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**Original Article**

## **Does Mandatory Postgraduate Clinical Training Worsen Geographic Distribution of Dentists in Japan?**

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### **Abstract**

Postgraduate clinical training for dentists has been mandatory in Japan since 2006. Hirata *et al.* reported that the geographic distribution of postgraduate dental trainees by prefecture in 2006 was worse than that of practicing dentists. This suggests that the postgraduate clinical training system could intensify the problem of distribution of dentists. In this study, therefore, we reviewed the geographic distribution of postgraduate dental trainees and practicing dentists between 2006 and 2010 in detail by city, ward, town and village by using the Lorenz curve and Gini coefficient. The results showed that while there was no significant worsening of geographic distribution of postgraduate dental trainees, the distribution of practicing dentists continued to deteriorate. A number of reasons may explain these findings: the clinical training system is based on a one-year employment contract, and dentists subsequently relocate as driven by the market; and geographic distribution among cities, towns and villages has worsened as a result of the merger of municipalities. The geographic distribution of practicing dentists is expected to deteriorate further if the number of dentists takes a downward turn in the future. Therefore, it is necessary to continuously review the distribution of postgraduate dental trainees.

**Key words:** Postgraduate clinical training for dentists—Dentists—  
Geographic location—Health policy—Japan

### **Introduction**

Postgraduate clinical training for dentists has been mandatory in Japan since 2006. In a 2009 study on the influence of this measure on the geographic distribution of dentists,

Hirata *et al.* found that the geographic distribution of postgraduate dental trainees in 2006 by prefecture was worse than that of practicing dentists<sup>9</sup>. This suggests that the postgraduate clinical training system might worsen the geographic distribution of dentists.

In this study, the geographic distribution of postgraduate dental trainees and practicing dentists between 2006 and 2010 by city, ward, town and village was reviewed in detail by using the Lorenz curve and Gini coefficient in order to evaluate how the postgraduate clinical training system influenced the geographic distribution of practicing dentists.

### Materials and Methods

The research items included the number of postgraduate dental trainees by clinical training facility each month from fiscal 2006 to 2010. The research was conducted in February of each fiscal year by e-mail, fax, mail, and telephone, targeting all postgraduate clinical training programs for dentists. The numbers of postgraduate dental trainees for each month of the fiscal year were added up and divided by 12 to obtain the average number of postgraduate dental trainees.

The data on the number of practicing dentists by municipality was collected from surveys on medical doctors, dentists and pharmacists (as of December 31 of 2006, 2008, and 2010)<sup>15-17</sup>. Practicing dentists in this case included postgraduate dental trainees.

There are 47 prefectures in Japan and each prefecture consists of cities, towns, villages, and special wards. A city has a population of 50,000 people or more, while towns and villages are less populated and located in non-urban areas. Special wards are located in Tokyo and are legally equivalent to cities. In regards to the population in each city, ward, town, and village, results from the Surveys of Population, Population Change and the Number of Households Based on the Basic Resident Registration (as of March 31 of each year from 2006 to 2010)<sup>9-13</sup> were used.

Since many municipalities were merged

during this period, the numbers of postgraduate dental trainees, practicing dentists, and populations used for the analysis were aggregated by municipality at the end of each fiscal year.

The Lorenz curve was described and the Gini coefficient calculated to investigate changes in geographic disparity in the number of dentists between 2006 and 2010. First, the numbers of postgraduate dental trainees per 100,000 people were arranged in order, from low to high, for each research year from 2006 to 2010 by city, ward, town, and village to describe the Lorenz curve, with the cumulative percentage of populations by city, ward, town, and village on the abscissa and the cumulative percentage of numbers of postgraduate dental trainees on the ordinate. Similarly, the Lorenz curve was described in regards to the number of practicing dentists in 2006, 2008, and 2010<sup>7</sup>. If the number of dentists per population is distributed completely equally among cities, wards, towns, and villages, the Lorenz curve will become a diagonal line passing through the origin (equal distribution line) and will be further from the equal distribution line if the distribution is more uneven. The Gini coefficient can be obtained from the area between the Lorenz curve and equal distribution line, and this value represents the extent of uneven distribution of dentists, ranging from zero (complete evenness) to one (complete unevenness).

Finally, the annual transition in the Gini coefficient was compared between the number of postgraduate dental trainees and the number of practicing dentists to review the influence of the postgraduate clinical training system on the number of practicing dentists.

Microsoft Excel 2010 (Microsoft, USA) was used for the statistical analysis.

### Results

We obtained answers from all clinical training programs for all years (Table 1).

