Statistical Analysis of Current Oral Health Care and Dental Education Resources in China

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Objective: *To collect information and statistical data regarding the current oral health care and dental education resources in China.*
Methods: *Electronic databases were searched and a literature review conducted. The homepages of relevant universities and colleges were visited to collect dental education information. In addition, private conversations with related experts were conducted.*
Results: *Compared with the 3rd National Oral Health Survey (2005), the ratio of gingival bleeding in individuals aged 33 to 44 years has increased in the last 10 years. The average percentage of residents visiting departments of dentistry in public hospitals is less than 10%. The total number of dentists and assistant dentists increased to 167,227 in 2016, with a ratio of 1.21 per 10,000 people. There is a great imbalance in the distribution of dental practitioners among the provinces. There are 101 dental schools or departments of stomatology that provide 5-year dental training courses and offer bachelor's degrees in dentistry, with another 93 dental institutions offering shorter 3-year training courses for assistant dentists.*
Conclusion: *The results of the present study show that there has been significant change during recent years in China. However, the ratio of dental practitioners to the population as well as the number of dental visits carried out is still much lower than in developed countries and does not satisfy the demand for dental care in China. The quality and quantity of dental education, including continuing dental education, calls for improvement in the future.*
Key words: *oral health care, dental education, China, dentist, oral health status*
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The most-recent 4th National Oral Health Survey (2015–2017) showed that the oral health care situation in China is unsatisfactory and needs urgent improvement[1]. One reason for this is that people seeking oral health care in China are mostly driven by disease-induced pain and suffering rather than by the desire for preventive-orientated dental care[2-4]. Another reason is the shortage of oral health care resources[5]. This has resulted in a large burden placed on both the individual economic level and the governmental level as regards dental disease[2,6-8].

In recent decades, with the rapid change and development of the Chinese society and economy, there has been a change in the level of individual awareness of dental disease as well as in oral health care and dental education resources. However, there is not enough information and statistical data about the current prevalence of dental disease, dental care resources or dental education resources[5,9]. The aim of the present study was to review and analyse the available data and provide recommendations for the future development of the Chinese dental health care model.

Material and methods

Electronic databases, including Medline for English literature and Wanfang for Chinese literature, were searched using key words such as 'oral health care',

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Table 1 General information of the National Oral Health Surveys.

Surveys	Year	Subjects	Provinces	Populations
1st	1983	383,265	29	Aged 7, 9, 12, 15, 17
2nd	1995	140,712	11	Aged 5, 12, 15,18, 35–44, 64–75
3rd	2005	93,826	30	Aged 5, 12, 35–44, 64–75
4th	2015–2017	172,425	31	Aged 3–5, 12–15, 35–44, 55–64, 65–74

'oral health status', 'dental education', and 'China'. A literature review, including Chinese oral health epidemiology survey reports, Chinese government statistical yearbooks, and Chinese college enrolment brochures, was conducted to obtain information on the oral health and dental education status in China. The homepages of universities and colleges with dental departments and departments of stomatology were visited to gather the latest information on dental education. In addition, when the information gained from electronic databases, publications, and the internet was unclear, private conversations were conducted with relevant experts at various institutions.

Results

National Oral Health Surveys

Four National Oral Health Surveys have been conducted in China since 1983[1,10-12]. Table 1 summarizes the duration, number of subjects involved, number of provinces where the subjects were distributed, and ages of the populations involved in those surveys.

The 4th National Oral Health Survey was carried out from 2015 to 2017[1]. In total, more than 172 thousand subjects from 31 provinces were involved. The rate of people's oral health knowledge was 60.1%, and 84.9% had a positive attitude towards oral health care. The brushing rates of children aged 5 and 12 were 24.1% and 31.9%, respectively, with the rate of fluoride toothpaste use 42.1% and 55%, respectively. The proportions of preventive dental diseases and consultation examinations were 40% and 43.2% in the 5- and 12-year-old population, respectively. In adults, 36.1% brushed twice a day and 61.0% used fluoride toothpaste. The caries prevalence rates in the permanent teeth of 12-year-old children and the primary teeth of 5-year-old children were 34.5% and 70.9%, respectively. Among 35- to 44-year-olds, the detection rates of oral calculus and gingival bleeding were as high as 96.7% and 87.4%, respectively. Among 65- to 74-year-olds, the number of remaining teeth was 22.5, the proportion of edentulous jaws was 4.5% and the proportion of missing teeth that had been restored was 63.2%.

