trained on the inspection standard. After training, a consistency test with the reference examiner and the examiner's own standard was performed. One or two examiners selected from each province attended the training programme and then conducted all the clinical examinations in their own province. Only examiners with a consistency test result higher than 0.8 could take part in further examinations. The survey was conducted from November 2013 to May 2015.

### *Statistical analysis*

Data analysis was performed using SPSS 24.0 software (IBM, Armonk, NY, USA). A descriptive analysis of each factor involved was performed for demographic characteristics, dt/DT, mt/MT, ft/FT, dmft/DMFT, caries prevalence, gingival bleeding rate and calculus rate. Furthermore, the mean value of dmft/DMFT was compared among all categories of involved factors using non-parameter tests (Mann-Whitney test for variables

**Table 2** Caries prevalence and dt, mt, ft, dmft [should these be written in capitals?] for children aged 0 to 5 years.

| Variable | dt | | mt | | ft | | dmft | Caries prevalence (%) |
|---|---|---|---|---|---|---|---|---|
| | Mean ± SD | Ratio (%) | Mean ± SD | Ratio (%) | Mean ± SD | Ratio (%) | Mean ± SD | |
| Total | 1.48 ± 3.00 | 100.00 | 0.00 ± 0.00 | 0.00 | 0.00 ± 0.00 | 0.00 | 1.48 ± 3.00 | 30.60 |
| Male | 1.65 ± 3.05 | 100.00 | 0.00 ± 0.00 | 0.00 | 0.00 ± 0.00 | 0.00 | 1.65 ± 3.05 | 34.00 |
| Female | 1.20 ± 2.93 | 100.00 | 0.00 ± 0.00 | 0.00 | 0.00 ± 0.00 | 0.00 | 1.20 ± 2.93 | 25.00 |
| Visual | 0.90 ± 1.45 | 100.00 | 0.00 ± 0.00 | 0.00 | 0.00 ± 0.00 | 0.00 | 0.90 ± 1.45* | 30.00 |
| Verbal and hearing | 1.33 ± 2.72 | 100.00 | 0.00 ± 0.00 | 0.00 | 0.00 ± 0.00 | 0.00 | 1.33 ± 2.72 | 30.40 |
| Physical | 5.90 ± 5.72 | 100.00 | 0.00 ± 0.00 | 0.00 | 0.00 ± 0.00 | 0.00 | 5.90 ± 5.72 | 60.00 |
| Intellectual and mental | 0.75 ± 1.94 | 100.00 | 0.00 ± 0.00 | 0.00 | 0.00 ± 0.00 | 0.00 | 0.75 ± 1.94 | 25.00 |

*Difference among groups: $P < 0.05$.

**Table 3** Caries prevalence and dt + DT, mt + MT, ft + FT, dmft + DMFT of children aged 6 to 12 years.

| Variable | dt + DT | | mt + MT | | ft + FT | | dmft + DMFT | Caries prevalence (%) |
|---|---|---|---|---|---|---|---|---|
| | Mean ± SD | Ratio (%) | Mean ± SD | Ratio (%) | Mean ± SD | Ratio (%) | Mean ± SD | |
| Total | 2.12 ± 2.88 | 96.80 | 0.05 ± 0.41 | 2.28 | 0.02 ± 0.23 | 0.91 | 2.19 ± 2.94 | 56.54 |
| Male | 2.23 ± 2.96 | 97.38 | 0.04 ± 0.28 | 1.75 | 0.02 ± 0.19 | 0.87 | 2.29 ± 3.00 | 57.34 |
| Female | 1.95 ± 2.78 | 94.66 | 0.08 ± 0.56 | 3.89 | 0.03 ± 0.29 | 1.46 | 2.06 ± 2.88 | 54.95 |
| Visual | 2.04 ± 2.35 | 98.08 | 0.03 ± 0.21 | 1.44 | 0.01 ± 0.09 | 0.48 | 2.08 ± 2.36 | 63.48 |
| Verbal and hearing | 2.40 ± 3.44 | 98.77 | 0.01 ± 0.16 | 0.41 | 0.01 ± 0.12 | 0.41 | 2.43 ± 3.46 | 57.14 |
| Physical | 2.63 ± 3.09 | 97.41 | 0.07 ± 0.44 | 2.59 | 0.00 ± 0.00 | 0.00 | 2.70 ± 3.27 | 63.04 |
| Intellectual and mental | 2.15 ± 2.84 | 93.89 | 0.09 ± 0.59 | 3.93 | 0.05 ± 0.35 | 2.18 | 2.29 ± 2.95 | 57.33 |

