

## Scientific Research Report

## Socio–Economic Disparities in Dental Health and Dental Care Utilisation Among Older Chinese

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## ARTICLE INFO

## Article history:

Available online 31 July 2020

## Key words:

Senior care  
Dental care  
China

## ABSTRACT

**Introduction:** Dental care is mostly excluded from healthcare coverage in China. This study examines disparities in dental care and in the costs of such care, according to insurance type and socio–economic status, among Chinese older adults.

**Methods:** The data were obtained from the 2015 China Health and Retirement Longitudinal Study (CHARLS). A final sample of 5,230 respondents was included, with a mean age of 72 years. Edentulousness, any dental visit and per-patient dental care expenditure were used as outcome variables. Both unweighted and weighted logistic regression analyses were used to examine the association of socio–economic status (education, insurance type and income) associated with edentulousness and use of dental care.

**Results:** We found that 28% of Chinese older adults have no remaining teeth and that only 19% had used dental care in the past year. The uninsured and those with rural resident insurance had edentulousness rates of 31%, while the edentulousness rate in those with urban employee insurance was 19%. About 13% of the uninsured study respondents and 15% of those with rural resident insurance had used dental care compared with 30% of those with urban employee insurance. Those in the highest income and education groups and those enrolled in a plan with a lower coinsurance rate had a higher likelihood of using dental care services and spending more on dental care than did those in the lowest socio–economic groups.

**Conclusions:** Dental care disparities in China may be reduced through increasing the proportion of the population with insurance and expanding the range of dental treatments covered by all three major insurance schemes.

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## Background

Dental care services have improved in China from the 1990s to date. Dental conditions have significant effects on oral health, with good health essential for maintaining general health and a determining factor for one's quality of life<sup>1–5</sup>. However, this was not obvious to Chinese patients until recently. New health-policy developments in China are redefining dental care to align with the standard of oral health found in developed countries in Europe. First, related to the

supply side, private dental clinics are in a phase of rapid growth as a result of sustained policy support of private health care<sup>6</sup>. Twenty years ago, dental services were only available in dental hospitals and in some tertiary and secondary general hospitals in major cities. Dental care services are now provided by both hospitals and standalone clinics throughout the country. There were almost 30,000 dental care organisations in China in 2014, and 42% were standalone clinics<sup>6</sup>. Second, from the demand side, China has achieved near-universal health coverage in a short period of time<sup>7</sup>. Currently, dental care is mostly excluded from health coverage; however, the expansion of health coverage has raised awareness about general health, including oral health<sup>6</sup>. Oral health-promotion programmes have been implemented in

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<https://doi.org/10.1111/idj.12600>

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some urban communities in China<sup>8</sup>. As social medical insurance covers most medical care services, the expansion of health coverage substantially reduced patients' financial burden from health care<sup>7</sup>, which may allow patients increased capacity to pay for dental services. Few studies have been conducted to examine China's dental care in the era of universal coverage and private health care.

This project focussed on the elderly population because dental care markets for older adults in China, Canada, Australia, New Zealand and the USA are largely comparable. The seniors in these countries have near-universal or universal health coverage, but the medical insurance covers only minimal dental services<sup>6,9–11</sup>. In 2018, older adults in China accounted for 12% of the total population<sup>12</sup>. In addition, most of the seniors in these countries received dental care through organisations with a high level of market orientation. Therefore, the findings from this study have policy implications for these countries and other healthcare systems with similar market characteristics.

This study examines disparities in dental care and costs of care according to insurance type and socio-economic status (SES) among Chinese older adults. ( $\geq 65$  years of age). Advancing age puts seniors at risk for many dental conditions. Tooth loss is one of the most critical indicators of dental health<sup>5,13,14</sup>, and tooth loss in seniors is associated with disability and mortality<sup>15</sup>. As tooth loss in seniors is often caused by other dental diseases (e.g. periodontal diseases), the prevalence of tooth loss can also somewhat reveal the societal need for dental care. The risk of losing teeth increases with age<sup>14</sup>. To the best of our knowledge, this study is the first to examine tooth loss in Chinese seniors.

