



Original Article

Distribution of students admitted to dental schools of general universities in Taiwan in 2020



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Abstract *Background/purpose:* In Taiwan, the average income of a dentist increases after the implementation of national health insurance in 1995. Thus, the domestic departments of dentistry become a popular choice of university departments for high school graduates. The purposes of this study were to evaluate the distribution of students admitted to dental schools of general universities in each city or county in 2020 and to further compare the differences in regional distributions of dental freshmen accepted by three admission ways in 2020.

Materials and methods: This study collected the number of dental freshmen of general universities in each city or county in 2020 for further evaluating the differences in regional distributions of dental freshmen accepted by three admission ways in 2020.

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Results: The distribution of dental freshmen in 2020 did have a big urban-rural gap. These dental freshmen were more concentrated in municipalities than in non-municipalities in Taiwan. The execution of three admission ways did play a role in balancing the urban-rural gap in the distribution of dental freshmen.

Conclusion: The urban-rural gap of the distribution of dental freshmen was not larger than that of dentists. The increased guaranteed enrollment quota of dental freshmen for the high school graduates in the offshore islands do cause unequal opportunities of admission to dental schools. If these extra-enrolled dentists do not return to their hometowns to practice, this may worsen the surplus of dentists and may fail to improve the uneven distribution of dentists in Taiwan.

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Introduction

The development of dentists in Taiwan has been over a century since the Japanese colonial period when the dentists were first recognized as having a professional position by law.¹ The Department of Dentistry of National Taiwan University established in 1953 was the first institution for dental education established in Taiwan. The earliest dental students in the Department of Dentistry of National Taiwan University were recruited through the public university entrance examination in 1955 to open a new era of dental education in Taiwan.²

Today, there are three ways for admission of high school graduates into dental schools or departments of dentistry, which are “examination admission”, “numerous stars initiatives admission”, and “individual application admission”. Moreover, there are 8 universities with dental schools or departments of dentistry in Taiwan, of which 7 are general universities and one is the military university. High school graduates who want to enter the dental schools or departments of dentistry of a general university should use the aforementioned three university admission ways and obtain the admission permission. Because the average income of a dentist increases after the implementation of national health insurance in 1995, the domestic dental schools or departments of dentistry become a popular choice of university departments by high school graduates. In addition, the dental freshmen have a higher registration rate and a lower re-examination rate than before.³ The number of dental students who graduate from foreign dental schools or departments of dentistry increase and those who return to Taiwan and pass the national dentist examinations also increase, finally resulting in an abrupt augmentation in the number of dentists in Taiwan.⁴

The previous studies found that Taiwan is facing the problems of a surplus of dentists, an uneven regional distribution of dentists, and a concentration of dentists in the metropolitan areas.^{4,5} However, another study discovered that the hometowns of the dentist and the place of graduated dental school influence the dentist future practice location.² Furthermore, for the reason of balancing the uneven regional distribution of dentists, the government agreed to establish the eighth department of dentistry in

the National Cheng Kung University in the southern region of Taiwan in 2019.²

Although there were some studies focusing on the regional distribution of dentists in Taiwan, very few studies assessed the regional distribution of enrolled dental freshmen in Taiwan. Therefore, this study tried to analyze the regional distribution of enrolled dental freshmen in 2020 to further understand the urban-rural gap in the distribution of dental freshmen in different regions of Taiwan and to evaluate its impact on the regional distribution of dentists in Taiwan in the future. The results of this study may serve as a reference for future policy development to balance the opportunities for both urban and rural students admitted to dental schools or departments of dentistry in Taiwan.

Materials and methods

This study used the secondary data analysis to collect the information about the population and the number of enrolled dental freshmen in Taiwan in 2020. This information was open to access and could be collected from the related websites.

We obtained the population data including the total population in cities and counties in May 2020 from the website of the Ministry of the Interior. In addition, the information of enrolled dental freshmen in 2020 was available from the website of the Joint Board of College Recruitment Commission. This information included the admission ways, dental schools, and examination areas of enrolled dental freshmen. There are three admission ways for dental freshmen, including the examination admission, numerous stars initiatives admission, and individual application admission. Furthermore, there are 7 general universities with dental schools or departments of dentistry. These are National Taiwan University, National Yang-Ming University, and Taipei Medical University in Taipei City; China Medical University and Chung Shan Medical University in Taichung City; National Cheng Kung University in Tainan City; and Kaohsiung Medical University in Kaohsiung City. According to the location of the examination room in the examination area, we could find the location of the city or county. The whole area of Taiwan was divided into five

regions: northern, central, southern, eastern regions, and offshore islands. The northern region included Taipei City, New Taipei City, Keelung City, Taoyuan City, Hsinchu City, and Hsinchu County. The central region included Miaoli County, Taichung City, Changhua County, Nantou County, and Yunlin County. The southern region included Chiayi City, Chiayi County, Tainan City, Kaohsiung City, and Pingtung County. The eastern region included Yilan County, Hualien County, and Taitung County. Moreover, the offshore islands included Penghu County, Kinmen County, and Lienchiang County. In addition, the whole area of Taiwan was also divided into two groups: municipalities and non-municipalities. For statistical analysis, coefficient of variation (CV) was determined for comparisons of variability. Mann–Whitney U test and Kruskal–Wallis test were used for comparisons of different subgroups, and Pearson’s chi-square analysis was used to analyze the relationship between two types of variables.

Results

Taiwan currently has 8 universities with dental schools or departments of dentistry, of which 7 are general universities that participate in the admission system of the Joint Board of College Recruitment Commission. There are 6 municipalities (directly under the control of central government) in 22 cities and counties (including offshore

islands). All 8 universities with dental schools or departments of dentistry are located in 4 municipalities.

The distributions of enrolled dental freshmen in Taiwan in 2020

The numbers of enrolled dental freshmen accepted by different admission ways in 22 cities and counties in Taiwan in 2020 were obtained and shown in Table 1. There was a total number of 386 enrolled dental freshmen accepted by the admission system of the Joint Board of College Recruitment Commission in 2020. Of these 386 enrolled dental freshmen, 146 were enrolled by the examination admission, 41 by the numerous stars initiatives admission, and 199 by the individual application admission (Table 1). For individual application admission, there were 5 guaranteed quotas for the high school graduates from the offshore islands, but they were not admitted or gave up after admission finally. Thus, these 5 students of guaranteed quotas were not included for statistical analysis in this study. Taipei City was the city with the largest number of enrolled dental freshmen (108, 27.98%), and Nantou County and Hualien County were the counties with the smallest number (non-zero) of enrolled dental freshman (1, 0.26%) among all cities and counties in Taiwan (Table 1). It should be noted that there was none of enrolled dental freshman in Chiayi County and Taitung County. The mean number of enrolled dental freshmen in one city or county in Taiwan

Table 1 Distributions of enrolled dental freshmen in 22 cities and counties of Taiwan in 2020.