These results, together with results from previous analyses, suggest that the oral health situation, especially the periodontal health situation, in China is still poor and needs urgent improvement[10-14].

Dental visit ratio of public institutions

According to the state-level analysis of the oral health care system by the American Dental Association Health Policy Institute, during 2013, 58% of adults had a dental visit in the US[15]. However, this kind of statistics system on oral health care has not yet been perfected in China, especially for the private dental institutions[16]. On the other hand, as only public dental and medical institutions are allowed to utilize basic medical insurance for basic dental treatment in China, most residents prefer to visit public institutions for dental treatment when needed. The percentage of Chinese residents visiting departments of dentistry in public hospitals partially reflects the dental visit conditions in China. As shown in Figure 1, the best condition is in Beijing, where 37.6% residents visited a dentist in a public dental and medical institution, followed by Shanghai, Zhejiang and Tianjin with a percentage of 26.9%, 21.7% and 20.8%, respectively. However, in most provinces, the percentage was less than 10%. Considering the high prevalence of dental disease, as previously mentioned, a huge number of people have untreated dental disease in China.

Dental institutions

There are several kinds of institutions providing oral health care in China, including dental departments in

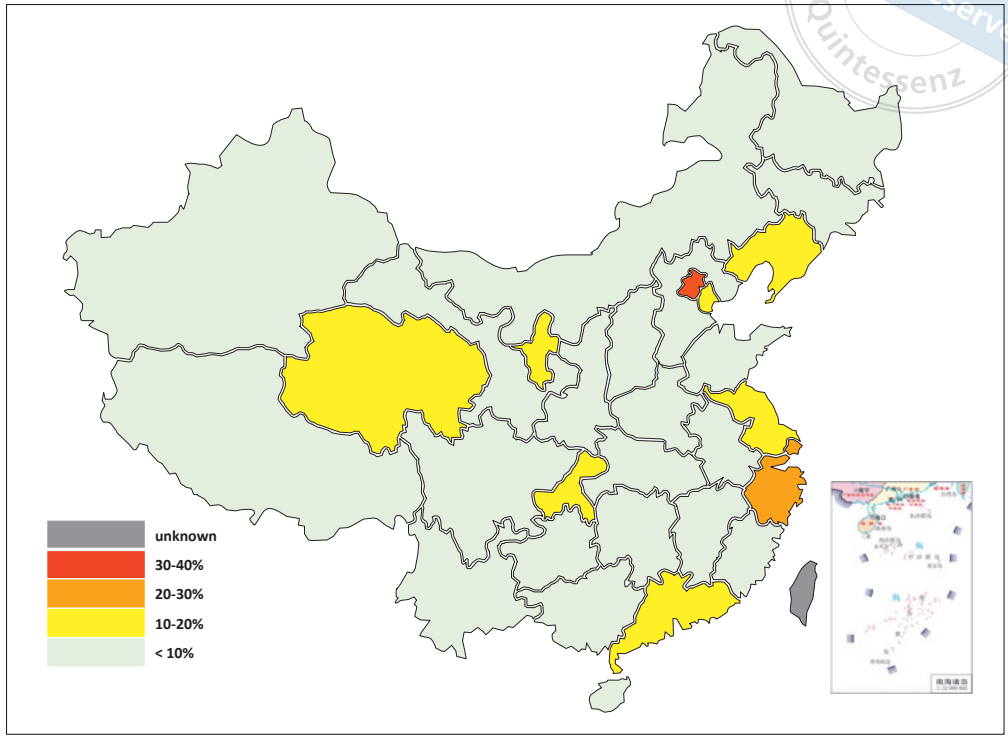

Fig 1 Percentage of residents visiting a department of dentistry in China in 2016.