Older adults, especially those of low SES, experience challenges in accessing dental care. Significant socio-economic disparities in tooth loss are found among American seniors<sup>15</sup>. Only about 44% of elderly Americans used dental care in 2014: 61% from the high-income group and just 24% from the low-income group<sup>16</sup>. Strong pro-wealthy disparities in dental care have also been found in Canada, which has a universal health system but private dental care<sup>9</sup>. The disparities were similar in Australia and New Zealand where the dental sector is also predominantly private<sup>10</sup>. No published studies have examined the equity of dental health and dental care in China after the recent shifts in demand and supply of dental care.

Equitable access to health care is a primary goal of the Chinese universal healthcare system, which is part of the 'socialist market economy'. However, during the study period, dental care was mostly privately financed in China. Older adults do not have dental insurance through the localised single-payer system. Dental hygiene, oral examinations, X-rays, root canal treatment, treatments for gum disease and provision of crowns are not covered by the social medical insurance. Moreover, from the supply side, most dental hospitals and dental departments in general hospitals are owned by local governments but have a high level of market orientation that focuses on meeting the needs of clients. Most stand-alone dental clinics are privately owned and managed. Therefore, we hypothesise that significant socio-economic disparities exist in the dental care of Chinese seniors. Seniors with a high level of education are likely to have a higher level

of awareness of dental health relative to seniors with a lower level of education. Those with higher family income and urban employee insurance have the ability to pay for dental care. Although most of the total dental costs are paid out of pocket, regardless of the type of social medical insurance<sup>17,18</sup>, the insurance is a composite measure of household registration or hukou, employment status/history, and generosity of medical coverage. The government established China's socio-economic divide through household registration, or hukou, in the 1950s. People with 'agricultural' hukou status are enrolled in the rural resident insurance scheme, but many have migrated to cities and were not able to change their hukou status. People with 'non-agricultural' hukou status are enrolled in the urban resident insurance or urban employee insurance schemes based on their employment status/history. The urban employee insurance scheme has better coverage of medical services and lower coinsurance rates than the other two insurance schemes<sup>19</sup>.

Lastly, the study aimed to estimate annual per-patient costs of dental care for seniors who have used dental care. We examined whether a socio-economic gradient exists in dental care costs, controlling for other patient-level characteristics.

## Methods

### Data source

We used cross-sectional data of an ongoing longitudinal study. The publicly available data were obtained from the 2015 China Health and Retirement Longitudinal Study (CHARLS), which is the Chinese equivalent of the Health and Retirement Study<sup>20</sup>. The CHARLS project is a nationally representative survey funded by the US National Institute on Aging, the World Bank and the Natural Science Foundation of China. The survey collects high-quality representative data on a wide range of topics, including sociodemographic characteristics, health and health care. The survey had a response rate of 82.1% and included almost 20,000 participants  $\geq 45$  years of age. Investigated respondents of CHARLS project were chosen through multistage probability sampling<sup>20</sup>. We included respondents who were  $\geq 65$  years of age. The CHARLS project did not include hospitalised patients and residents of nursing homes in its baseline survey. In the end, a final sample of 5,230 respondents without missing values on key dependent and independent variables were included. An individual cross-sectional weight with household clustering and individual non-response adjustments was applied to ensure that the sample was a representative cross-section of the total older adult population.

### Measures

Edentulousness, any dental visit and per-patient dental care expenditure were used as outcome variables. The probability of edentulousness was based on the answer to the question 'Have you lost all of your teeth?' The probability of any dental visit was based on the answer to the question 'In the past year, have you seen a dentist for dental care?' Although the

survey did not ask participants to specify whether the dental service was curative or cosmetic, we assume that these dental visits were predominantly for treatment of disease as cosmetic dentistry is extremely rare in Chinese elders<sup>21</sup>. The annual per-patient dental care expenditure was calculated based on the answer to the question ‘What was the medical cost of all the dental care in the past year?’ As dental care is mostly excluded from the medical care costs covered by insurance schemes in China, dental care costs are almost equal to the out-of-pocket payments<sup>17,18</sup>. The explanatory variables of interest included level of education, family income and type of insurance. Socioeconomic status was measured by education and income. The level of education was categorised as follows: lower than primary school; primary school; middle school; high school; and college and above. Respondents were divided into five categories according to family income quintiles. Health insurance was categorised into six types, as follows: uninsured; rural resident insurance; urban resident insurance; urban employee insurance; government health care programme; and other insured. Most Chinese people have rural resident insurance or one of the two urban health insurances<sup>19</sup>. Other controlled variables include sex, age, marital status, geographical region, rural/urban residence registration, self-assessed health status, the presence of chronic disease and smoking status. A descriptive analysis was conducted to describe the characteristics of the respondents.