	Examination admission	Numerous stars initiatives admission	Individual application admission	Total
Municipalities (n = 6)				
Taipei City	50	5	53	108
New Taipei City	7	1	17	25
Taoyuan City	8	2	8	18
Taichung City	28	3	37	68
Tainan City	10	13	16	39
Kaohsiung City	21	3	24	48
Non-municipalities (n = 16)				
Keelung City	1	1	1	3
Hsinchu City	3	1	11	15
Chiayi City	6	4	10	20
Hsinchu County	0	1	1	2
Miaoli County	1	0	1	2
Changhua County	7	2	8	17
Nantou County	1	0	0	1
Yunlin County	0	2	2	4
Chiayi County	0	0	0	0
Pingtung County	0	0	3	3
Penghu County	0	1	2	3
Yilan County	2	2	1	5
Hualien County	1	0	0	1
Taitung County	0	0	0	0
Kinmen County	0	0	1	1
Lienchiang County	0	0	3	3
Nationwide (n = 22)	146	41	199	386
Mean	6.64	1.86	9.05	17.55

was 17.55 (386/22). There were 15 of the 22 cities and counties with 17 or fewer dental freshmen that were below the mean number of 17.55 dental freshmen in one city or county in Taiwan.

One hundred and forty-six dental freshmen were enrolled by examination admission. Taipei City was the city with the largest number of dental freshmen enrolled by examination admission (50, 34.25%), and Keelung City, Miaoli County, Nantou County, and Hualien County were the city or county with the smallest number (non-zero) of dental freshmen enrolled by examination admission (1, 0.68%) among all cities and counties in Taiwan (Table 1). It should be noted that there were 8 cities or counties without any dental freshmen enrolled by examination admission. The mean number of dental freshmen enrolled by examination admission in one city or county of Taiwan was 6.64 (146/22). There were 15 of the 22 cities and counties with 6 or fewer dental freshmen enrolled by examination admission that were below the mean number of 6.64 dental freshmen enrolled by examination admission in one city or county of Taiwan (Table 1).

A total of 41 dental freshmen were enrolled by numerous stars initiatives admission. Tainan City was the city with the largest number of dental freshmen enrolled by numerous stars initiatives admission (13, 31.71%). There were 5 cities or counties with the smallest number (non-zero) of dental freshmen enrolled by numerous stars initiatives admission (1, 2.44%) among all cities and counties in Taiwan. It should be noted that there were 8 cities or counties without any dental freshmen enrolled by numerous stars initiatives admission. The mean number of dental freshmen enrolled by numerous stars initiatives admission in one city or county of Taiwan was 1.86 (41/22). There were 13 of the 22 cities and counties with 1 or fewer dental freshmen enrolled by numerous stars initiatives admission that were below the mean number of 1.86 dental freshmen enrolled by numerous stars initiatives admission in one city or county in Taiwan (Table 1).

A total of 199 dental freshmen were enrolled by individual application admission. Taipei City was the city with the largest number of dental freshmen enrolled by individual application admission (53, 26.63%). There were 5 cities or counties with the smallest number (non-zero) of dental freshmen enrolled by individual application admission (1, 0.50%) among 22 cities and counties of Taiwan. It should be noted that there were 4 cities and counties without any dental freshmen enrolled by individual application admission (Table 1). The mean number of dental freshmen enrolled by individual application admission in one city or county of Taiwan was 9.05 (199/22). There were 15 of the 22 cities and counties with 8 or fewer dental freshmen enrolled by individual application admission that were below the mean number of 9.05 dental freshmen enrolled by individual application admission in one city or county of Taiwan (Table 1).

Comparisons of enrolled dental freshmen in different regions of Taiwan in 2020 are shown in Table 2. The enrollment rate of dental freshmen (79.27%) in municipalities was significantly higher than that (20.73%, $P < 0.001$) in non-municipalities. Moreover, 124, 27, and 155 dental freshmen in municipalities and 22, 14, and 44 dental freshmen in non-municipalities were enrolled by

examination admission, numerous stars initiatives admission, and individual application admission, respectively. Thus, the enrollment rates of dental freshmen enrolled by examination admission (32.12%), numerous stars initiatives admission (6.99%), and individual application admission (40.16%) in municipalities were all significantly higher than the corresponding enrollment rates (5.70%, 3.63%, and 11.40%, respectively) in non-municipalities of Taiwan (Table 2).

We also found that the enrollment rate of dental freshmen in cities with dental schools (68.13%) was significantly higher than that (31.87%) in cities and counties without any dental schools (Table 2). In addition, the enrollment rates of dental freshmen enrolled by examination admission (28.24%), numerous stars initiatives admission (6.22%), and individual application admission (33.68%) in cities with dental schools were all significantly higher than the corresponding enrollment rates (9.59%, 4.40%, and 17.88%, respectively) in cities and counties without dental schools in Taiwan (Table 2).

Furthermore, the enrollment rate of dental freshmen in the northern region of Taiwan (44.30%) was higher than those in other 4 regions of Taiwan. In addition, the enrollment rates of dental freshmen enrolled by examination admission (17.88%) and individual application admission (23.58%) in the northern region of Taiwan were both relatively higher than the corresponding enrollment rates in other 4 regions of Taiwan, respectively. For numerous stars initiatives admission, however, the southern region of Taiwan had the highest enrollment rates of dental freshmen (5.18%) among the 5 regions of Taiwan. Therefore, it implies that admitted dental freshmen are mainly concentrated in the northern municipalities or cities with dental schools, especially the Taipei City.