The number of practicing dentists increased by 4,143, from 94,580 to 98,723, during the

Table 1 Number of postgraduate clinical training programs for dentists

	2006	2007	2008	2009	2010
Number of programs	272	282	288	302	309

Table 2 Population, number of dentists, and Gini coefficient

	2006	2007	2008	2009	2010
Population ( $\times 1,000$ )	127,055	127,082	127,057	127,104	127,058
Number of practicing dentists	94,580	—	96,674	—	98,723
Number of postgraduate dental trainees	2,633	2,353	2,262	2,366	2,396
Gini coefficient of practicing dentists	0.232	—	0.223	—	0.222
Gini coefficient of postgraduate dental trainees	0.755	0.743	0.753	0.737	0.745
Gini coefficient of practicing dentists in 2006 and cumulative postgraduate dental trainees	—	—	0.248	—	0.262

5-year period from 2006 to 2010 (Table 2). The number of postgraduate dental trainees who received clinical training during this period was 12,010. It was therefore recognized that 5,234 practicing dentists resigned during these 5 years (Table 2).

The number of cities, wards, towns, and villages was 1,840 in 2006, decreasing to 1,750 in 2010 due to the merger of municipalities.

Figures 1, 2, and 3 represent the Lorenz curve for the distribution of the numbers of postgraduate dental trainees and practicing dentists in 2006, 2008, and 2010, respectively. Each figure comprises data from all cities, wards, towns, and villages for each year. A slight increase and decrease was observed in the annual transition of the Gini coefficient for the number of postgraduate dental trainees by city, ward, town, and village, with an overall trend toward a slight decrease (Fig. 4). On the other hand, the annual transition of the Gini coefficient for the number of practicing dentists consistently decreased, from 0.232 to 0.222 (Fig. 5).

The Lorenz curve for the number of postgraduate dental trainees was below that for the number of practicing dentists for all

years, and further from the equal distribution line. The Gini coefficient was 0.755 for the number of postgraduate dental trainees in 2006, vs. 0.232 for the number of practicing dentists, and 0.753 vs. 0.223 in 2008, and 0.745 vs. 0.222 in 2010. That is, the number of postgraduate dental trainees indicated a larger value for all years (Table 2, Figs. 1–3). This indicates that geographic distribution was poorer for the number of postgraduate dental trainees than for the number of practicing dentists for all the years surveyed.

Supposing that postgraduate dental trainees remained as practicing dentists without moving from the city, ward, town or village where clinical training was received, the numbers of postgraduate dental trainees from 2007 to 2010 would be added to the number of practicing dentists in 2006, and the total number of practicing dentists would become 99,195 in 2008 and 103,957 in 2010. When the Gini coefficient was obtained for 2008 and 2010 based on the number of practicing dentists obtained by accumulating the numbers of postgraduate dental trainees, a constant increase was recognized in the Gini coefficient, from 0.232 to 0.262 (Fig. 5).