### Analysis

First of all, we calculated descriptive statistics using sampling weights. Then, we used both unweighted and weighted logistic regressions to examine which factors were associated with edentulousness and use of dental care. The values of variance inflation factors for the explanatory variables of interest were all smaller than 7. As a sensitivity check, probit models were also used to estimate the probability of edentulousness and dental care. The results were essentially the same as the findings from the logistic regressions. We report odds ratios from the logistic regressions in this study. Dental care costs were modelled using generalised linear models with log link and gamma distribution<sup>22</sup>. Estimates from these types of models account for positively skewed costs in the distribution. Differences in dental care costs, stratified according to SES and insurance type, were calculated by comparing the average dental care costs of patients with different levels of education and types of insurance, and in different quintiles of family income. All analyses were undertaken using STATA, version 13<sup>23</sup>.

### Results

Descriptive statistics for the study sample are presented in [Table 1](#). The mean age of the participants was 71.7 years. About 57% of the respondents were enrolled in rural resident insurance, 9% and 17% were covered by the urban resident and employee insurances, respectively, while 9% of the respondents were uninsured; of the remainder, 5.5% were enrolled in a Government healthcare programme and 2.5%

were enrolled in other types of insurance schemes or in commercial medical insurance schemes. About 32% did not graduate from elementary school, and only 11% had a level of education of high school or above. The respondents were equally distributed across the eastern, central and western regions of China. Most were married, 65–74 years of age and lived in rural areas.

We found that, in 2015, about 28% of Chinese seniors over age 65 had no remaining teeth ([Table 1](#)). Only about 19% of elderly Chinese had seen a dentist in the past year. Average annual dental expenditure among Chinese seniors with a visit to a dentist in 2015 was \$178.

### Disparities in tooth loss

The least educated seniors and those without health insurance had higher rates of edentulousness than the other groups ([Table S1](#)). The edentulousness rates in those with primary school education or lower than primary school education were 25.7% and 35.9%, respectively, and those with a college education and higher had an edentulousness rate of 6.9%. The uninsured and those with rural resident insurance had edentulousness rates of around 31%, while the edentulousness rate in those with urban employee insurance was 19.4%. The differences in edentulousness according to family income were not as substantial as the disparities according to level of education and insurance type. The unweighted multivariate regression ([Figure 1](#)) showed that college-educated seniors were 62% less likely to lose all teeth than the least educated seniors. The insurance type and family income level were not significantly associated with edentulousness when other variables were controlled. Similar results were found in the weighted analysis ([Figure S1](#)).

### Disparities in dental care utilisation

The level of education was categorised as follows: high SES groups had higher rates of dental care utilisation than low SES groups ([Table 1](#)). The uninsured and those with rural resident insurance had dental care utilisation rates of 12.9% and 15.3%, respectively; the dental care rate in those with urban employee insurance was 29.9%. The dental care utilisation rates in those with primary school education or lower than primary school education were 18.4% and 12.8%, respectively, and those educated to high school or to college and above had dental care utilisation rates of 30.6% and 30.7%, respectively. In total, 29.4% of those in the highest quintile had seen a dentist in the past year compared with only 12.9% in the lowest quintile. The unweighted multivariate regression showed that the level of education was categorised as follows: SES and insurance type were significantly associated with dental care utilisation ([Figure 2](#)). For example, seniors with a high school education were twice as likely to use dental care as seniors with less than primary school education. Those with urban employee insurance were 54% more likely than the uninsured to have seen a dentist in the past year. Those in the richest quintile were 76% more likely to use dental care than those in the poorest quintile. The findings from the weighted analysis are essentially the same as the unweighted results ([Table S2](#) and [Figure S2](#)).

