

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.e-jds.com

Correspondence

The regional distribution of dentists in Taiwan



KEYWORDS

Dentist's practice place;
Domestic dental schools;
Foreign dental schools;
Regional distribution of dentists

Since different regions or administrative districts have different population structures and developments, the medical resources (such as the number of clinics or physicians) are also discrepant in different regions of Taiwan. As for the ideal practice locations, most of them are the areas with convenient transportation and high population density. However, physicians' choice of practice place is closely related to geographical relationship, including the locations of their graduation school and internship hospital, the places where their family and friends live, and the areas where they are familiar with [1].

The vast majority of practicing dentists in Taiwan are dental graduates from domestic dental schools, but there are also some Taiwanese who graduated from foreign dental schools and returned to Taiwan to practice. In addition, the eight dental schools in Taiwan are all located in the western region of Taiwan, including 4 in the northern region, 2 in the central region, and 2 in the southern region of Taiwan. The background of regional development and the geographical distribution of dental schools are the main factors causing the uneven distribution of dentists in Taiwan [2]. In this article, we attempted to explore the regional distribution of dentists in Taiwan based on the regions where their graduation schools were located.

The open information related to the number of dentists based on their graduation schools and practice locations was released by the nationwide dental professional guild (Taiwan Dental Association, TWDA) according to the data of

January 2023. Among 16,533 dentists, their practice place and graduation school background were classified according to the five regions of Taiwan or the three regions in the western Taiwan (Table 1). We distinguished the graduation schools of dentists into the domestic dental schools (including the northern, central, and southern dental schools) and the foreign dental schools. The dentists' practice regions of Taiwan were divided into the northern, central, southern, and eastern regions, and offshore islands. According to the graduation schools of dentists and their practice regions, we used the chi-square test and adjusted residual (AR) value to compare between the practice region tendencies of dentists and their graduation schools in different regions of Taiwan. The results are shown in Table 1. The AR value is conceptually the "post hoc comparison" of the chi-square test. It is a simple indicator to judge the significant contribution. In this article, Pearson's chi-square analysis was used to determine whether it was significantly high in the number of dentists (AR value ≥ 2) or significantly low in the number of dentists (AR value ≤ -2) in a cell of the table.

Based on the dentist's practice place according to the five regions of Taiwan, of the dentists graduating from dental schools in different regions of Taiwan, dentists graduating from the northern dental schools were more likely to practice in the northern region and less likely to practice in the central and southern regions of Taiwan. Those graduating from the central dental schools were more

<https://doi.org/10.1016/j.jds.2023.12.021>

1991-7902/© 2023 Association for Dental Sciences of the Republic of China. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Table 1 Relationship of the location of dental schools where the dentists graduated and the number of dentists (adjusted residual value or AR value) according to their practice place in the five regions of Taiwan or in the three regions of the western Taiwan in January 2023.

School background	Number of dentists (AR value) according to their practice place in the five regions of Taiwan				
	^a Northern region (n = 6)	^a Central region (n = 5)	^a Southern region (n = 5)	^a Eastern region (n = 3)	^a Offshore islands (n = 2)
Category 1					
Northern schools	4964 (41.8)	820 (−23.4)	889 (−28.6)	220 (4.3)	25 (0.5)
Central schools	2134 (−20.4)	1889 (35.5)	1020 (−8.3)	102 (−3.2)	13 (−1.3)
Southern schools	1213 (−26.6)	480 (−12.0)	1823 (42.9)	80 (−1.5)	15 (0.9)
Category 2					
Northern schools	4964 (40.4)	820 (−22.8)	889 (−27.4)	220 (3.9)	25 (0.4)
Central schools	2134 (−20.7)	1889 (35.2)	1020 (−7.8)	102 (−3.4)	13 (−1.3)
Southern schools	1213 (−26.8)	480 (−11.8)	1823 (43.3)	80 (−1.7)	15 (0.9)
Foreign schools	500 (3.5)	162 (−0.8)	152 (−3.9)	29 (1.5)	3 (0.1)
Category 3					
Domestic schools	8311 (−3.5)	3189 (0.8)	3732 (3.9)	402 (−1.5)	53 (−0.1)
Foreign schools	500 (3.5)	162 (−0.8)	152 (−3.9)	29 (1.5)	3 (0.1)
School background	Number of dentists (AR value) according to their practice place in the three regions of the western Taiwan				
	Northern region (n = 6)	Central region (n = 5)	Southern region (n = 5)		
Category 1					
Northern schools	4964 (43.4)	820 (−23.2)	889 (−28.3)		
Central schools	2134 (−21.4)	1889 (35.3)	1020 (−8.6)		
Southern schools	1213 (−27.2)	480 (−12.1)	1823 (43.0)		
Category 2					
Northern schools	4964 (41.8)	820 (−22.6)	889 (−27.2)		
Central schools	2134 (−21.7)	1889 (35.0)	1020 (−8.0)		
Southern schools	1213 (−27.5)	480 (−11.9)	1823 (43.3)		
Foreign schools	500 (3.8)	162 (−0.7)	152 (−3.8)		
Category 3					
Domestic schools	8311 (−3.8)	3189 (0.7)	3732 (3.8)		
Foreign schools	500 (3.8)	162 (−0.7)	152 (−3.8)		

Category 1: Classification according to the geographical regions of dental schools (excluding foreign dental schools) located.

Category 2: Classification according to the geographical regions of dental schools (including foreign dental schools) located.

Category 3: Classification according to whether dental schools are domestic or foreign.