**Table 4** Caries prevalence and DT, MT, FT and DMFT of adolescents aged 13 to 18 years.

| Variable | DT | | MT | | FT | | DMFT | Caries prevalence (%) |
|---|---|---|---|---|---|---|---|---|
| | Mean ± SD | Ratio (%) | Mean ± SD | Ratio (%) | Mean ± SD | Ratio (%) | Mean ± SD | |
| Total | 1.54 ± 2.61 | 86.52 | 0.14 ± 0.64 | 7.87 | 0.10 ± 0.48 | 5.62 | 1.78 ± 2.93 | 50.90 |
| Male | 1.38 ± 2.27 | 90.12 | 0.10 ± 0.59 | 6.41 | 0.05 ± 0.27 | 3.47 | 1.74 ± 2.57* | 48.30 |
| Female | 1.83 ± 3.09 | 82.99 | 0.21 ± 0.71 | 9.43 | 0.17 ± 0.69 | 7.58 | 2.63 ± 3.94 | 55.50 |
| Visual | 1.90 ± 2.42 | 90.63 | 0.05 ± 0.32 | 2.23 | 0.15 ± 0.61 | 7.14 | 2.09 ± 2.80** | 65.40 |
| Verbal and hearing | 0.88 ± 1.52 | 79.25 | 0.20 ± 1.08 | 17.92 | 0.03 ± 0.23 | 2.83 | 1.10 ± 1.89 | 38.50 |
| Physical | 1.72 ± 2.17 | 91.67 | 0.16 ± 0.45 | 8.33 | 0.00 ± 0.00 | 0.00 | 1.37 ± 3.06 | 65.60 |
| Intellectual and mental | 1.20 ± 2.45 | 84.62 | 0.06 ± 0.55 | 8.92 | 0.03 ± 0.23 | 6.46 | 1.88 ± 2.46 | 56.50 |

*Difference among groups: $P < 0.05$; **Difference among groups: $P < 0.01$.

with two categories and Kruskal-Wallis test for these factors with three or more categories). The gingival bleeding rate and calculus rate were compared using a chi-square test.

## Results

A total of 1379 disabled children and adolescents (mean age 11.48 ± 4.27 years) underwent oral health examination. The demographic information for participants enrolled in the study is shown in Table 1.

Tables 2 to 4 show the prevalence of dental caries, mean dmft/DMFT values and the subgroup (dt/DT, mt/MT and ft/FT) values in the groups aged 0 to 5, 6 to 12 and 13 to 18 years under different stratification of sex and disability type. The results found that 30.60% of disabled children aged 0 to 5 years, 56.54% of children aged 6 to 12 years and 50.90% of adolescents aged 13 to 18 years experienced dental caries. The mean DMFT values in the groups aged 0 to 5, 6 to 12 and 13 to 18 years were 1.48 ± 3.00, 2.19 ± 2.94 and 1.78 ± 2.93, respectively.

A significant difference between sexes was only found in the group aged 0 to 5 years ($P < 0.05$). Both the mean dmft value for the group aged 0 to 5 years ($P < 0.05$) and that for the group aged 13 to 18 years ($P < 0.01$) showed a significant difference among different disability types.

The periodontal status of the disabled children and adolescents included in this study is shown in Figs 1 to 4. As per the results, 13.70% of the group aged 0 to 5 years, 24.81% of that aged 6 to 12 years and 42.06% of

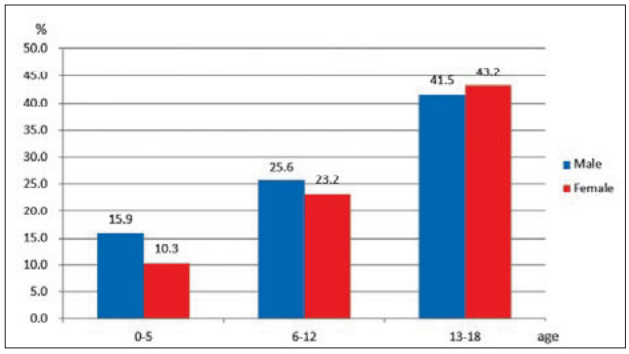


**Fig 1** Gingival bleeding rate for children and adolescents aged 0 to 5, 6 to 12 and 13 to 18 years by sex.

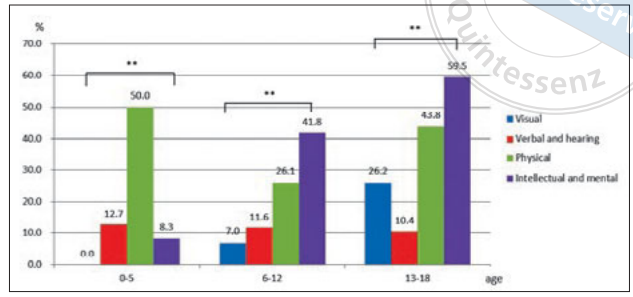


**Fig 2** Gingival bleeding rate for children and adolescents aged 0 to 5, 6 to 12 and 13 to 18 years by disability type. **Difference among groups: $P < 0.01$.