**Table 1 – Overview of dental health, care and costs among Chinese older adults in 2015.**

|  | N     | Frequency (%) |          | Proportion of seniors who have lost all teeth (%) |          | Dental care utilization rate (%) |          | Per-patient dental care costs (\$) |          |
|--|-------|---------------|----------|---|----------|----------------------------------|----------|------------------------------------|----------|
|  |       | Unweighted    | Weighted | Unweighted  | Weighted | Unweighted                       | Weighted | Unweighted                         | Weighted |
| All                                      | 5,230 | 100           | 100      | 28.5  | 27.8     | 17.3                             | 19.2     | 136                                | 178      |
| Gender                                   |       |               |          |   |          |                                  |          |                                    |          |
| Male                                     | 2,675 | 51.2          | 50.8     | 26.1  | 25.8     | 16.5                             | 18.7     | 120                                | 187      |
| Female                                   | 2,555 | 48.9          | 49.2     | 31.0  | 29.9     | 18.3                             | 19.8     | 152                                | 168      |
| Age group                                |       |               |          |   |          |                                  |          |                                    |          |
| 65–69 years                              | 1,915 | 36.6          | 34.2     | 19.8  | 19.3     | 20.4                             | 21.7     | 124                                | 139      |
| 70–74 years                              | 1,866 | 35.7          | 34.8     | 27.0  | 24.5     | 16.7                             | 19.2     | 142                                | 172      |
| 75–79 years                              | 893   | 17.1          | 17.6     | 36.5  | 34.1     | 16.1                             | 19.3     | 173                                | 296      |
| 80–84 years                              | 407   | 7.8           | 9.4      | 48.4  | 50.0     | 11.8                             | 14.9     | 106                                | 141      |
| 85+ years                                | 149   | 2.9           | 4.0      | 58.4  | 50.8     | 8.7                              | 8.5      | 117                                | 110      |
| Smoking status                           |       |               |          |   |          |                                  |          |                                    |          |
| Yes                                      | 2,522 | 48.2          | 46.7     | 28.8  | 27.5     | 16.2                             | 18.7     | 116                                | 184      |
| No                                       | 2,708 | 51.8          | 53.3     | 28.3  | 28.1     | 18.4                             | 19.6     | 153                                | 172      |
| Presence of chronic disease              |       |               |          |   |          |                                  |          |                                    |          |
| Yes                                      | 4,214 | 80.6          | 80.7     | 28.3  | 28.0     | 18.0                             | 20.0     | 134                                | 178      |
| No                                       | 1,016 | 19.4          | 19.3     | 29.5  | 27.1     | 14.7                             | 15.8     | 151                                | 176      |
| Education level                          |       |               |          |   |          |                                  |          |                                    |          |
| Lower than primary school                | 1,823 | 34.9          | 32.2     | 35.8  | 35.9     | 13.1                             | 12.8     | 129                                | 124      |
| Primary school                           | 2,421 | 46.3          | 44.3     | 26.3  | 25.7     | 17.3                             | 18.4     | 123                                | 184      |
| Middle school                            | 606   | 11.6          | 12.6     | 23.9  | 22.4     | 24.1                             | 28.7     | 142                                | 175      |
| High school                              | 276   | 5.3           | 7.9      | 16.7  | 23.3     | 27.9                             | 30.6     | 166                                | 190      |
| College and above                        | 104   | 2.0           | 2.9      | 10.6  | 6.9      | 26.9                             | 30.7     | 335                                | 365      |
| Marital status                           |       |               |          |   |          |                                  |          |                                    |          |
| Married + married not living with spouse | 3,922 | 75            | 73.4     | 25.5  | 24.7     | 17.9                             | 20.0     | 134                                | 183      |
| Widowed                                  | 1,227 | 23.5          | 25.1     | 38.0  | 37.0     | 16.1                             | 17.5     | 151                                | 165      |
| Others                                   | 81    | 1.6           | 1.6      | 32.1  | 26.3     | 12.4                             | 9.6      | 40                                 | 34       |
| Region of residence                      |       |               |          |   |          |                                  |          |                                    |          |
| East                                     | 1,751 | 33.5          | 37.1     | 30.8  | 28.8     | 18.0                             | 20.3     | 145                                | 222      |
| Central                                  | 1,688 | 32.3          | 30.5     | 26.1  | 25.4     | 16.9                             | 18.3     | 116                                | 132      |
| West                                     | 1,791 | 34.2          | 32.4     | 28.6  | 29.1     | 17.1                             | 18.8     | 147                                | 170      |
| Rural/Urban residence registration       |       |               |          |   |          |                                  |          |                                    |          |
| Rural                                    | 3,261 | 62.4          | 52.5     | 31.0  | 31.7     | 15.5                             | 15.5     | 109                                | 114      |
| Urban                                    | 1,969 | 37.7          | 47.5     | 24.4  | 23.5     | 20.4                             | 23.3     | 172                                | 229      |
| Health insurance coverage                |       |               |          |   |          |                                  |          |                                    |          |
| No health insurance                      | 486   | 9.3           | 9.0      | 33.1  | 31.4     | 12.1                             | 12.9     | 98                                 | 103      |
| Rural resident health insurance          | 3,418 | 65.4          | 56.9     | 30.4  | 30.9     | 15.7                             | 15.3     | 114                                | 120      |
| Urban resident health insurance          | 342   | 6.5           | 8.9      | 25.7  | 29.4     | 19.0                             | 16.4     | 182                                | 197      |
| Urban employee health insurance          | 670   | 12.8          | 17.2     | 19.9  | 19.4     | 24.2                             | 29.9     | 214                                | 288      |
| Government healthcare programme          | 204   | 3.9           | 5.5      | 22.1  | 16.6     | 28.4                             | 38.6     | 144                                | 197      |
| Others + commercial medical insurance    | 110   | 2.1           | 2.5      | 23.6  | 22.1     | 22.7                             | 26.3     | 130                                | 173      |