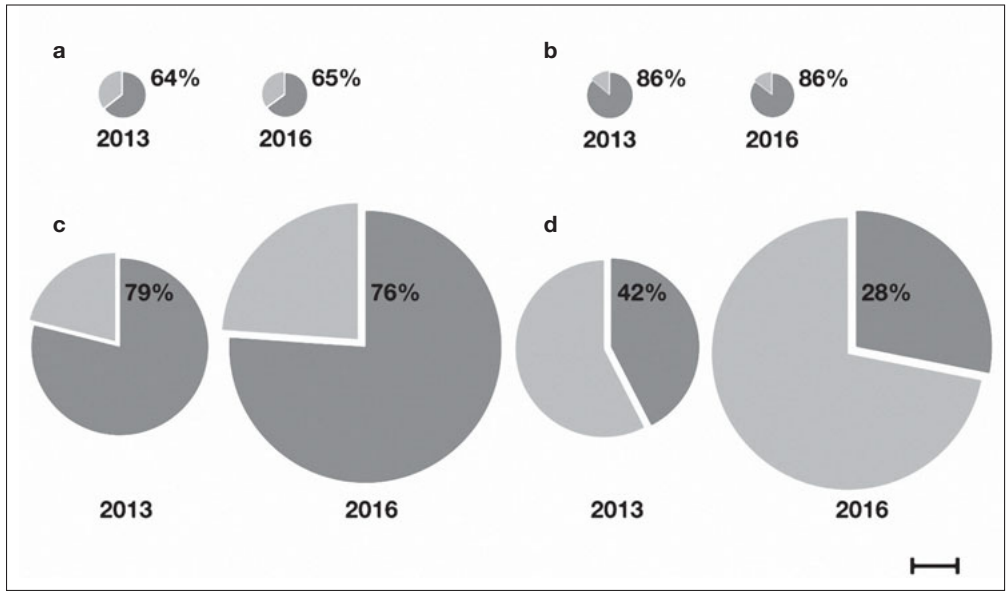

Fig 2 The location and ownership of specialized dental health resources in China. **(a)** Location of dental prevention and treatment institutions (light grey: rural institutions; dark grey: urban institutions). **(b)** Ownership of dental prevention and treatment institutions (light grey: private institutions; dark grey: public institutions). **(c)** Location of dental hospitals (light grey: rural hospitals; dark grey: urban hospitals). **(d)** Ownership of dental hospitals (light grey: private hospitals; dark grey: public hospitals). Bar: 100 institutions or hospitals.

general hospitals, dental hospitals, dental prevention and treatment institutions and dental clinics[5,17]. The dental prevention and treatment institutions are usually established by local health authorities such as the Health and Family Planning Commissions[16,17].

As shown in Figure 2, in 2013, among the total of 101 dental prevention and treatment institutions, 64% were located in urban areas, while 86% were public. The total number, location and ownership of the dental prevention and treatment institutions was much the same in 2016. However, the number of dental hospitals increased significantly, from 384 in 2013 to 594 in 2016. In addition, the percentage of private dental hospitals was 72% in 2016 compared with 58% in 2013, although the locations of dental hospitals did not change much from 2013 to 2016.

Dental practitioners

According to the China Health Statistical Yearbook, in 2013 in China there were 129,504 dentists and assistant dentists who served 1.36 billion people[18]. In 2016, the total number of dentists and assistant dentists increased to 167,227, with a ratio of 1.21 per 10,000 people[16]. However, there was a major imbalance in the distribution of dental practitioners among the provinces (Fig 3a and b). In 2016, Beijing had the highest percentage of dental practitioners in the country, with a ratio of 3.83 per 10,000 people, with the lowest percentage in Tibet, with a mere 160 dental practitioners serving 3.31 million people. Although in recent years the number of dentists and assistant dentists has increased significantly, compared with other countries there is a shortage of dental practitioners, a situation that can be resolved by improving the dental education situation in the country (Fig 3c)[16,19].