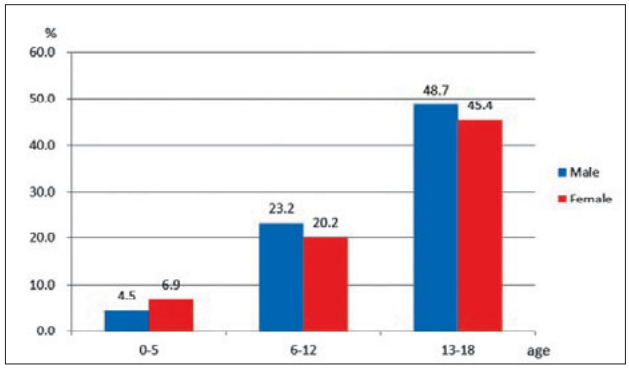


**Fig 3** Dental calculus rate for children and adolescents aged 0 to 5, 6 to 12 and 13 to 18 years by sex.

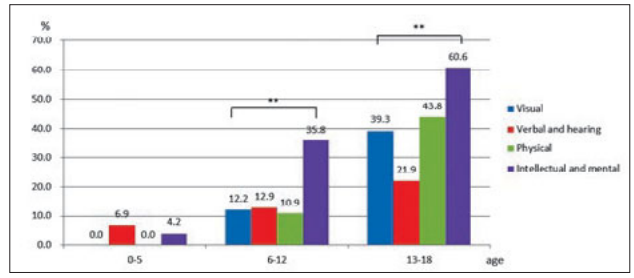


**Fig 4** Dental calculus rate for children and adolescents aged 0 to 5, 6 to 12 and 13 to 18 years by disability type. **Difference among groups: $P < 0.01$.

that aged 13 to 18 years suffered from gingival bleeding. The gingival bleeding rate increased with age. Participants who were physically disabled reported a worse gingival bleeding rate than those with other disability types in the group aged 0 to 5 years, as well as the intellectually and mentally disabled group in the children and adolescents aged 6 to 12 and 13 to 18 years ($P < 0.01$).

The calculus rates for the three age groups were 5.48%, 22.41% and 47.62%, respectively, also showing an increasing trend with age. Of the participants aged 6 to 12 and 13 to 18 years, the intellectually and mentally disabled group reported a worse calculus rate than other disability types ($P < 0.01$).

## Discussion

According to an estimate from the WHO[11], the proportion of the population living with disabilities or special needs in developing countries amounts to 12%, whereas the same indicator in developed countries is approximately 10%. This is the first study to conduct a large-scale oral health survey covering different types of disabled children and adolescents from eastern, central and western regions of China. The study used data sourced from special education schools or welfare institutions in 10 provinces. Descriptive and univariate analyses of the oral health condition were used to provide a necessary basis for the health authorities to improve the dental health of disabled children and adolescents in China.

The prevalence of caries in disabled children and adolescents (6 to 12 years 56.54%, 13 to 18 years 50.90%) was higher than that in children without disabilities (12 years 38.5%, 15 years 44.4%)[12]. This result was similar to the findings of previous studies[2,4,11,13] and may be related to their disabilities relating to cognition, memory, communication and manual dexterity, as well as a lack of sufficient oral health promotion and treatment resources. Diet is likely the main reason, since sweets are given by parents to children with disabilities mostly as a reward for behaviour control. Moreover, the proportion of dt/DT for both primary and permanent teeth (0 to 5 years 100.00%, 6 to 12 years 96.80%, 13 to 18 years 86.52%) remained at a higher level than those without

disabilities (3 to 5 years 96.6%, 12 years 83.4%, 15 years 81.3%)[12,14] indicating that children with disabilities have insufficient treatment for caries.

Disabled children and adolescents in all age groups suffered from periodontal problems and their periodontal health became worse as they got older.

The significant difference in caries status recorded in the present study between male and female patients aligns with that found in national surveys[12]. A possible explanation for the higher level of dental caries in female patients is the increased frequency of snacking.

The findings indicated that disability type was strongly associated with not only the dmft of primary teeth and DMFT of permanent teeth, but also the prevalence of gingival bleeding and calculus. Children with intellectual, mental, visual and physical disabilities have poorer oral health status than those with verbal and hearing disabilities. There are many possible explanations for this. It may because it is more difficult for individuals with intellectual, mental and visual disabilities to access social and dental care resources, meaning they are at a disadvantage when it comes to understanding the importance of oral hygiene. Such barriers make it more difficult for intellectually and mentally disabled people to comprehend complex tasks. Regarding physically disabled people, handling instruments, like toothbrushes or floss, is more difficult than it is for others.