(continued on next page)

Table 1 (Continued)

|  | N     | Frequency (%) |          | Proportion of seniors who have lost all teeth (%) |          | Dental care utilization rate (%) |          | Per-patient dental care costs (\$) |          |
|--|-------|---------------|----------|---|----------|----------------------------------|----------|------------------------------------|----------|
|  |       | Unweighted    | Weighted | Unweighted  | Weighted | Unweighted                       | Weighted | Unweighted                         | Weighted |
| Self-assessed health status                                      |       |               |          |   |          |                                  |          |                                    |          |
| Very good and good   | 743   | 14.2          | 15.3     | 29.3  | 26.5     | 14.0                             | 16.3     | 161                                | 214      |
| Fair   | 1,520 | 29.1          | 29.7     | 27.1  | 28.3     | 17.9                             | 20.5     | 145                                | 216      |
| Poor   | 1,951 | 37.3          | 36.6     | 28.2  | 26.9     | 18.4                             | 18.6     | 134                                | 148      |
| Very poor  | 1,016 | 19.4          | 18.4     | 30.7  | 30.0     | 16.9                             | 20.7     | 114                                | 144      |
| The level of education was categorised as follows: Family income |       |               |          |   |          |                                  |          |                                    |          |
| Poorest  | 1,046 | 20.0          | 20.0     | 31.5  | 30.7     | 12.8                             | 12.9     | 69                                 | 65       |
| Quintile 2   | 1,046 | 20.0          | 20.0     | 28.8  | 28.2     | 14.1                             | 13.9     | 94                                 | 107      |
| Quintile 3   | 1,042 | 19.9          | 20.0     | 28.7  | 29.6     | 15.2                             | 15.9     | 116                                | 128      |
| Quintile 4   | 1,048 | 20.0          | 20.0     | 26.8  | 27.6     | 20.7                             | 20.5     | 141                                | 148      |
| Richest  | 1,048 | 20.0          | 20.0     | 26.9  | 24.2     | 24.0                             | 29.4     | 210                                | 290      |

Source: 2015 survey data from the China Health and Retirement Longitudinal Study (CHARLS). The conversion rate (fixed at 31 December 2014) is 1 USD = 6.2068 CNY.