The distributions of enrolled dental freshmen per 100,000 people in 22 cities and counties of Taiwan in 2020

Since a larger population might reflect a larger number of admitted dental freshmen, we used the population of May 2020 to calculate the number of admitted dental freshmen per 100,000 people in each city or county of Taiwan. Distributions of enrolled dental freshmen per 100,000 people in 22 cities and counties of Taiwan in 2020 are shown in Table 3. We found that there was a number of 1.64 dental freshmen per 100,000 people nationwide in Taiwan in 2020. Of the 1.64 dental freshmen per 100,000 people, 0.62 was enrolled by examination admission, 0.17 by numerous stars initiatives admission, and 0.84 by individual application admission (Table 3). Chiayi City was the city with the largest number (7.48) of dental freshmen per 100,000 people, and Nantou County was the county with the smallest non-zero number (0.20) of dental freshmen per 100,000 people among 22 cities and counties of Taiwan. However, Lienchiang County had a very sparse population, so its number of dental freshmen per 100,000 people was very high (23.01). There were 14 of the 22 cities and counties with 1.34 or fewer dental freshmen per 100,000 people that were below the number of 1.64 dental freshmen per 100,000 people nationwide in Taiwan (Table 3).

Table 2 Comparisons of enrolled dental freshmen in different regions of Taiwan in 2020.

	Examination admission	Numerous stars initiatives admission	Individual application admission	Total
Municipalities (n = 6)				
Dental freshmen (%)	124 (32.12)	27 (6.99)	155 (40.16)	306 (79.27)
Mean	20.67	4.5	25.83	51
Non-municipalities (n = 16)				
Dental freshmen (%)	22 (5.70)	14 (3.63)	44 (11.40)	80 (20.73)
Mean	1.38	0.88	2.75	5
Mann–Whitney U test	0.5***	10.5**	2.5***	1***
Cities with dental schools (n = 4)				
Dental freshmen (%)	109 (28.24)	24 (6.22)	130 (33.68)	263 (68.13)
Mean	27.25	6	32.5	65.75
Cities and counties without dental schools (n = 18)				
Dental freshmen (%)	37 (9.59)	17 (4.40)	69 (17.88)	123 (31.87)
Mean	2.06	0.94	3.83	6.83
Mann–Whitney U test	<0.001***	2**	1**	<0.001***
Northern region (n = 6)				
Dental freshmen (%)	69 (17.88)	11 (2.85)	91 (23.58)	171 (44.30)
Mean	11.5	1.83	15.17	28.5
Central region (n = 5)				
Dental freshmen (%)	37 (9.59)	7 (1.81)	48 (12.44)	92 (23.83)
Mean	7.4	1.4	9.6	18.4
Southern region (n = 5)				
Dental freshmen (%)	37 (9.59)	20 (5.18)	53 (13.73)	110 (28.50)
Mean	7.4	4	10.6	22
Eastern region (n = 3)				
Dental freshmen (%)	3 (0.78)	2 (0.52)	1 (0.26)	6 (1.55)
Mean	1	0.67	0.33	2
Offshore islands (n = 3)				
Dental freshmen (%)	0 (0)	1 (0.26)	6 (1.55)	7 (1.81)
Mean	0	0.33	2	2.33
Kruskal–Wallis test	5.48	3.92	6.13	4.69

** $P < 0.01$, *** $P < 0.001$.

For examination admission, Chiayi City was the city with the largest number (2.25) of dental freshmen enrolled by examination admission per 100,000 people, and New Taipei City was the city with the smallest non-zero number (0.17) of dental freshmen enrolled by examination admission per 100,000 people among 14 cities and counties with non-zero dental freshmen in Taiwan. There were 17 of the 22 cities and counties with 0.55 or fewer dental freshmen enrolled by examination admission per 100,000 people that were below the number of 0.62 dental freshmen enrolled by examination admission per 100,000 people nationwide (Table 3).

For numerous stars initiatives admission, Chiayi City was the city with the largest number (1.50) of dental freshmen enrolled by numerous stars initiatives admission per 100,000 people, and New Taipei City was the city with the smallest non-zero number (0.02) of dental freshmen enrolled by numerous stars initiatives admission per 100,000 people among 14 cities and counties with non-zero dental freshmen in Taiwan. There were 13 of the 22 cities and counties with 0.16 or fewer dental freshmen enrolled by numerous stars initiatives admission per 100,000 people that were below the number of 0.17 dental freshmen

enrolled by numerous stars initiatives admission per 100,000 people nationwide in Taiwan (Table 3).

For individual application admission, Chiayi City was the city with the largest number (3.74) of dental freshmen enrolled by individual application admission per 100,000 people, and Hsinchu County and Miaoli County were the counties with the smallest non-zero number (0.18) of dental freshmen enrolled by individual application admission per 100,000 people among 18 cities and counties with non-zero dental freshmen in Taiwan. However, Lienchiang County had a very sparse population and high school graduates were only admitted by individual application admission, so its number of dental freshmen enrolled by individual application admission per 100,000 people was very high (23.01). There were 14 of the 22 cities and counties with 0.72 or fewer dental freshmen enrolled by individual application admission per 100,000 people that were below the number of 0.84 dental freshmen enrolled by individual application admission per 100,000 people nationwide in Taiwan (Table 3).

Comparisons of enrolled dental freshmen per 100,000 people in different regions of Taiwan are exhibited in Table 4. We found that the mean numbers of enrolled dental

Table 3 Distributions of enrolled dental freshmen per 100,000 people in 22 cities and counties of Taiwan in 2020.

	Examination admission	Numerous stars initiatives admission	Individual application admission	Total
Taipei City	1.90	0.19	2.02	4.11
New Taipei City	0.17	0.02	0.42	0.62
Taoyuan City	0.35	0.09	0.35	0.80
Taichung City	0.99	0.11	1.31	2.41
Tainan City	0.53	0.69	0.85	2.08
Kaohsiung City	0.76	0.11	0.87	1.73
Keelung City	0.27	0.27	0.27	0.81
Hsinchu City	0.67	0.22	2.45	3.33
Chiayi City	2.25	1.50	3.74	7.48
Hsinchu County	0	0.18	0.18	0.35
Miaoli County	0.18	0	0.18	0.37
Changhua County	0.55	0.16	0.63	1.34
Nantou County	0.20	0	0	0.20
Yunlin County	0	0.29	0.29	0.59
Chiayi County	0	0	0	0
Pingtung County	0	0	0.37	0.37
Penghu County	0	0.95	1.90	2.86
Yilan County	0.44	0.44	0.22	1.10
Hualien County	0.31	0	0	0.31
Taitung County	0	0	0	0
Kinmen County	0	0	0.72	0.72
Lienchiang County	0	0	23.01	23.01
Nationwide (n = 22)	0.62	0.17	0.84	1.64
Mean ± SD	0.46 ± 0.61	0.25 ± 0.38	0.80 ± 0.98	1.50 ± 1.79
CV	1.34	1.52	1.22	1.19

The item of Lienchiang County was excluded from the statistics of mean, SD and CV.