Analysis of the constituent ratio of dentists and assistant dentists in China shows interesting tendencies (Fig 4)[16,18,20]: the percentage ratio of males continuously decreased from 56% in 2010 to 51.8% in 2016 (Fig 4a); the percentage of dentists and assistant dentists with less than 10 years of working experience greatly increased, from 28.5% in 2010 to 35.9% in 2016 (Fig 4b); the percentage of those with postgraduate education experience increased from 6.8% in 2010 to 9.2% in 2016 (Fig 4c); the percentage of those with a 5-year standard dental course after 12 years of basic education as well as those with a shorter 3-year training course after 12 years of basic education also increased from 62.7% in 2010 to 68.7% in 2016 (Fig 4d); the percentage of those with 9 years of basic education and a shorter 3-year training courses or even less decreased from 30.6% in 2010 to 22.2% in 2016 (Fig 4e); the percentage of those with a higher professional titles, including visiting staff, associate chief physician and chief physician, decreased from 37.8% in 2010 to 32.5% in 2016 (Fig 4f).

These tendencies suggest that there are increasingly more female Chinese dentists of a younger age and with a better education. On the other hand, with the increase of private dental institutions that do not have a professional title assessment system, many dental practitioners no longer have the opportunity to obtain a higher professional title.

Dental education system

Dental education in China originated in the 1910s. In 1917, the Canadian dentist and missionary, Dr Ashley Woodward, founded the first dental school in Chengdu, Sichuan province. In 1935, Dr Zhilian Huang, who graduated from the University of Minnesota, established another public dental school in Nanjing. Later, in 1945, this school moved to Xi'an and became one of the largest dental schools in the country. In 1936, Dr Le Goaer arrived in Shanghai and established St. John's College of Dental Medicine. Dentists graduated from Chengdu and moved to Xi'an, Beijing and Wuhan, where they established more dental schools during the 1940s and 1960s. At present, there are 101 dental schools or departments of stomatology that can provide 5 years of dental training and offer a bachelor's degree in dentistry[21]. As shown in Figure 5a, by 1990 there were 33 of such schools and in the following 20 years, another 55 schools were established. In the last eight years, 13 more schools have been approved to train students and offer a bachelor's degree in dentistry. Among 31 administrative regions in China, Liaoning province has the most educational institutions, followed by the provinces of Shandong, Zhejiang and Guangdong (Fig 5b). Apart from the normal 5-year dental education courses on offer, a further 93 dental institutions offer shorter 3-year training courses for assistant dentists. The distribution of those institutions is shown in Figure 5c. Noteworthy is the fact that, at present, the autonomous region of Tibet has no dental training institutions.

Discussion

Chinese society and economy have changed rapidly in recent decades. The dental education and dental care systems have undergone tremendous improvement[5,22,23]. The present study reviewed and analyzed the latest data regarding the current situation with dental care resources and dental education in China. The 4th National Oral Health Survey showed a high prevalence of dental diseases in China, together with better oral health literacy levels and health behaviours among Chinese people[1]. Taking into consideration China's very large population, if those who have detected calculus were actually treated, 234.7 million people aged 35 to 44 years would need to be treated. This represents a very significant disease burden, considering the ratio of dentists and assistant dentists to the population (Fig 3). On the other hand, although the periodontal index showed a worse tendency than that of the 3rd National Oral Health Survey (2005), the modification and improvement of the survey protocol and procedure resulted in more reasonable results[24-26].

