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Perspective

# Geographical distribution of the practicing dentists based on their graduation schools and practice locations in Taiwan in 2022

Feng-Chou Cheng <sup>a,b,c</sup>, Ming-Chung Lee <sup>b\*\*</sup>,  
Chun-Pin Chiang <sup>d,e,f,g\*</sup>

<sup>a</sup> Chia-Te Dental Clinic, New Taipei City, Taiwan

<sup>b</sup> School of Life Science, College of Science, National Taiwan Normal University, Taipei, Taiwan

<sup>c</sup> Science Education Center, National Taiwan Normal University, Taipei, Taiwan

<sup>d</sup> Department of Dentistry, National Taiwan University Hospital, College of Medicine, National Taiwan University, Taipei, Taiwan

<sup>e</sup> Graduate Institute of Clinical Dentistry, School of Dentistry, National Taiwan University, Taipei, Taiwan

<sup>f</sup> Graduate Institute of Oral Biology, School of Dentistry, National Taiwan University, Taipei, Taiwan

<sup>g</sup> Department of Dentistry, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan

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\* Corresponding author. Department of Dentistry, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, No. 707, Section 3, Chung-Yang Road, Hualien, 970, 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 addresses: [t43006@ntnu.edu.tw](mailto:t43006@ntnu.edu.tw) (M.-C. Lee), [cpchiang@ntu.edu.tw](mailto:cpchiang@ntu.edu.tw) (C.-P. Chiang).

Although a medical education system for cultivating physicians, which did not include the dental education system for cultivating dentists, was first introduced to Taiwan during the Japanese colonial period (1895–1945), Taiwan's dental profession was still booming and the number of dentists in Taiwan reached 738 until the end of the World

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**Table 1** School distribution of the dental students and dental graduates as well as geographical distribution of the practicing dentists based on their graduation schools and practice locations in Taiwan in 2022.

Dental school University name	Domestic dental schools								Total	Foreign dental schools	Overall
	National Defense Medical Center	National Taiwan University	Kaohsiung Medical University	Taipei Medical University	Chung Shan Medical University	National Yang Ming Chiao Tung University	China Medical University	National Cheng Kung University			
<b>School establishment time and location</b>											
Time	1941	1953	1957	1960	1960	1976	1980	2019			
Location	Taipei City	Taipei City	Kaohsiung City	Taipei City	Taichung City	Taipei City	Taichung City	Tainan City			
Region	Northern	Northern	Southern	Northern	Central	Northern	Central	Southern			
<b>Numbers of the dental students and dental graduates</b>											
Approved enrollment quotas	20	29	80	82	76	38	46	20	391	a	–
Students studying (Male, female)	137# (84, 53)	221 (141, 80)	538 (332, 206)	562 (327, 235)	481 (234, 247)	259 (148, 111)	312 (204, 108)	105 (60, 45)	2615 (1530, 1085)	a	–
Graduates (Male, female)	23# (14, 9)	33 (21, 12)	88 (53, 35)	98 (60, 38)	78 (46, 32)	46 (30, 16)	56 (29, 27)	0	422 (253, 169)	50 <sup>a</sup>	472
Proportion (%)	5.39	7.73	20.61	22.95	18.27	10.77	13.11	0	98.83	11.71	100
<b>Number of the practicing dentists</b>											
Number	753	1257	3611	3568	3745	1340	1413	0	15,687	846	16,533
Proportion (%)	4.55	7.60	21.84	21.58	22.65	8.11	8.55	0	94.88	5.12	100
<b>Geographical distribution of the practicing dentists by city and county administrative districts</b>											
New Taipei City	95	317	367	942	524	297	182	0	2724	147	2871
Taipei City	208	511	488	1039	600	373	187	0	3406	212	3618
Taoyuan City	84	123	231	371	236	156	137	0	1338	87	1425
Taichung City	93	42	275	251	932	101	381	0	2075	99	2174
Tainan City	33	51	433	178	303	78	129	0	1205	31	1236
Kaohsiung City	99	42	1180	174	266	75	103	0	1939	97	2036
Keelung City	10	21	22	64	50	16	14	0	197	14	211
Hsinchu City	22	29	59	89	93	46	29	0	367	31	398
Chiayi City	2	4	62	44	89	18	24	0	243	6	249
Hsinchu County	14	28	46	51	55	58	27	0	279	9	288
Miaoli County	10	14	27	39	56	7	31	0	184	16	200
Changhua County	6	19	107	112	232	30	82	0	588	36	624
Nantou County	11	4	33	21	62	7	25	0	163	4	167
Yunlin County	6	7	38	31	62	9	26	0	179	7	186
Chiayi County	5	1	29	17	34	4	9	0	99	3	102
Pingtung County	11	9	119	27	58	17	5	0	246	15	261
Yilan County	13	13	30	58	35	27	11	0	187	12	199
Hualien County	22	12	30	31	34	12	9	0	150	12	162
Taitung County	4	6	20	17	11	5	2	0	65	5	70
Penghu County	4	2	11	6	8	4	0	0	35	1	36
Kinmen County	1	2	4	6	5	0	0	0	18	2	20
<b>Geographical distribution of the practicing dentists by municipality and non-municipality groups</b>											
Municipality	612	1086	2974	2955	2861	1080	1119	0	12,687	673	13,360
Non-municipality	141	171	637	613	884	260	294	0	3000	173	3173