Mean ± SD = Mean ± Standard Deviation; CV = Coefficient of Variance.

freshmen per 100,000 people (1.96) in municipalities was higher than that (1.32) in non-municipalities of Taiwan. Moreover, the mean number of dental freshmen enrolled by examination admission (0.79), numerous stars initiatives admission (0.20), and individual application admission (0.97) per 100,000 people in municipalities were higher than the corresponding mean numbers of dental freshmen enrolled by the examination admission (0.32) and individual application admission (0.73), respectively, in non-municipalities, but was lower than the corresponding mean number of dental freshmen enrolled by the numerous stars initiatives admission (0.27) in non-municipalities of Taiwan. Moreover, the difference was significant for examination admission ($P < 0.05$). In addition, to take the whole area of Taiwan as a unit of calculation, the numbers of enrolled dental freshmen per 100,000 people were 1.88 in municipalities and 1.11 in non-municipalities of Taiwan (Table 4).

We also discovered that the mean number of enrolled dental freshmen per 100,000 people (2.58) in cities with dental schools was significantly higher than that (1.25, $P < 0.05$) in cities and counties without dental schools. Moreover, the mean numbers of dental freshmen enrolled by examination admission (1.05), numerous stars initiatives admission (0.27), and individual application admission

(1.26) per 100,000 people in cities with dental schools were significantly higher than the corresponding mean numbers of dental freshmen enrolled by the examination admission (0.32, $P < 0.01$) and individual application admission (0.69, $P < 0.05$), respectively, in cities and counties without dental schools, and was higher than the corresponding mean number of dental freshmen enrolled by the numerous stars initiatives admission (0.24, $P > 0.05$). In addition, to take the whole area of Taiwan as a unit of calculation, the numbers of enrolled dental freshmen per 100,000 people were 2.61 in cities with dental schools and 0.91 in cities and counties without dental schools (Table 4).

Furthermore, the largest mean number of enrolled dental freshmen per 100,000 people was 2.33 in the southern region of Taiwan (Table 4). Moreover, the largest mean numbers of dental freshmen per 100,000 people were 0.71 enrolled by examination admission in the southern region of Taiwan, 0.48 enrolled by numerous stars initiatives admission in the offshore islands, and 1.31 enrolled by individual application admission in the offshore islands of Taiwan. In addition, to take the whole region as a unit of calculation among 5 different regions, the numbers of enrolled dental freshmen per 100,000 people were 1.66 in the northern region, 1.59 in the central region, 1.76 in the southern region, 0.60 in the eastern region, and 1.63 in the

Table 4 Comparisons of enrolled dental freshmen per 100,000 people in different regions of Taiwan in 2020.

	Examination admission	Numerous stars initiatives admission	Individual application admission	Total
Municipalities (n = 6)	0.76	0.16	0.95	1.88
Mean ± SD	0.79 ± 0.62	0.20 ± 0.25	0.97 ± 0.62	1.96 ± 1.27
CV	0.79	1.22	0.64	0.65
Non-municipalities (n = 15)	0.31	0.19	0.61	1.11
Mean ± SD	0.32 ± 0.58	0.27 ± 0.43	0.73 ± 1.10	1.32 ± 1.97
CV	1.77	1.59	1.51	1.49
Mann–Whitney U test	18*	40	22	23
Cities with dental schools (n = 4)	1.08	0.24	1.29	2.61
Mean ± SD	1.05 ± 0.60	0.27 ± 0.28	1.26 ± 0.55	2.58 ± 1.06
CV	0.57	1.03	0.43	0.41
Cities and counties without dental schools (n = 17)	0.27	0.13	0.51	0.91
Mean ± SD	0.32 ± 0.54	0.24 ± 0.40	0.69 ± 1.04	1.25 ± 1.85
CV	1.70	1.67	1.50	1.48
Mann–Whitney U test	6**	24	11*	10*
Northern region (n = 6)	0.67	0.11	0.88	1.66
Mean ± SD	0.56 ± 0.69	0.16 ± 0.09	0.95 ± 1.01	1.67 ± 1.62
CV	1.23	0.56	1.06	0.97
Central region (n = 5)	0.64	0.12	0.83	1.59
Mean ± SD	0.39 ± 0.39	0.11 ± 0.12	0.48 ± 0.52	0.98 ± 0.91
CV	1.02	1.42	1.05	0.82
Southern region (n = 5)	0.59	0.32	0.85	1.76
Mean ± SD	0.71 ± 0.92	0.46 ± 0.65	1.17 ± 1.49	2.33 ± 3.01
CV	1.30	1.41	1.27	1.29
Eastern region (n = 3)	0.30	0.20	0.10	0.60
Mean ± SD	0.25 ± 0.23	0.15 ± 0.25	0.07 ± 0.13	0.47 ± 0.57
CV	0.91	1.73	1.73	1.21
Offshore islands (n = 2)	0	0.41	1.23	1.63
Mean ± SD	0	0.48 ± 0.67	1.31 ± 0.84	1.79 ± 1.51
CV	–	1.41	0.64	0.85
Kruskal–Wallis test	3.26	1.23	6.38	3.07

* $P < 0.05$, ** $P < 0.01$; The item of Lienchiang County was excluded from the statistics of mean, SD and CV. Mean ± SD = Mean ± Standard Deviation; CV = Coefficient of Variance.

offshore islands (Table 4). Therefore, it indicates that the numbers of enrolled dental freshmen per 100,000 people are still more in municipalities and cities with dental schools. However, the numbers of enrolled dental freshmen per 100,000 people are relatively even in the northern, central and southern regions of Taiwan. However, it is still low in the eastern region of Taiwan.

The coefficients of variance (CV) of the number of enrolled dental freshmen per 100,000 people were 1.34 for the examination admission, 1.52 for the numerous stars initiatives admission, 1.22 for the individual application admission, and 1.19 for the overall (Table 3). The corresponding CV values for municipalities were 0.79, 1.22, 0.64, and 0.65, respectively. Moreover, the corresponding CV values were greatest for non-municipalities, which were 1.77, 1.59, 1.51, and 1.49, respectively. Furthermore, similar results of CV values were discovered for cities with dental schools as well as for cities and counties without dental schools (Table 4). It indicates that the numbers of enrolled dental freshmen per 100,000 people are not more dispersed nationwide. However, the numbers of enrolled dental freshmen per 100,000 people are less dispersed in

municipalities and in cities with dental schools and more dispersed in non-municipalities and cities and counties without any dental schools (Table 4).