### Disparities in per-patient costs of dental care

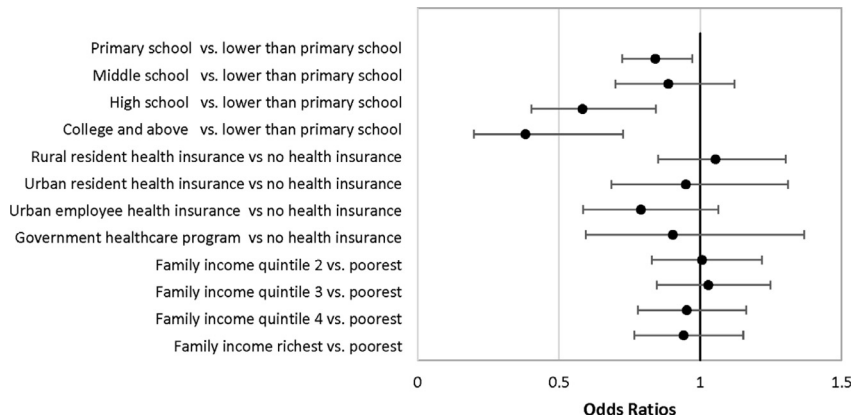
Unadjusted per-patient costs of dental care differ across SES groups and according to other control variables (Table S3). For example, the per-patient costs in college-educated seniors were almost three times higher than those in seniors with less than primary school education. Figure 3 illustrates differences in adjusted per-patient costs of dental care stratified according to the level of education was categorised as follows SES and insurance type, with results presented as average marginal effects following generalised linear model regressions. The dental-care costs for the college-educated seniors were \$88 higher, on average, than the costs for seniors with less than primary school education. No statistically significant differences are seen for other educational levels. Those with urban employee insurance, urban resident insurance and rural employee insurance had costs that were \$68, \$80 and \$30 higher, respectively, than the costs for the uninsured. The highest quintiles (2–4 and wealthiest) of family income demonstrated costs \$22, \$41, \$54, and \$111, respectively, higher than that found for the lowest quintile (poorest seniors). We found essentially the same associations in the weighted analysis (Figure S3).

### Discussion

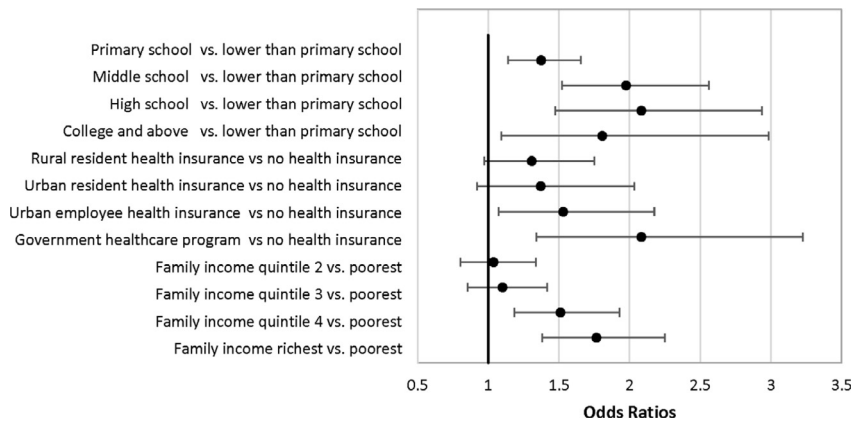
This study examined seniors' access to dental care and the costs of care in a healthcare system that universally covers most medical services but not dental care. We found that only 19% of elderly Chinese subjects had seen a dentist in the past year. One regional study, in 2010, in Northeast China found that about 20% of seniors aged 65–74 years had a dental care visit(s) in the past 2 years, but that 61% of seniors had a 'perceived need' for a dental visit(s)<sup>24</sup>. While access to basic health care is a core principle of the Chinese healthcare system, the fact that almost 30% of Chinese seniors have no remaining teeth and only 19% of elderly Chinese saw a dentist in the past year highlights the potential unmet dental care needs among Chinese seniors. Older adults with unmet dental needs often experience cavities<sup>25</sup>, dry mouth, difficulty biting/chewing, pain<sup>26</sup> and embarrassment; they also avoid smiling and have reduced social participation<sup>27</sup>. These problems impact the physical, social and emotional well-being of seniors. In contrast to dental care, other specialty care is easily accessible for Chinese seniors<sup>28,29</sup>. This separation of the dental system from the rest of health care is similar to the situation in the USA.<sup>30</sup>