More than half of the adults in the US visit a dentist each year; however, in China, the average percent-

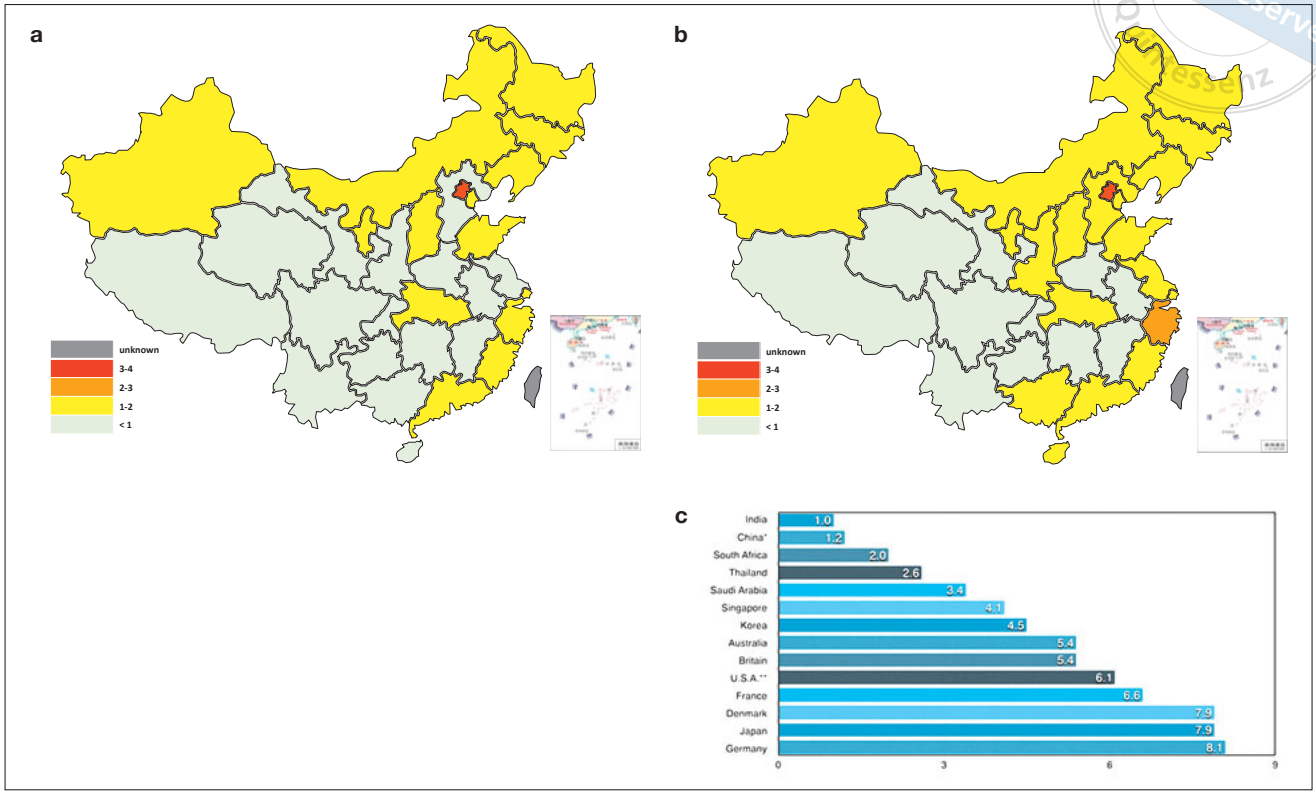

Fig 3 Number of practising dentists per capita in China (2013 and 2016) and in several world countries (2007 to 2010). **(a)** Dentist and assistant dentist numbers per 10,000 people in 2013. **(b)** Dentist and assistant dentist numbers per 10,000 people in 2016. **(c)** Dentist numbers per 10,000 people in several countries (2007 to 2010). * indicates the total number of dentists and associated dentists in 2016; ** indicates the total number of dentists in 2015.