The relationship between the distribution of enrolled dental freshmen in 5 different regions of Taiwan and 3 different admission ways or the locations of dental schools in 2020

The overall number of enrolled dental freshmen was 386, including 154 for northern dental schools, 128 for central dental schools, and 104 for southern dental schools (Table 5). We found that 83 of 171 dental freshmen from the northern region of Taiwan were admitted to northern dental schools, 55 of 171 dental freshmen from the northern region of Taiwan were admitted to central dental schools, and 43 of 110 dental freshmen from the southern region of Taiwan were admitted to southern dental schools (Table 5). Moreover, 3 of the 6 dental freshmen from the east region of Taiwan were admitted to southern dental schools. Conversely, one of the 7 dental freshmen from the

Table 5 The distribution of enrolled dental freshmen in 5 different regions of Taiwan according to three different admission ways and the locations of dental schools in Taiwan in 2020.

		Enrolled dental freshmen					Total
		Northern region	Central region	Southern region	Eastern region	Offshore islands	
Northern dental schools (n = 3)	Examination admission	28	8	15	1	0	52
	Numerous stars initiatives admission	4	3	8	0	1	16
	Individual application admission	51	18	14	1	2	86
	Total	83	29	37	2	3	154
Central dental schools (n = 2)	Examination admission	30	21	13	0	0	64
	Numerous stars initiatives admission	4	1	5	1	0	11
	Individual application admission	21	17	12	0	3	53
	Total	55	39	30	1	3	128
Southern dental schools (n = 2)	Examination admission	11	8	9	2	0	30
	Numerous stars initiatives admission	3	3	7	1	0	14
	Individual application admission	19	13	27	0	1	60
	Total	33	24	43	3	1	104
Nationwide	Total	171	92	110	6	7	386

offshore islands was admitted to southern dental schools (Table 5).

For examination admission, 69 of the 146 enrolled dental freshmen were from the northern region of Taiwan, including 28 admitted to northern dental schools, 30 admitted to central dental schools, and 11 admitted to southern dental schools. Predictably, only 3 of 146 enrolled dental freshmen were from the eastern region of Taiwan. Moreover, none of 146 enrolled dental freshmen were from the offshore islands (Table 5).

For numerous stars initiatives admission, 20 of the 41 enrolled dental freshmen were from the southern region of Taiwan, including 8 admitted to northern dental schools, 5 admitted to central dental schools, and 7 admitted to southern dental schools. Only 2 and 1 enrolled dental freshmen were from the eastern region of Taiwan and the offshore islands, respectively (Table 5).

For individual application admission, 91 of the 199 enrolled dental freshmen were from the northern region of Taiwan, including 51 admitted to northern dental schools, 21 admitted to central dental schools, and 19 admitted to southern dental schools. Predictably, only 1 and 6 enrolled dental freshmen were from the eastern region of Taiwan and the offshore islands, respectively (Table 5).

Furthermore, to exclude enrolled dental freshmen from the eastern region of Taiwan and the offshore islands with too few numbers, we used Pearson's chi-square analysis to compare the relationships between the regions of dental freshmen and the regions with dental schools or the three ways of admission for dental freshmen. For the relationship between the regions of dental freshmen and the regions with dental schools, enrolled dental freshmen from the northern region of Taiwan tended to choose the dental schools in the northern region, those from the central region of Taiwan tended to choose the dental schools in the central region, and those from the southern region of Taiwan tended to choose the dental schools in the southern region, which were all significant (AR value ≥ 2) (Table 6).

In addition, high school graduates from the northern region of Taiwan did not significantly tend to choose the dental schools in the southern region (AR value ≤ -2), and high school graduates from the central region of Taiwan did not relatively tend to choose dental schools in the northern region, which was significant (Table 6).

For the relationship between the three admission ways and the regions of dental schools, the dental schools in the central region tended to recruit students by the examination admission, which was significant (AR value ≥ 2), but did not tend to recruit high school graduates by the individual application admission, which was significant (AR value ≤ -2). In addition, the dental schools in the southern region did not tend to recruit high school graduates by the examination admission, which was also significant (AR value ≤ -2) (Table 6).

For the relationship between the three admission ways and the regions of dental freshmen, high school graduates from the northern region did not tend to use the numerous stars initiatives admission as a way of admission, which was significant (AR value ≤ -2). Instead, they tended to use the examination admission and individual application admission as the ways of admission, although it was not significant. On the contrary, high school graduates from the southern region of Taiwan did not tend to use the examination admission and individual application admission as the ways of admission, although it was not significant. Instead, they tended to use numerous stars initiatives admission as a way of admission, which was significant (AR value ≥ 2). In addition, high school graduates from the central region of Taiwan used the three ways of admission more evenly for enrollment into the dental schools (Table 6).

Discussion

Previous studies inferred that the location where the dentists grow up, the location of their dental schools, and the

Table 6 The relationships between the regions of dental freshmen and the regions with dental schools or the three ways of admission for dental freshmen in Taiwan in 2020.

	Numbers of dental freshmen (% , AR) ^a		
	Northern dental freshmen	Central dental freshmen	Southern dental freshmen
Northern dental schools	86 (48.59%, 3.3)	29 (29.29%, -2.4)	41 (34.75%, -1.3)
Central dental schools	57 (32.20%, -0.3)	42 (42.42%, 2.3)	31 (26.27%, -1.9)
Southern dental schools	34 (19.21%, -3.3)	28 (28.28%, 0.2)	46 (38.98%, 3.4)
Total	177 (100%)	99 (100%)	118 (100%)
	Examination admission	Numerous stars initiatives admission	Individual application admission
Northern dental schools	52 (35.62%, -1.3)	28 (40%, 0.0)	83 (42.78%, 1.2)
Central dental schools	64 (43.84%, 3.5)	18 (25.71%, -1.4)	53 (27.42%, -2.3)
Southern dental schools	30 (20.55%, -2.3)	24 (34.29%, 1.4)	58 (29.90%, 1.1)
Total	146 (100%)	70 (100%)	194 (100%)
	Examination admission	Numerous stars initiatives admission	Individual application admission
Northern dental freshmen	69 (48.25%, 1.0)	18 (28.57%, -2.8)	90 (47.87%, 1.1)
Central dental freshmen	37 (25.87%, 0.3)	15 (23.81%, -0.3)	47 (25%, -0.1)
Southern dental freshmen	37 (25.87%, -1.3)	30 (47.62%, 3.3)	51 (27.13%, -1.2)
Total	143 (100%)	63 (100%)	188 (100%)

AR = adjusted residual.

