

**Original Article**

## **Geographic Distribution of Postgraduate Dental Trainees in Japan**

**SoIchiro Hirata, Shiro Mataki\*, Hitoshi Akiyama\*\*, Hiroshi Nitta\*, Mahito Okada, Takaharu Sakayori, Hiroki Sugito\*\*\* and Takuo Ishii**

*Department of Social Dentistry, Tokyo Dental College,  
1-2-2 Masago, Mihama-ku, Chiba 261-8502, Japan*

*\* Division of Comprehensive Patient Care,  
Graduate School, Tokyo Medical and Dental University,  
1-5-45 Yushima, Bunkyo-ku, Tokyo 113-8510, Japan*

*\*\* General Dentistry, The Nippon Dental University Hospital,  
2-3-16 Fujimi, Chiyoda-ku, Tokyo 102-8158, Japan*

*\*\*\* Dental Health Division, Health Policy Bureau,  
Ministry of Health, Labour and Welfare,  
1-2-2 Kasumigaseki, Chiyoda-ku, Tokyo 100-8916, Japan*

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### **Abstract**

Postgraduate clinical training for dentists in Japan became mandatory in April 2006. Mandatory postgraduate clinical training for physicians has been criticized as having accelerated the imbalance in distribution of physicians. This suggests the danger that the same phenomenon might occur in distribution of dentists. It is also necessary to investigate the geographic distribution of dental trainees and practicing dentists in Japan. In this study, the number of dental trainees enrolled in each clinical training program and number that had actually received clinical training at each facility were compared by prefecture. The results suggest that disparities in the number of dental trainees among prefectures are being compensated for by movement across prefectural borders under the clinical training facilities-group system. Postgraduate dental trainees, however, showed a significantly greater imbalance in geographic distribution than practicing dentists. Continuation of the postgraduate clinical training for dentists under the existing system may accelerate this imbalance in distribution of dentists. To prevent this, practical measures should be taken in accordance with the coming review of the system, based on research regarding changes in geographic distribution of dental trainees.

**Key words:** Postgraduate clinical training for dentists—  
Imbalanced distribution of dentists—  
Number of postgraduate dental trainees—  
Clinical training facilities-group system

## Introduction

Postgraduate clinical training for dentists in Japan became mandatory on April 1, 2006, in accordance with an amendment to the Dental Practitioners Law in 2000. Postgraduate clinical training for physicians has been mandatory since 2004. It has been criticized, however, as having accelerated the imbalance in distribution of physicians in Japan. Therefore, it is necessary to investigate geographic distribution of dental trainees and practicing dentists in Japan.

The government has been discussing and reporting on appropriate methods for supplying dentists to clinical practice<sup>2,3)</sup>. On the other hand, Hirata *et al.*, on the assumption that the number of clinical training programs for dentists in each prefecture reflected its ability to offer such training, reported that prefectures with more dentists or dental clinics had a greater ability to offer postgraduate clinical training for dentists<sup>7)</sup>. As 85.3% of the 2006 postgraduate dental trainees are enrolled in clinical training programs at dental university/school-affiliated hospitals<sup>10)</sup>, imbalance in distribution of dentists in Japan is expected to grow under the current system of postgraduate clinical training for dentists.

The system of postgraduate clinical training for dentists is composed of clinical training programs as its basic units. There are two types of clinical training program: single facility-based and facilities group-based programs. Under the single-facility system, dental trainees receive training at a single dental institution (single-system facility). Under the facilities-group system, dental trainees make rounds among a dental institution that manages the program (program-management facility) and the other dental institution(s) (collaborating facilities). In general, the single-system and program-management facilities are hospitals, whereas the collaborating facilities are dental clinics. Under the facilities-group system, dental trainees can receive training at any collaborating facility located in a prefecture other than the location of the program-management facility. Dental trainees are redistributed among

prefectures as a result of their movement across prefectural boundaries, and disparities in their number among prefectures may be corrected.

This report presents our findings from a study focusing on the number of postgraduate dental trainees who actually received clinical training at each facility.

## Materials and Methods

A survey was conducted by mail or e-mail during the period from February 1, 2007, to February 13, 2007. A copy of the questionnaire was sent by mail to the director of each single-system or program-management facility where the 2006 clinical training program for dentists was available. The same questionnaire was also e-mailed to the contact person of each facility listed on the Electronic Information System for Dental Residents (D-REIS), an Internet search site for clinical training programs for dentists. Responses were collected by mail, e-mail, fax, or telephone.

The questionnaire asked about the number of postgraduate dental trainees who had actually received clinical training at the single-system, program-management, or collaborating facility in each month between April 2006 and March 2007.

The numbers of postgraduate dental trainees enrolled in individual clinical training programs were summed by prefecture, and the result was defined as the "number of dental trainees belonging to a program". On the other hand, the numbers of postgraduate dental trainees who had actually received clinical training at individual facilities in each month were summed by prefecture, and the cumulative total was divided by 12 to determine the monthly average, which was defined as the "number of dental trainees belonging to a facility". Using these numbers as indices, this study compared disparities in number of dental trainees among prefectures.