Improving equity of access has received particular attention in China, but this study provides evidence that socio-economic disparities in dental care remain. We found that, in China, dental care disparities are substantial and that patients with rural resident insurance and lower SES have a noticeably lower likelihood of using dental care than their peers with urban insurances and higher SES. Sharp differences in the use of dental care and costs of care across income groups and insurance types underscore the extent of seniors' exposure to potentially high financial burdens.

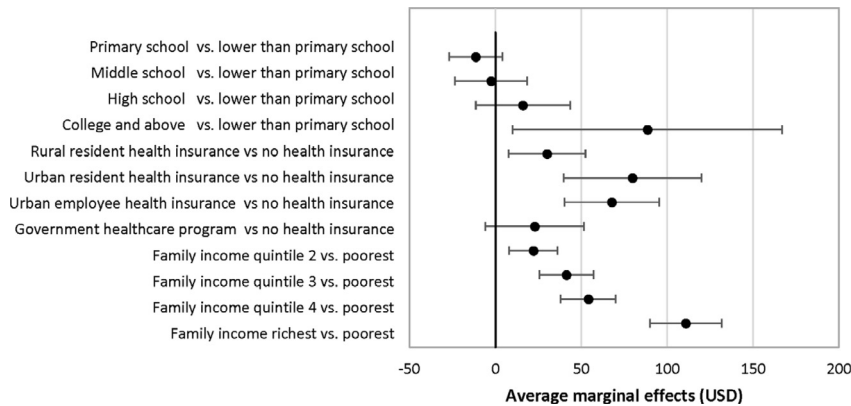
The findings from our analysis of dental care utilisation highlight the positive impact of insurance coverage and



**Fig. 1 – Odds ratios of losing all teeth in Chinese seniors according to level of education, insurance type and family income. Source: authors’ analyses of data from the 2015 China Health and Retirement Longitudinal Study (CHARLS). n = 5,230 The filled circle indicates the mean, and error bars denote 95% CI.**



**Fig. 2 – Odds ratios of receiving dental care in the past year in Chinese seniors according to level of education, insurance type and family income. Source: authors’ analyses of data from the 2015 China Health and Retirement Longitudinal Study (CHARLS). n = 5,230. The filled circle indicates the mean, and error bars denote 95% CI.**



**Fig. 3 – Adjusted per-patient dental care costs for Chinese seniors: an average marginal effect of level of education, insurance type and family income was found. Source: authors’ analyses of data from the 2015 China Health and Retirement Longitudinal Study (CHARLS). The conversion rate (fixed at 31 December 2014) is 1 USD = 6.2068 CNY. n = 826. The filled circle indicates the mean, and error bars denote 95% CI.**

generous health insurance plans. The uninsured have the lowest likelihood of using dental care. Because rural health plans have a higher coinsurance rate than urban health insurance, those enrolled in rural resident insurance have a much lower likelihood of using dental care than those insured by urban health plans. This suggests that further reducing the proportion of those uninsured and coinsurance rates of those enrolled in health insurance plans may improve access to dental care for Chinese seniors and reduce disparities associated with SES and insurance types.

Although in China dental care is currently separated from medical care, the Chinese government aims to bridge the divide. Oral health was recently written into the Healthy China 2030 blueprint<sup>31</sup>. It is anticipated that in the future, social medical insurances will cover a wider range of dental services than they do at present. As US researchers explore expanding dental coverage as a standalone benefit or in conjunction with enhancing benefits for other services<sup>11</sup>, we recommend that the Chinese single-payer system covers preventive dental care (examinations, cleaning, X-rays, fluoride treatments) and basic dental treatments (pain relief, composite fillings, tooth extractions, root canal treatment and crowns). Reduction in medical costs of caring for older patients with untreated dental disease is expected to offset some of the costs of expanding coverage<sup>32,33</sup>.