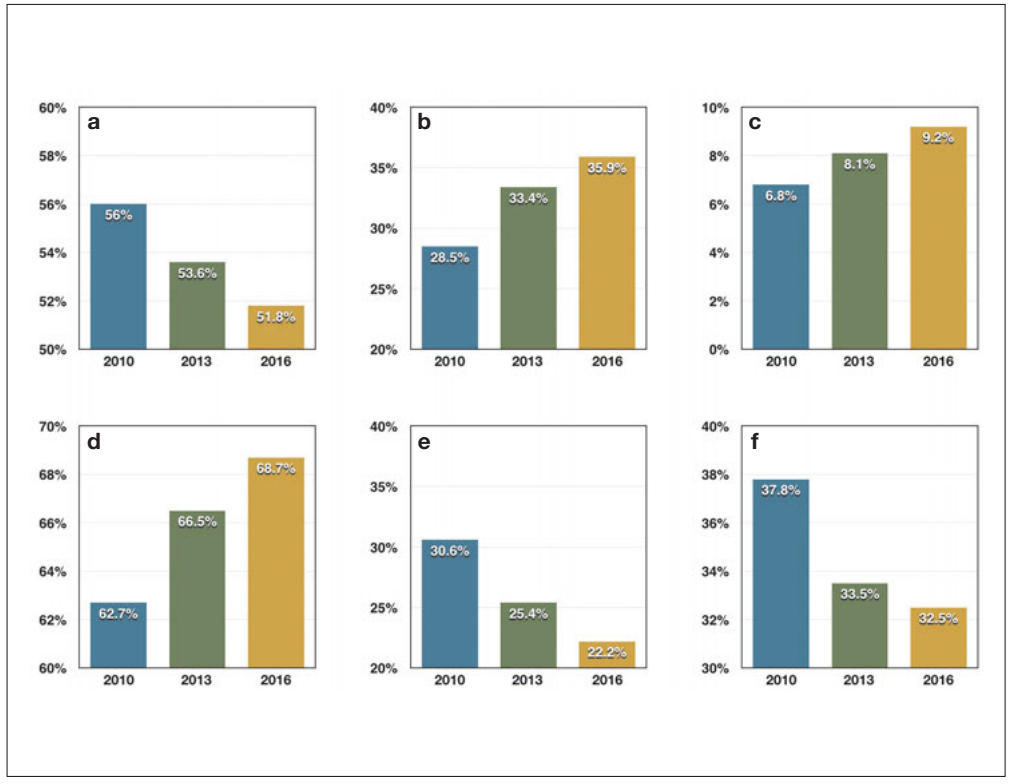

Fig 4 Trends of the constituent ratio of dentists and assistant dentists in China from 2010 to 2016. **(a)** Percentage ratio of males. **(b)** Percentage of dentists and assistant dentists with less than 10 years of working experience. **(c)** Percentage of dentists and assistant dentists with postgraduate education experience. **(d)** Percentage of dentists and assistant dentists with a 5-year standard dental course after 12 years of basic education and a shorter 3-year training course after 12 years of basic education. **(e)** Percentage of dentists and assistant dentists with 9 years of basic education and a shorter 3-year training course or even less. **(f)** Percentage of dentists and assistant dentists with visiting staff, associate chief physician or chief physician titles.