^a The whole area of Taiwan was divided into five regions: the northern, central, southern, and eastern regions and offshore islands. The northern region (n = 6) included Keelung City, New Taipei City, Taipei City, Taoyuan City, Hsinchu City, and Hsinchu County. The central region (n = 5) included Miaoli County, Taichung City, Changhua County, Nantou County, and Yunlin County. The southern region (n = 5) included Chiayi City, Chiayi County, Tainan City, Kaohsiung City, and Pingtung County. The eastern region (n = 3) included Yilan County, Hualien County, and Taitung County. The offshore islands (n = 2) included Penghu County and Kinmen County.

likely to practice in the central region and less likely to practice in the northern and southern regions of Taiwan. Those graduating from the southern dental schools were more likely to practice in the southern region and less likely to practice in the central and northern regions of Taiwan (Table 1). Although there were very few of them practicing in the eastern region of Taiwan or the offshore islands, compared among various dentist groups, dentists graduating from the northern dental schools were more likely to practice in the eastern region, while those graduating from the central dental schools were less likely to practice in the

eastern region of Taiwan (Table 1). Compared between dentists graduating from the domestic and foreign dental schools, dentists graduating from the domestic dental schools were more likely to practice in the southern region and less likely to practice in the northern region of Taiwan. Those graduating from the foreign dental schools were more likely to practice in the northern region and less likely to practice in the southern region of Taiwan (Table 1). Furthermore, based on the dentist's practice place according to the three regions of the western Taiwan, the relevant comparison results were consistent with the above (Table 1).

In Taiwan, there are three major problems of the dentist occupation: a surplus of dentists, an uneven regional distribution of dentists, and a concentration of dentists in the metropolitan regions [3,4]. In this article, we used Pearson's chi-square analysis to confirm that there is a high degree of geographical relationship between the regional distribution of dentists and the locations of their graduation dental schools. According to our previous studies about the distribution of dental freshmen in Taiwan in 2020, the students from the northern region accounted for 44.3 % of the dental freshmen admitted by all dental schools, while the dental enrollment quotas of the northern dental schools accounted for 39.9 % of total enrollment quotas [5]. On the other hand, compared to dentists graduating from the domestic dental schools, those graduating from the foreign dental schools have a significantly great tendency to practice in the northern region of Taiwan. This means that if the current situation remains unchanged, the imbalance in the regional distribution of dentists in Taiwan may continue to worsen. Therefore, promoting a balanced distribution of dental enrollment quotas and even providing dental enrollment quotas to universities in the eastern region of Taiwan may be one of the feasible methods to solve the uneven geographical distribution of dentists in Taiwan.

Declaration of competing interest

A conflict of interest occurs when an individual's objectivity is potentially compromised by a desire for financial gain, prominence, professional advancement or a successful outcome. *JDS* Editors strive to ensure that what is published in the Journal is as balanced, objective and evidence-based as possible. Since it can be difficult to distinguish between an actual conflict of interest and a perceived conflict of interest, the Journal requires authors to disclose all and any potential conflicts of interest.

Acknowledgments

This study was supported by the research grant from the National Science and Technology Council, Taiwan (NSTC 112-2410-H-003-134).

References

- [1]. Ouyang LCL. The geographical study of health care facility distribution in Taipei City, Taiwan. *J Geogr Res* 2006;45:51–72 [In Chinese, English abstract].
- [2]. Chang JYF, Cheng FC, Liu TH, Lin TC, Chang YT, Chiang CP. Distributions of dental freshmen and practicing dentists and their correlations in different regions of Taiwan in 2020. *J Dent Sci* 2021;16:1125–32.
- [3]. Cheng FC, Chang JYF, Lin TC, Chang WC, Chang YT, Chiang CP. Imbalance in the geographical distribution of practicing dentists in postgraduate dental training institutions in Taiwan. *J Dent Sci* 2020;15:249–56.
- [4]. Cheng FC, Chang JYF, Lin TC, Tsai PF, Chang YT, Chiang CP. The changes of the number and regional distribution of dentists and dental institutions 9 years after the implementation of postgraduate year training program for dentists in Taiwan. *J Dent Sci* 2021;16:437–44.
- [5]. Chang JYF, Cheng FC, Liu TH, Lin TC, Chang YT, Chiang CP. Distributions of dental freshmen enrolled by northern, central, and southern dental schools in each city or county and different regions of Taiwan in 2020. *J Dent Sci* 2021;16:1162–9.

Feng-Chou Cheng

*Chia-Te Dental Clinic, New Taipei City, Taiwan
School of Life Science, College of Science, National Taiwan Normal University, Taipei, Taiwan
Science Education Center, National Taiwan Normal University, Taipei, Taiwan*

Tzu-Chiang Lin

Center for Teacher Education, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan

Ming-Chung Lee**

School of Life Science, College of Science, National Taiwan Normal University, Taipei, Taiwan

Chun-Pin Chiang*

*Department of Dentistry, National Taiwan University Hospital, College of Medicine, National Taiwan University, Taipei, Taiwan
Graduate Institute of Clinical Dentistry, School of Dentistry, National Taiwan University, Taipei, Taiwan
Graduate Institute of Oral Biology, School of Dentistry, National Taiwan University, Taipei, Taiwan
Department of Dentistry, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan*

**Corresponding author. School of Life Science, College of Science, National Taiwan Normal University, No. 88, Sec. 4, Ting-Chou Road, Taipei, 11677, Taiwan.
E-mail address: t43006@ntnu.edu.tw (M.-C. Lee)

*Corresponding author. Department of Dentistry, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, No. 707, Section 3, Chung-Yang Road, Hualien, 970, Taiwan.
E-mail address: cpchiang@ntu.edu.tw (C.-P. Chiang)

Received 22 December 2023
Available online 29 December 2023