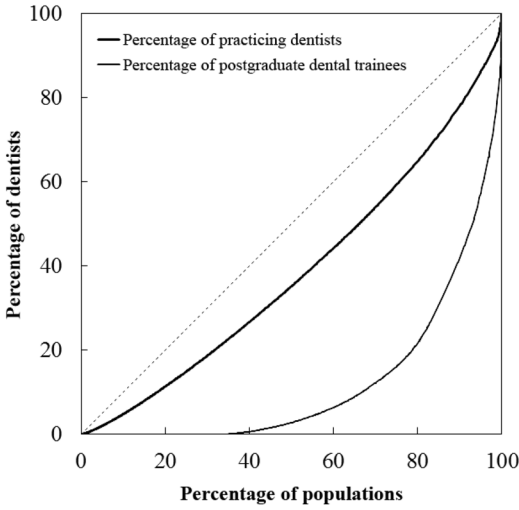


Fig. 1 Lorenz curve plotted for dentist distribution in 2006

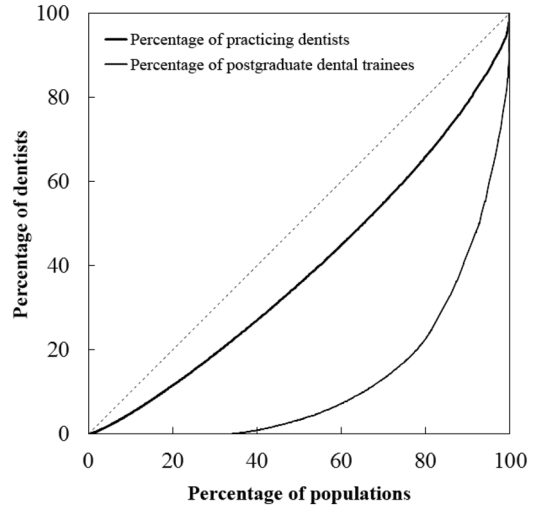


Fig. 3 Lorenz curve plotted for dentist distribution in 2010

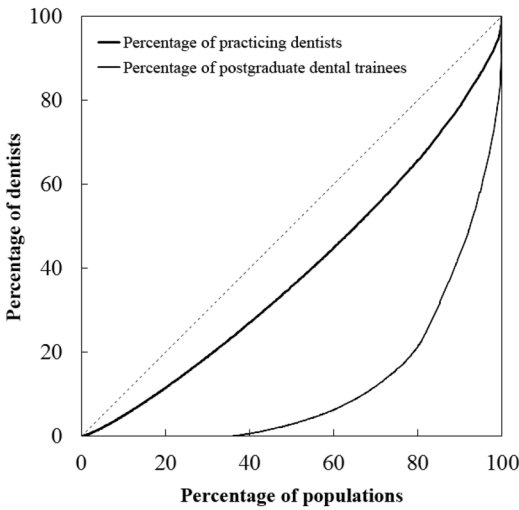


Fig. 2 Lorenz curve plotted for dentist distribution in 2008

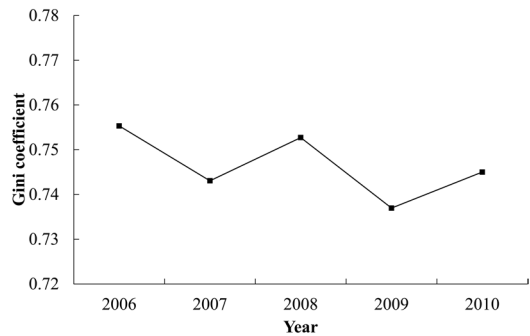


Fig. 4 Gini coefficient measuring degree of postgraduate dental trainee distribution

**Discussion**

The Lorenz curve and Gini coefficient were originally used to measure inequity in income distribution. However, they have also been used as indices to measure the geographic distribution of medical doctors and dentists in recent years<sup>1,3,4,7,20,21)</sup>. Therefore, it

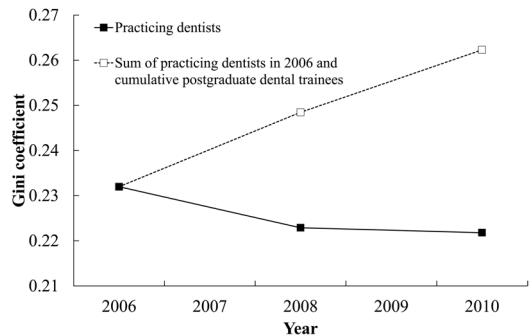


Fig. 5 Gini coefficient measuring degree of practicing dentist distribution

Table 3 Number of dental facilities

	2006	2007	2008	2009	2010
Dental clinics	67,392	67,798	67,779	68,097	68,384
Hospitals with dental department*	1,198	1,192	1,106	1,094	1,084
Hospitals with department of oral and maxillofacial surgery*	764	788	802	816	829
Postgraduate clinical training facilities	1,464	1,628	1,794	1,890	2,002

\*overlapping

was considered appropriate to use them as indices to determine the geographic distribution of postgraduate dental trainees and practicing dentists.

There are two kinds of clinical training program in the postgraduate clinical training system for dentists in Japan. One is the single clinical training facility system, where 12 months of training is given at one facility. This has mainly been adopted by the dental and oral surgery departments of hospitals, including university hospitals. The other is the clinical training facilities group system, where postgraduate dental trainees rotate between one program management facility (mainly a university hospital) and one or more collaborating facility (mainly a dental clinic). In the group system, postgraduate dental trainees are assigned to collaborating facilities for 3 to 9 months. This assignment period varies depending on the clinical training program. During the assignment period to a collaborating facility, the postgraduate dental trainee may be assigned to a municipality separate from the municipality where the program management facility is located. Therefore, in order to clarify the location of postgraduate dental trainees, the number of postgraduate dental trainees by clinical training facility by month needs to be researched rather than the number of postgraduate dental trainees by clinical training program. This indicates the validity of the present study, as all the locations of the postgraduate dental trainees were researched in regards to all clinical training programs.

The cumulative number of postgraduate

dental trainees for the 5 years commencing 2006 was 12,010, while the increase in the number of practicing dentists for this period was only 4,143. The ratio of the cumulative number of postgraduate dental trainees for this 5-year period to the total number of practicing dentists in 2010 was 12.2%, indicating that the geographic distribution of postgraduate dental trainees cannot be ignored in reviewing the geographic distribution of practicing dentists. If we assumed that the number of resigned dentists was not taken into consideration and that postgraduate dental trainees remained where they received training after completion of the program, the Gini coefficient showed a consistent increase. This suggests that an extension of the training period would worsen the geographic distribution of practicing dentists. Therefore, it is important to take into account the geographic distribution of postgraduate dental trainees when reviewing the geographic distribution of dentists.