^a Pearson's chi-square analysis was used to determine whether there was a significant higher number of dental freshmen (AR value ≥ 2) or a significant smaller number of dental freshmen (AR value ≤ -2).

location of their training institutions may affect the choice of their practice locations. Moreover, the dentists tend to choose their practice locations in the same areas of their growth, dental schools or training institutions.^{2,6} However, the above inferences have not been confirmed by long-term follow-up studies. This study began to evaluate the relationship between the distribution of dentists and the location of their development stages. Through the university admissions list, we obtained the information on the examination areas of enrolled dental freshmen. The principle of the allocation of the examination area is to arrange the examination room closer to the address filled in by the dental student or closer to his or her high school, so the location of the examination room can be estimated as the city or county where the dental student lives and grows.

Since Taiwan's dental departments of universities recruit high school graduates, if we want to understand the distribution of enrolled dental freshmen, we must first understand Taiwan's university admission system. In Taiwan, the university entrance system has long been based on traditional joint college entrance examination. From 1994, it had been widely criticized for its dominance in the admission of higher education and it was hoped that an alternative way of admission could be developed. Therefore, "admission by recommendation and screening" had been piloted the 1990s. Also, the traditional joint college entrance examination was lifted and the "Multi-tracks Program of Recruitment for Universities" was introduced and the advanced subjects test was implemented in 2002.⁷

Today, Taiwan's university admission ways are divided into three major admission ways: examination admission, numerous stars initiatives admission, and individual application admission.

Examination admission is that students take the advanced subjects test first, and the admission departments are determined according to the students' volunteers and test scores, similar to the previous joint college entrance examination. Numerous stars initiatives admission is that qualified students are recommended from high schools to university departments. Its purpose is to help disadvantaged students, balance the gap between urban and rural areas, and allow students with weaker socioeconomic status to have the opportunity to enter high-quality universities. Individual application admission is that students apply to the university departments based on their personal interests and the university departments decide to admit students based on their characteristics. Since the implementation of national health insurance in Taiwan in 1995 has enabled dentists to have a good socioeconomic status and a high living standard, the domestic departments of dentistry or dental schools have become a popular choice of university departments through these three admission ways.³ Therefore, this study could not only analyze the distribution of enrolled dental freshmen, but also compared the urban-rural gap in the distribution of these three admission ways. Also, because dental schools were located in the northern, central, and southern regions of Taiwan, comparisons could be made in three dimensions:

the distribution of enrolled dental freshmen, different admission ways, and the regions of dental schools.

In Taiwan, there are three major dentist occupation problems: a surplus of dentists, an uneven distribution of dentists, and a concentration of dentists in the metropolitan areas.^{4,5} This study analyzed the distribution of enrolled dental freshmen in 2020 and also had similar findings, i.e. the enrolled dental freshmen were concentrated in municipalities, cities with dental schools, and the northern region of Taiwan and accounted for 79.27%, 68.13%, and 44.30% of all admitted dental freshmen, respectively. Moreover, Taipei City had the relatively large number (108) of enrolled dental freshmen and accounted for 27.98% of 386 enrolled dental freshmen. Therefore, our results indicate that the urban-rural gap in educational resources still exist and subsequently lead to the urban-rural gap in the number of students admitted to popular departments. In addition, from 2010 to 2018, the total number of new dentists who pass the national dentist examination is 4,002, and the total number of increased practicing dentists during this period is 3061. Thus, an estimated number of dentists who resign during this period is 941.⁴ Therefore, if the above situation remains unchanged, Taiwan may continue to increase nearly 400 practicing dentists per year. As the population growth slows down, the problem of a surplus of dentists becomes worse.

However, the quality and quantity of required dental care vary with the increased and decreased population of a city or a country, and any regional imbalance of dentist distribution tends to increase continuously, depending on differences in the numbers of new-entry dentists. Therefore, the presence or absence of a dental school in a city has a certain effect on the number of dentists and new-entry dentists in a particular region.⁸ Indeed, only 4 administrative regions in Taiwan have dental schools, accounted for 18.18% of all administrative regions, and 68.13% of enrolled dental freshmen were from these 4 administrative regions. Therefore, it is expected that the majority of these admitted dental students may choose to practice in the regions near their schools or near their hometowns in the future. Thus, the problems of an uneven distribution of dentists and a concentration of dentists in the metropolitan areas may also continue to worsen. In Taiwan, the urban-rural gap in the distribution of resources creates an urban-rural gap in educational opportunities. This study found that the urban-rural gap in admissions of dental students was extremely large. For example, the proportions of admitted dental freshmen from municipalities were 84.93% (124/146) for the examination admission, 65.85% (27/41) for the numerous stars initiatives admission, 77.89% (155/199) for the individual application admission, and 79.27% (306/386) for the overall. It could be seen that there was a large urban-rural gap, but high school graduates from non-municipalities were relatively more likely to enter the dental schools through the numerous stars initiatives admission.

From another perspective, we compared the distribution of enrolled dental freshmen in this study with the distribution of dentists in 2019,⁹ and used the ratio of municipalities to non-municipalities as an indicator of the urban-rural gap. The ratio of dental freshmen from municipalities to dental freshmen from non-municipalities was

563.64% (124/22) for the examination admission, 192.86% (27/14) for the numerous stars initiatives admission, 352.27% (155/44) for the individual application admission, and 382.5% (306/80) for the overall (Table 2). Besides, the ratio was 407.89% (155/38) for individual application admission under exclusion of guaranteed quota of offshore island students. However, the ratio of dentists in municipalities to dentists in non-municipalities was 422.16% (12,230/2897), which was also higher than that of overall admitted dental freshmen. Thus, the way of examination admission reflects the most realistic urban-rural gap in admission opportunities, but the execution of admission protection for disadvantaged dental students reduces this gap.