Disabled individuals are at a high risk of health problems, especially young children and adolescents who largely rely on family and social support[15]. The oral health status of children with special needs is initially similar to that of normal children, but their diet, eating patterns, medication needs, physical limitations and lack of oral cleaning ability, as well as the attitude of their caregivers, contribute to a subsequent decline in their oral health status[16]. The reduced access to oral health care for disabled children and adolescents results from financial, social and physical barriers, as well as their inability to cooperate during treatment or routine oral health care[4,7,11,13,17].

To promote the oral health of children and adolescents with disabilities, a targeted approach is necessary. Educational activities are the most common method and should be adapted to individuals' needs based on their type of disability. Hartwig et al[18] carried out a quasi-experimental study of the effects of oral health educational intervention for children and adolescents with neurological and psychomotor disabilities in southern Brazil. The clinical examination showed a significant decrease in dental debris and gingival indices compared with baseline after supervised tooth brushing and educational activities[18]. Alwadi et al[19] described different inclusive methods to allow children to share their opinions on oral health in the study, mainly through children's knowledge and their oral health practices and experiences of visiting dental clinics, as well as the physical barriers they experienced and their positive and negative feelings about oral health. Their findings highlight that it is possible to include disabled children in the oral health process is possible, and this will help to transform services and reduce such children's oral health inequalities[19]. Sardana et al[16] delivered specially designed oral health education and performed two different motivational techniques using tactile or auditory sensations. A significant improvement in mean plaque and gingival scores was noted at the 6-month evaluation, indicating that tactile and auditory measures were effective in educating and motivating visually impaired children regarding daily oral hygiene maintenance[16].

Clinical professionals play an important role in treatment success and sustainable monitoring of oral health status for disabled children and adolescents. To ensure the dental workforce is able to respond to the needs of those with disabilities, education is essential[20]. Education in tooth brushing and oral health knowledge for disabled children and their caregivers, regular oral examination and fluoride treatment have been carried out, but relevant training for clinical professionals in special skills required to deal with children and adolescents with special needs is still insufficient[17].Wilson et al[20] carried out a survey and discussion on final-year dental students' insight into disability-related issues. The results highlighted the importance of tailoring education for medical students and young clinical professionals to increase their capability and confidence in treating and helping disabled children and adolescents more effectively[20]. The ability to provide systematic and targeted oral health services for disabled children and adolescents is in urgent need of strengthening. Performing dental treatment under general anaesthesia can improve the oral quality of life in children with disabilities and their families significantly. Notable progress has been made in China regarding general anaesthesia techniques[21].

Caregivers play an essential role in the daily care and education of disabled children and adolescents[22]. It is thus extremely important to alert caregivers about the importance of prophylactic and therapeutic measures of oral health[3,13]. Abullais et al[13] carried out a questionnaire-based study to evaluate caregivers' knowledge of, attitude towards and practices employed in oral healthcare at centres for the intellectually disabled in southern Saudi Arabia. They found that the care-

givers' knowledge and attitude needed improvement and that they should be advised to participate in training programmes on the importance of preventive oral health services and dental treatments[13]. Zeng et al[3] used a questionnaire to analyse caregivers' oral health knowledge and attitudes in Shanghai city and found their knowledge to be low; thus, tailored educational programmes should be carried out for caregivers to strength their oral health education, especially in suburban areas.

The present study has some limitations. First, limited by the characteristic of the disabled children and adolescents, a randomised sampling method was unable to be used for the study design. Second, only univariate analysis was applied, which could not avoid mutual effects between different variables. Third, the social and economic status, oral health habits and other information relating to the participants requires further analysis. Nevertheless, the results reflect the oral health status of and associated factors for disabled children and adolescents to some extent.

## Conclusion

The prevalence of dental caries of disabled children and adolescents in China is high and was higher than the mean level in the fourth national survey. All age groups of disabled children and adolescents suffered from periodontal problems and their periodontal health became worse as they got older. Disability type was strongly associated with dental caries, gingival bleeding and calculus, all of which may be related to a lack of sufficient oral health promotion and treatment resources. Specially designed oral health education and training for clinical professionals and caregivers are important and indeed necessary to improve the oral health status of disabled children and adolescents.

## Conflicts of interest

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

## Author contribution

Dr Lu Gao participated in the data analysis and drafted the manuscript; Dr Xue Nan LIU designed the study, collected the data and revised the manuscript. Both authors read and approved the final manuscript for submission.

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