While dental coverage will be expanded in China, we expect that the three major insurance schemes will change coverage of their policies at different rates because they are governed and funded by different agencies<sup>19</sup>. Seniors insured by rural resident insurance may have improved access to dental care in the next decade, but they will still experience dental care disparities compared with those enrolled in urban plans. However, for policy researchers, this offers an opportunity to analyse the causal effects of insurance coverage and coinsurance rates on dental care.

The findings from this study and future causal analyses are relevant to policy researchers in other universal coverage systems with a private dental sector<sup>9–11,28</sup>, such as the Medicare programme in the USA and the Canadian public health care system. Researchers from these countries suggest bridging the dental-medical divide and making oral health an integral part of health care<sup>34–36</sup>. Some offer legislative, professional and economic reasons for why dental care is not incorporated into public insurance<sup>37</sup>. There are debates on whether oral health is a personal or societal responsibility. Regardless of who is responsible for oral health, the universal healthcare system has a responsibility at least to mitigate the factors that diminish people's ability and responsibility to take care of their teeth. Expanding coverage to include essential dental services will probably mitigate the effects of low SES and reduce, but not eliminate, dental health disparities.

### Limitations

Our study had several limitations. First, the CHARLS asks participants to self-report on tooth loss, as well as their use of, and amount spent on, dental care. The project has no claims data or other independent sources to verify respondents' reported dental use or expenses. Second, important individual-level data, such as the presence of dental diseases,

screening-based or self-reported unmet needs, types of dental services (curative vs. cosmetic) and provider type were not available. In the future, researchers will need to design an oral health survey to collect such data, with the aim to study oral health and care in greater detail. Third, we used data from only 1-year cross-sectional data of the CHARLS to estimate dental health, care and costs, with which we cannot establish a causal relationship between dental care and the socio-economic variables and insurance type. As the three social medical insurance schemes will expand coverage of dental care over different timescales, future research will have appropriate data with which to analyse the causal effects of insurance coverage of dental services on the utilisation of dental care. The current study sets a baseline for future assessment of senior dental health and care in response to changing insurance policies. Lastly, many dental problems are preventable, and dental health is determined before reaching seniority. The data do not allow us to study the access of seniors to oral care services in their younger years.

### Conclusions

This report provides one of the first descriptions of dental care and disparities in China. It sets a baseline for future policy evaluation of dental care, costs of care and impact of dental coverage on care and costs.

This study highlighted the potential unmet need for dental care among Chinese seniors and striking health disparities after stratification of data according to SES and insurance types. Following analysis of data on a nationally representative sample, we found that almost 30% of Chinese seniors have no remaining teeth, and that only 19% of elderly Chinese had visited a dentist in the past year. The high SES groups and those enrolled in a plan with a low coinsurance rate had a higher likelihood of using dental care services and spending more on dental care than did the lowest SES groups. We welcome the fact that oral health was recently written into the Healthy China 2030 blueprint<sup>31</sup>. While more studies are required, we expect that further reduction of the proportion of uninsured rates seniors in China and extending insurance plans to cover preventive dental care and basic dental treatments will increase access of Chinese seniors to dental care and reduce socio-economic disparities. The findings from this study and from future updated analyses have implications for other universal coverage systems with a private dental sector.

### Acknowledgements

We would like to acknowledge the China Health and Retirement Longitudinal Study (CHARLS) team for collecting nationally representative data, and for making the data public.

### Conflict of interest

The authors declare that they have no competing interests.

## Authors' contributions

NY participated in the concept and design of this study. CL participated in acquisition of data and analysis. Both authors participated in interpretation of data and preparation of the manuscript, and both approved the submitted manuscript.

## Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

## Consent for publication

Not applicable.

## Data Availability

Data are available on request from the CHARLS project.

## Ethics statement

Data were acquired from the CHARLS project. The CHARLS project team has received approval from the Ethical Review Committee (IRB) at Peking University in January 2011. Every participant had signed the informed consent.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1111/ijdj.12600](https://doi.org/10.1111/ijdj.12600).

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