(continued on next page)

Table 1 (continued)

Dental school	Domestic dental schools								Foreign dental schools	Overall	
	National Defense Medical Center	National Taiwan University	Kaohsiung Medical University	Taipei Medical University	Chung Shan Medical University	National Yang Ming Chiao Tung University	China Medical University	National Cheng Kung University			Total
<b>Geographical distribution of the practicing dentists by city and county groups</b>											
City	646	1140	3117	3152	3093	1160	1186	0	13,494	724	14,218
County	107	117	494	416	652	180	227	0	2193	122	2315
<b>Geographical distribution of the practicing dentists by regions</b>											
Northern	433	1029	1213	2556	1558	946	576	0	8311	500	8811
Central	126	86	480	454	1344	154	545	0	3189	162	3351
Southern	150	107	1823	440	750	192	270	0	3732	152	3884
Eastern	39	31	80	106	80	44	22	0	402	29	431
Outlying islands	5	4	15	12	13	4	0	0	53	3	56

# This was based on the data obtained from the address book issued by the dental school of National Defense Medical Center (NDMC) in the 2021 academic year.

<sup>a</sup> Studying abroad is a basic right of people guaranteed by the Constitution of Taiwan. The laws and regulations of Taiwan do not restrict people from studying dentistry abroad, and there are currently no official statistics on the number of dental students studying abroad. The Legislative Yuan Gazette in February 2022 pointed out that there are about 150–200 dental graduates from foreign dental schools returning to Taiwan every year. However, they need to complete one-year clinical training in the teaching hospitals in Taiwan before they can participate in the second phase of national dentist license examination (NDLE), and the number of quotas for this clinical training is limited to 50 per year.

War II (1945).<sup>1</sup> This means that based on the national health needs, the profession of dentists is necessary in modern society, and a dental education system for cultivating dentists is even more crucial. However, the dental school of National Defense Medical Center (NDMC), which was established in 1941, moved to Taiwan in 1949 and unexpectedly became the first dental school to appear in Taiwan. However, its main function is to train military dentists. Then, the dental school of National Taiwan University (NTU), which was founded in 1953 and became the first dental school established in Taiwan, had its first class of five dental graduates in 1961. Sixteen years after the war, Taiwan's dental profession finally welcomed its first batch of new young dentists. After another 60 years of growth, Taiwan's dental profession has developed into a comprehensive dental system with complete dental specialties.<sup>2</sup> Since the implementation of National Health Insurance (NHI) in 1995, the career of dentists has been favored by the social value system, which has accelerated the growth of the number of dentists in Taiwan.<sup>3</sup> Currently, there are eight dental schools in Taiwan. In this article, we attempted to explore the geographical distribution of the practicing dentists based on their graduation schools and practice locations in Taiwan in 2022.