On the other hand, we also compared the distribution of admitted dental freshmen per 100,000 people with the distribution of dentists per 100,000 people, and used the ratio of admitted dental freshmen per 100,000 people from municipalities to those from non-municipalities as an indicator of the urban-rural gap. The ratios of admitted dental freshmen per 100,000 people from municipalities to those from non-municipalities were 245.16% (0.76/0.31) for the examination admission, 84.21% (0.16/0.19) for the numerous stars initiatives admission, 155.74% (0.95/0.61) for the individual application admission, and 169.37% (1.88/1.11) for the overall. Similarly, the corresponding ratio of dentists per 100,000 people in municipalities to that in non-municipalities was 186.07% (74.65/40.12), which was also higher than that for the overall admitted dental freshmen per 100,000 people. However, the difference of these corresponding ratios between admitted dental freshmen and dentists was less. Therefore, considering the factor of population, the urban-rural gap in admission opportunities was much reduced, and even the admission opportunities of students from non-municipalities were better than students from municipalities for the numerous stars initiatives admission. Thus, it completely reversed the urban-rural gap. Moreover, the CV value of admitted dental freshmen per 100,000 people among all cities and counties for the numerous stars initiatives admission was 1.52, which was higher than that for the examination admission (1.34) and the individual application admission (1.22). However, it resulted in a lower CV value of admitted dental freshmen per 100,000 people among all cities and counties for the overall (1.19). Therefore, the numerous stars initiatives admission did reduce the dispersion for the distribution of admitted dental freshmen per 100,000 people.

We additionally used the ratios of admitted dental freshmen per 100,000 people from cities with dental schools to those from cities or counties without dental schools as another indicator of the urban-rural gap. The above-mentioned ratios were 400% (1.08/0.27) for the examination admission, 184.62% (0.24/0.13) for the numerous stars initiatives admission, 252.94% (1.29/0.51) for the individual application admission, and 286.81% (2.61/0.91) for the overall. However, if we used the presence or absence of a dental school to distinguish urban or rural areas, this urban-rural gap in dental student admission opportunities became wider. Therefore, our findings indicate that the presence or absence of a dental school in a city also has a certain effect on the number of admitted dental students in a particular region.

Furthermore, we defined the admitted dental student index or the dentist index as the ratio of admitted dental students per 100,000 people or dentists per 100,000 people to their corresponding values in the whole area of Taiwan. The number of admitted dental students per 100,000 people in the whole area of Taiwan was 1.64. Thus, the admitted dental student index for Taipei City was 250.61% (4.11/1.64). However, the admitted dental student indexes for Penghu County, Kinmen County, and Lienchiang County were 174.39% (2.86/1.64), 43.90% (0.72/1.64), and 1403.05% (23.01/1.64), respectively. Moreover, this corresponding index for the three offshore island counties was 165.85% (2.72/1.64). Therefore, the admission opportunities of dental students from the offshore islands were about twice that of dental students from other regions of Taiwan. The gap of the admission opportunities of dental students between the capital and the offshore islands was only 1.51-fold (4.11/2.72). On the contrary, there was no any admitted dental student from the remote villages of Taiwan such as Chiayi County and Taitung County. These findings suggest that the admission opportunities of dental students among the offshore islands, the remote villages, and other regions of Taiwan are relatively unequal.

In addition, the number of dentists per 100,000 people in the whole area of Taiwan was 64.09. The above-defined dentist index for Taipei City was 196.15% (125.71/64.09). However, the dentist indexes for Penghu County, Kinmen County, and Lienchiang County were 56.36% (36.12/64.09), 20.03% (12.84/64.09), and 83.45% (53.48/64.09), respectively. Moreover, this corresponding dentist index for three offshore island counties was 38.02% (24.37/64.09). The gap of the number of dentists per 100,000 people between the capital and the offshore islands was up to 5.16-fold (125.71/24.37). On the contrary, the lowest corresponding dentist index was 33.50% (21.47/64.09) for Chiayi County. In 2006, the number of dentists per 100,000 people in the whole area of Japan was 74.0. The dentist index was 158.2% for Tokyo. However, the corresponding dentist index was 72.8% in Okinawa of the offshore island prefecture. The gap of the number of dentists per 100,000 people between Tokyo and Okinawa was only 2.17-fold. On the contrary, the lowest corresponding dentist index was 63.2% in Fukui.⁸ If we assume that all dental students choose to practice in the location of their growth, the distribution of dentists per 100,000 people will be close to the distribution of admitted dental students per 100,000 people. However, the actual situation is not the case. Although the urban-rural gap or the gap between the capital and the offshore islands of admitted dental students per 100,000 people was relatively small in Taiwan, these gaps in dentists per 100,000 people became much larger. This means that there are many market factors that drive dental students to move to cities or metropolitan areas after they become dentists.

To compare with other municipalities, the admitted dental student indexes were 37.80% for New Taipei City, 48.78% for Taoyuan City, 146.95% for Taichung City, 126.83% for Tainan City, and 105.49% for Kaohsiung City. Besides, the dentist indexes were 105.29% for New Taipei City, 85.82% for Taoyuan City, 108.80% for Taichung City, 93.82% for Tainan City, and 104.76% for Kaohsiung City. These results indicate that the distribution of admitted dental students and dentists per 100,000 people were different

among cities. Similarly, our findings also suggest that there are many market factors that drive dental students to move among different cities after they become dentists.

Furthermore, we compared different regions of Taiwan between admitted dental student and dentist indexes. The admitted dental student index was 101.22% for the northern region of Taiwan (1.66/1.64). However, the corresponding dental student indexes were 96.95% (1.59/1.64) for the central region, 107.32% (1.76/1.64) for the southern region, 36.59% (0.60/1.64) for the eastern region of Taiwan, and 165.85% (2.72/1.64) for the offshore islands. In addition, the dentist index was 122.08% (78.24/64.09) for the northern region of Taiwan. However, the corresponding dentist indexes were 82.43% (52.83/64.09) for the central region, 88.53% (56.74/64.09) for the southern region, 62.27% (39.91/64.09) for the eastern region of Taiwan, and 38.02% (24.37/64.09) for the offshore islands. Although enrolled dental freshmen were concentrated in the northern region of Taiwan, accounted for 44.30% of all admitted dental freshmen, there was no significant difference in the numbers of admitted dental freshmen per 100,000 people in each region of Taiwan. Because Taiwan's population is mainly concentrated in the northern region, there must be more admitted dental students or dentists in the northern region of Taiwan. Therefore, the difference in admitted dental students per 100,000 people between two geographical regions is not entirely the urban-rural gap.