The present results indicate that the geographic distribution of postgraduate dental trainees is improving by city, ward, town, and village. However, when the Gini coefficient for postgraduate dental trainees was compared with that for practicing dentists, the former was consistently larger, indicating that the geographic distribution of postgraduate dental trainees is significantly worse than that of practicing dentists. The geographic distribution of postgraduate dental trainees seems to be influenced by the fact that clinical training facilities occupy only 2 to 3% of all dental facilities (Table 3). In addition, Takiguchi *et*

*al.* reported that the presence of public dental schools has the strongest relationship with the sudden increase of dentists per 100,000 people in the relevant prefecture<sup>18</sup>). This is considered to be because there are only 19 prefectures and 28 municipalities with dental school hospitals where approximately 80% of postgraduate dental trainees belong per clinical training program.

On the other hand, the Gini coefficient for practicing dentists after clinical training was made mandatory is on a downward trend, and no further deterioration in the geographic distribution of practicing dentists due to poor geographic distribution of postgraduate dental trainees was recognized. According to the “spreading out” hypothesis<sup>5,6,14</sup>), distribution is equalized according to the competition principle, as seen in earlier studies on the number and distribution of medical doctors. Other studies have shown that the distribution of dentists also followed this trend in Japan from 1980 to 2000<sup>7,20</sup>). The present results showed that when the number of practicing dentists per 100,000 people was high (*i.e.*, 74.4 dentists in 2006) distribution was extremely equalized (*i.e.*, the Gini coefficient was approximately 0.2). Thus, the distribution of dentists followed the “spreading out” hypothesis, even after the major intervention in geographic distribution brought about by implementation of the mandatory postgraduate clinical training system.

Kobayashi and Takaki reported that “spreading out” was not observed in the distribution of medical doctors in Japan, although medical departments were added and enrollment was increased from 1970 to 1980<sup>3</sup>). The high proportion of hospital workers in urban areas and across-the-board handling of medical doctors in a variety of departments were pointed out as possible explanations for this. On the other hand, Okawa *et al.* noted that, unlike with medical doctors, approximately 85% of all practicing dentists in Japan are engaged in practice at dental clinics and most of them are general practitioners. It was further noted that selection of a place to open a new clinic will be likely to follow the

market principle since clinics can be freely opened anywhere in Japan<sup>7</sup>). Due to these reasons, the distribution of practicing dentists in Japan is assumed to follow the “spreading out” hypothesis.

There are other possible explanations as to why the postgraduate clinical training system has not worsened the geographic distribution of practicing dentists. First, postgraduate clinical training for dentists is based on an employment contract with a fixed term of one year and the number of clinical training facilities is limited; therefore, clinical training facilities need to newly hire postgraduate dental trainees for the following year, and continuous employment after completion of clinical training is difficult. Dentists who complete clinical training are expected to work at another medical institution in subsequent years. If this is the case, then the “spreading out” hypothesis would again apply during this period of further employment. Further study is necessary, however, to determine how the place of work in subsequent years influences geographic distribution.

Second, the influence of the merger of municipalities must be considered. In Japan, the political merger of municipalities has gathered pace since 1999. As a result, a total of 153 municipalities merged into 55 cities and towns during this research period<sup>19</sup>). An increase in the area of the municipality and the size of the population is believed to lead to a deterioration in the geographic distribution among cities, wards, towns, and villages. Therefore, this will lead to a decrease in the Gini coefficient by the unit of municipality.

We also believe that 5,234, the difference between the cumulative number of postgraduate dental trainees for the 5-year period investigated and the increase in the number of practicing dentists, is equivalent to the number of dentists who stopped providing medical care due to retirement, death, or some other cause. The proportion of this number to the number of practicing dentists was 8.0% in 2010, and that to the number of cumulative postgraduate dental trainees for the 5-year period was 65.5%. This may

represent a non-negligible influence on the observed decrease in the Gini coefficient for the number of practicing dentists. Further study is needed, however, to clarify this point.

In an earlier study on the supply of dentists in Japan conducted in 2005, the number of practicing dentists was predicted to peak between 2015 and 2030, thereafter taking a downward turn<sup>8)</sup>. Since then, the number of newly participating dentists has been limited by the raising of the pass standards for the national examination for dentists in 2007. Therefore, this number is now predicted to take a downward turn at an earlier stage. The tendency for medical doctors, who are in a shortage, to be concentrated in urban areas is well known. This suggests that the same trend might also be predicted for practicing dentists. Therefore, if the number of dentists also takes a downturn, this will further contribute to the departure from the predicted trend in the spreading out hypothesis. These results suggest that it is necessary to continuously review the distribution of postgraduate dental trainees in the future.

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