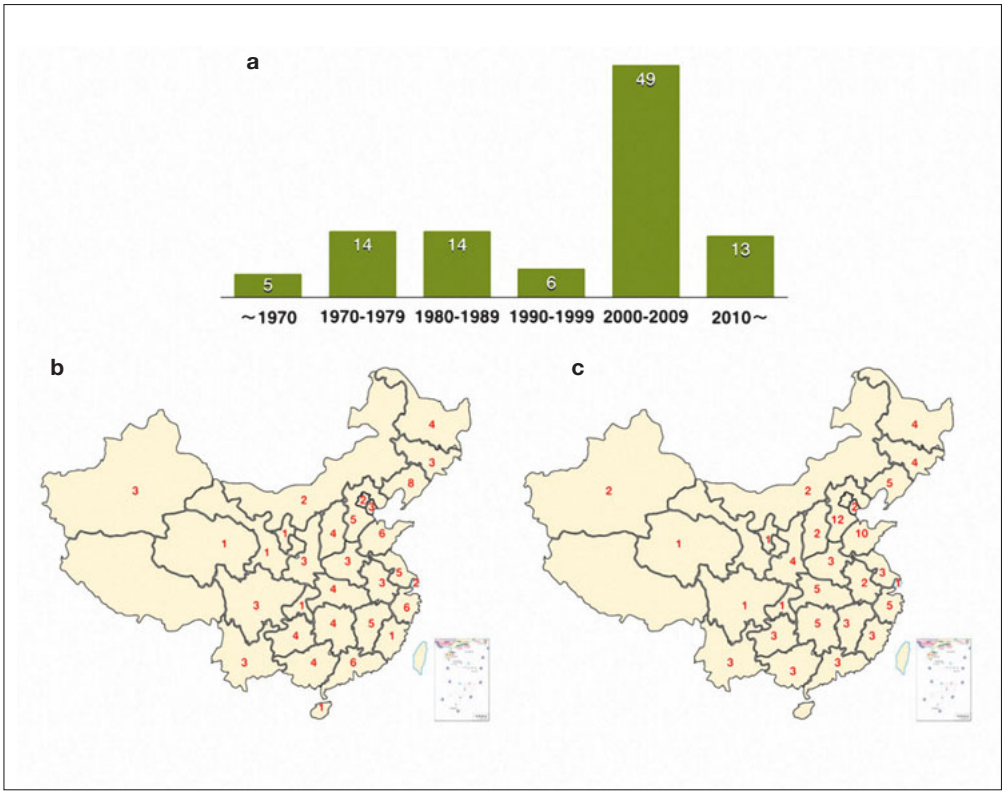

Fig 5 Education institutions for dentists and assistant dentists in China. **(a)** Number of newly established 5-year education institutions offering a bachelor's degree in dentistry for students of every age. **(b)** Number of 5-year education institutions offering a bachelor's degree in dentistry in 31 administrative regions. **(c)** Number of dental institutions offering shorter 3-year training courses for assistant dentists in 31 administrative regions.

age of residents visiting a department of dentistry in public hospitals is less than 10% (Fig 1). Although the statistics system has not yet been perfected in China, especially for private dental institutions, in the current disease-induced, pain-and-suffering-driven oral health care milieu, together with the current insurance system, a large number of dental diseases are not promptly diagnosed and treated. Dental visits are considered an important part of maintaining general good health, e.g. they can help in the early detection of systemic diseases such as diabetes mellitus. The fact that dental services are underutilized in China suggests that the government needs to consider guiding people to pay attention to the early prevention and treatment of dental diseases at the national dental health policy level[3,27].

The analysis of Chinese dental practitioners in this study showed that there are at now more female Chinese dentists who are younger and better educated. Meanwhile, the percentage of dentists with a higher professional title has declined in recent years (Fig 4) due to the very rapid growth of the dental education services in China over the past 20 years as well as the great increase of private dental institutions without the professional title evaluation system (Fig 2 and Fig 5a). However, the analysis of the dental education system also showed that those newly built dental schools do not have enough educators in many dentistry fields and that the quality of dental education needs continuous improvement[9].

The results of the 4th Oral Health Survey (2015 to 2017) showed that current dental resources are insufficient to meet the country's large dental treatment requirements. This latest survey showed that the periodontal condition of the Chinese population is generally poor. Although people tend to accept the importance of sound oral care (such as regular supragingival ultrasonic scaling), there are relatively few dentists and periodontists to undertake periodontal examinations, including the oral hygiene index, the bleeding index, the probe depth and so on, which has largely resulted in insufficient periodontal treatment. Related to this is the lack of professional oral hygienist training and a career system in this field, although the Chinese Stomatological Association has been making a great effort to promote the establishment of a proper oral hygienist system in China.

In conclusion, the investigation undertaken in this study of the oral health care system and dental education resources in China showed that although there has been a significant change over the past years, the current ratios of dental practitioners and dental visits to the population are still much lower than in the developed countries and do not satisfy the demands of the Chinese

population. The quality and quantity of dental education, including continuing dental education, in China calls for improvement in the future.

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Conflicts of interest

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

Author contribution

Dr Da Li LIU collected the data, undertook the statistical analysis and prepared the manuscript; Dr Yu Feng XIE collected the data and undertook the statistical analysis; Dr Rong SHU designed the study, collected data and revised the manuscript.

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