In this study, there were obviously more cases in which students from the northern region were admitted to dental schools in the northern region, students from the central region were admitted to dental schools in the central region, and students from the southern region were admitted to dental schools in the southern region. On the other hand, there were obviously fewer cases in which students from the northern region were admitted to dental schools in the southern region, and students from the central region were admitted to dental schools in the northern region. These findings indicate that students tend to choose dental schools in the same area where they grow up. Therefore, the presence of a dental school in a city also has a certain effect on the number of admitted dental students from the same area. On the other hand, the enrolled dental freshmen from the northern region of Taiwan were more likely admitted through the examination admission and the individual application admission, but less commonly through the numerous stars initiatives admission. On the contrary, enrolled dental freshmen from the southern region of Taiwan were more likely admitted through the numerous stars initiatives admission, but less frequently through the examination admission and the individual application admission. These results indicate that the differences in educational resources between regions affect the choice of dental student admission ways. The examination admission and individual application admission are more beneficial to northern students, while the numerous stars initiatives admission plays a balanced role.

Since the distribution of dentists is mainly the result of long-term influence by various market factors,¹⁰ and the distribution of admitted dental students is the result of the difference in educational resources among different regions of Taiwan and the execution of admission protection for enrolled dental students, all graduated dental students

who become dentists are affected by the same market factors and choose their practice locations depending on the similar market factors. Therefore, we also used the difference between admitted dental student index and dentist index to infer the direction that dental students might move after they become dentists. When the admitted dental student index is higher than the dentist index of the same region, it means that the dental students finally move out of the region after they become dentists. Conversely, when the admitted dental student index is lower than the dentist index of the same region, it means that the dental students finally move into the region after they become dentists. For example, dentists from non-municipalities may choose to practice in municipalities, especially those from remote villages or offshore island counties, while dentists from municipalities often move among different municipalities. Taipei City, Taichung City, and Tainan City may have more dentists moving out, while New Taipei City and Taoyuan City may have more dentists moving in. In addition, some dentists from the central and southern regions of Taiwan may choose to practice in other regions, while some dentists from other regions may choose to practice in the northern and eastern regions of Taiwan. However, most dentists from offshore islands may not return to their hometowns to practice. However, these inferences need to be supported by other empirical studies. Due to the concentration of the population in the northern Taiwan and the urban-rural gap in the job market, students from the northern region who go to other regions to study usually return to the northern region for employment, while students from other regions who go to the northern region to study often stay in the northern region for employment. The dentist's choice of practice location is also influenced by the similar phenomenon, finally resulting in the concentration of dentists in the northern region of Taiwan.^{11–13}

Although the execution of admission protection plays a role in balancing the distribution of admitted dental students, the numerous stars initiatives admission is beneficial to the students of non-star high schools in cities, and it is not helpful for the students of remote high schools with insufficient educational resources. In addition, this study found that the students from offshore islands were admitted to dental schools through the numerous stars initiatives admission and individual application admission, while there was none of admitted dental students from remote townships in Chiayi County and Taitung County of Taiwan. Therefore, the execution of admission protection for the students from offshore islands creates another result of unequal admission opportunity. In fact, taking year 2020 as an example, every 100,000 people compete for 1.64 admission quotas of dental schools. If the government hopes that the students from offshore islands have the same educational opportunities as the students from other regions, and the total population of the three offshore islands is about 257,000, five guaranteed admission quotas of dental schools ($1.64 \times 2.57 = 4.21$) will be available to meet the demand. In the absence of the admission protection, the chance of offshore island students admitted to dental schools is much lower than that of urban students, but over-protection and too many guaranteed dental admission quotas make the chance of offshore island

students much higher than that of urban students. Thus, another problem of unequal educational opportunity is formed.

Besides, there were 5 cases in which the guaranteed dental admission quotas of offshore island students was not accepted or gave up after admission. The admission qualification executed by a dental school is a very precious educational resource. Future studies should continue to track the reasons for the abandonment of offshore island students. The policy should protect both the offshore island and rural students' dental admission opportunities. Therefore, the guaranteed dental admission quotas for offshore island students should be controlled within a reasonable range to maintain equal educational opportunities among offshore island students, students from remote areas, and students from other regions. Too many guaranteed dental admission quotas for offshore island students are given, but these students do not return to their hometowns after they become dentists, resulting in worsening the problem of a surplus of dentists in the metropolitan areas and failing to improve the problem of an uneven distribution of dentists. The admission protection to dental schools for offshore island students was a policy that began in 1969. And the admission protection method in this study is actually just one of the admission protection methods. However, the shortage of dentists in offshore islands has not improved after the implementation of this policy. Obviously, the main reason is that dentists from offshore islands do not return to their hometowns to practice. In the future, it is necessary to track the practice trends of offshore island students after they become dentists, and explore the reasons why they do not want to return to their hometowns to practice. These results can serve as a basis for further review and revision of the policy about the admission protection to dental schools for offshore island students.

The importance of this study is that we develop a research method to analyze and compare the distribution of students from different admission ways. We conclude that the distribution of enrolled dental freshmen does have a big urban-rural gap, but this gap is not larger than that of dentists. The reason is that the difference in opportunities for students to enter the dental schools is related to the difference in educational resources between urban and rural areas. Although the choice of future practice location for dental students is affected by the location of their growth or dental schools, it is more affected by the overall market factors. The execution of admission protection does play a role in balancing the urban-rural gap in the distribution of admitted dental students, but the effectiveness of implementation and the actual equality of admission opportunity should still be continuously monitored. For example, there was none of students admitted to the dental schools in Chiayi County and Taitung County. The numerous stars initiatives admission may be only beneficial to students from non-star high schools in urban areas, but does not help students from high schools of remote areas. The excessive number of the offshore island students for the individual application admission does cause another phenomenon of unequal opportunity to enroll into universities. Long-term follow-up studies are needed to evaluate whether the dental students from offshore islands or remote areas of Taiwan return to their hometowns to

practice after they become dentists and to explore the reasons why they have no desires to return to their hometowns to practice. These results can be used as the basis for policy adjustments. However, market factors also play important roles in affecting the distribution of dentists in Taiwan. Future changes in the distribution of dentists in Taiwan should still be closely monitored.¹⁰

Declaration of competing interest

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

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