In this analysis, the data related to the dental student status of various dental schools in Taiwan in 2022 was obtained from the website of the Ministry of Education. In addition, the open information related to the number of the practicing dentists based on their graduation schools and practice locations, which was released by the nationwide dental professional guild (Taiwan Dental Association, TWDA) according to data of January 2023, was used and regarded as the number of the practicing dentists in Taiwan in 2022. The results of further statistical analysis of the above obtained data are shown in Table 1. Of the eight dental schools, there are 4 in the Taipei City, 2 in the Taichung City, one in the Kaohsiung City, and one in the Tainan City. In term of the dental student status, there were a total of 391 approved enrollment quotas, 2615 dental students still studying in dental schools, and 422 dental graduates in 2022. Among them, the dental school of Taipei Medical University (TMU) had the largest number of approved enrollment quotas, dental students studying, and dental graduates. In addition, females only accounted for about 40% of all dental students studying or dental graduates in overall. For dental students studying, however, there were slightly more females than males in the dental school of Chung Shan Medical University (CSMU). Although the quotas for the one-year clinical training of foreign dental graduates was limited to 50 per year, this number exceeded the approved enrollment quotas of 4 domestic dental schools in Taiwan. Furthermore, there were a total of 16,533 practicing dentists in Taiwan in 2022. Except the National Cheng Kung University (NCKU) still did not have dental graduates so far, of the other 7 dental schools, the dental school of Kaohsiung Medical University (KMU) had the most practicing dentists, accounting for 21.84% (3611/16,533) of the total number of practicing dentists. There were 846 practicing dentists graduating from foreign dental schools, accounting for 5.12% and more than those graduating from NDMC (4.55%). In term of geographical distribution of the practicing dentists by city and county

administrative districts, for each dental school, the administrative districts with the largest number of practicing dentists were the administrative district of their dental schools located. In overall, the Taipei City had the largest number of practicing dentists, accounting for 21.88% (3618/16,533). In term of geographical distribution by municipality and non-municipality groups, the practicing dentists mainly worked in municipalities, accounting for 80.81% (13,360/16,533). In term of geographical distribution by city and county groups, they mainly worked in cities, accounting for 86.00% (14,218/16,533). In term of geographical distribution by regions, they mainly worked in the northern region of Taiwan, accounting for 53.29% (8811/16,533), followed in a descending order by the southern (23.49%), central (20.27%), and eastern (2.61%) regions, and outlying islands (0.34%). However, the practicing dentists graduating from KMU mainly worked in the southern region, while those graduating from CSMU and China Medical University (CMU) mainly worked in the northern and central regions of Taiwan.

Based on our results, the practicing dentists were mainly concentrated in the Taipei City, municipalities, cities and the northern region of Taiwan in 2022, accounting for 21.88%, 80.81%, 86.00% and 53.29% of all practicing dentists, respectively. According to the 2022 population, in Taiwan, the number of dentists per 10,000 people was as high as 7.11. This means that Taiwan is facing three major dental manpower problems: the surplus, uneven distribution, and urban-rural gap of the dentists. These are consistent with our past findings.<sup>3–5</sup> However, the past research has rarely linked geographical distribution of the practicing dentists and their graduation schools. This article attempted to report these related data. We found that there is a high degree of association between the practicing places of dentists and the locations of their graduation schools. For example, the practicing dentists graduating from NDMC, NTU, TMU and National Yang Ming Chiao Tung University (NYMCTU) mainly worked in the Taipei City, while those graduating from CSMU and CMU mainly worked in the Taichung City, and those graduating from KMU mainly worked in the Kaohsiung City. On the other hand, the practicing dentists graduating from foreign dental schools were also highly concentrated in cities and

were unevenly distributed. This means that introducing more dentists graduating from foreign dental schools may worsen the problems of oversupply and uneven distribution of the dentists in Taiwan. Therefore, we think that the total quantity control for the dentists graduating from domestic dental schools and foreign dental schools must be adhered to maintain the sound development for dental profession in Taiwan. In addition, providing approved dental enrollment quotas to universities with fewer practicing dentists in their regions of Taiwan may help to balance the distribution of practicing dentists in Taiwan in the future.

## Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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