As the control index, the "number of practicing dentists" was determined by prefecture, based on data from the 2006 Ministry of

Table 1 Number of postgraduate clinical dental trainees who belonging to a program and facility by prefecture

Prefecture	Number of postgraduate dental trainees		Prefecture	Number of postgraduate dental trainees	
	belonging to a program	belonging to a facility		belonging to a program	belonging to a facility
Hokkaido	128	126.8	Shiga	8	12.8
Aomori	5	7.9	Kyoto	29	29.7
Iwate	55	47.4	Osaka	204	206.9
Miyagi	58	62.4	Hyogo	27	42.9
Akita	3	6.3	Nara	4	7.0
Yamagata	2	2.7	Wakayama	6	7.7
Fukushima	66	62.8	Tottori	5	6.1
Ibaraki	2	7.3	Shimane	5	5.8
Tochigi	7	13.0	Okayama	67	62.3
Gunma	6	11.6	Hiroshima	52	55.4
Saitama	103	130.3	Yamaguchi	3	12.5
Chiba	232	208.6	Tokushima	42	37.3
Tokyo	488	432.8	Kagawa	5	9.9
Kanagawa	240	255.5	Ehime	9	10.1
Niigata	125	108.9	Kochi	3	2.5
Toyama	3	3.3	Fukuoka	242	207.2
Ishikawa	9	8.4	Saga	5	7.5
Fukui	5	6.3	Nagasaki	40	41.3
Yamanashi	4	6.0	Kumamoto	10	19.8
Nagano	65	62.4	Oita	5	7.3
Gifu	78	62.7	Miyazaki	5	6.6
Shizuoka	6	17.0	Kagoshima	38	34.8
Aichi	132	132.8	Okinawa	7	8.8
Mie	6	7.9	Total	2,649	2,632.8

Health, Labour and Welfare survey involving physicians, dentists, and pharmacists<sup>13)</sup>.

For each of the numbers of dental trainees belonging to a program, dental trainees belonging to a facility, and practicing dentists, the ratio of the maximum to minimum number, and coefficient of variation were calculated as indicators of the maximum gap and relative dispersion, respectively. Then, as indicators of equality of geographic distribution of dental trainees, Lorenz curves and Gini coefficients were used. In this study, the x axis of the Lorenz curve represents the cumulative percentages of the population sequentially from the prefecture with the fewest dentists per population. The y axis represents the cumulative percentages of dental trainees belonging

to a program, dental trainees belonging to a facility, and practicing dentists. The population of each prefecture was extracted from statistics entitled "Current Population Estimates as of October 1, 2006"<sup>14)</sup>. The Gini coefficient was derived from the Lorenz curve.

These data were analyzed using Microsoft Office Excel 2007 (Microsoft Corporation, USA) and Ekuseru-Toukei 2008 (Social Survey Research Information Co., Ltd., Japan).

## Results

Responses were obtained regarding all of the 272 clinical training programs for 2006. The Table 1 shows the numbers of postgraduate

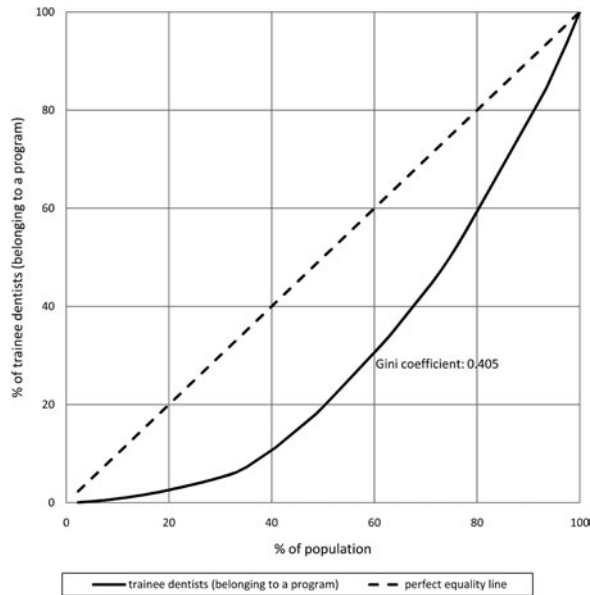


Fig. 1 Lorenz curve of clinical trainee dentists (belonging to a program) by prefecture

dental trainees belonging to a program and those belonging to a facility.

The cumulative total number of postgraduate dental trainees belonging to a program was 2,649. Tokyo was the prefecture with the largest number (488), and Yamagata and Ibaraki were the prefectures with the smallest (2 each). Mean number among prefectures was 56.0. There were 26 prefectures, or more than half of the 47 prefectures, with 10 or fewer dental trainees belonging to a program. The maximum gap was 244.0 times, the coefficient of variation was 1.65, and the Gini coefficient was 0.405 (Fig. 1).

The total number of postgraduate dental trainees belonging to a facility was 2,632.8. Tokyo was the prefecture with the greatest number (432.8), and Kochi was the prefecture with the smallest (2.5). Mean number among prefectures was 56.0. There were 19 prefectures with 10 or fewer dental trainees belonging to a facility. The maximum gap was 173.1 times, the coefficient of variation was 1.51, and the Gini coefficient was 0.335 (Fig. 2).

The total number of practicing dentists was

94,593. Tokyo was the prefecture with the largest number (14,819), and Tottori was the prefecture with the smallest (355). Mean number among prefectures was 2,013. The maximum gap was 41.7 times, the coefficient of variation was 1.26, and the Gini coefficient was 0.122 (Fig. 3).

Comparison between the numbers of postgraduate dental trainees belonging to a program and those belonging to a facility revealed a decrease in the maximum number in a prefecture from 488 to 432.8 (both in Tokyo), and an increase in the minimum number in a prefecture from 2 to 2.5. As a result, the maximum gap reduced from 244.0 to 173.1 times, which, however, remains larger than the maximum gap in the number of practicing dentists.

The variation coefficient for the number of practicing dentists was 1.26, smaller than that for the numbers of postgraduate dental trainees belonging to a program (1.65) and those belonging to a facility (1.51), indicating that the geographic distribution of dental trainees was more widely dispersed than that of practicing dentists.

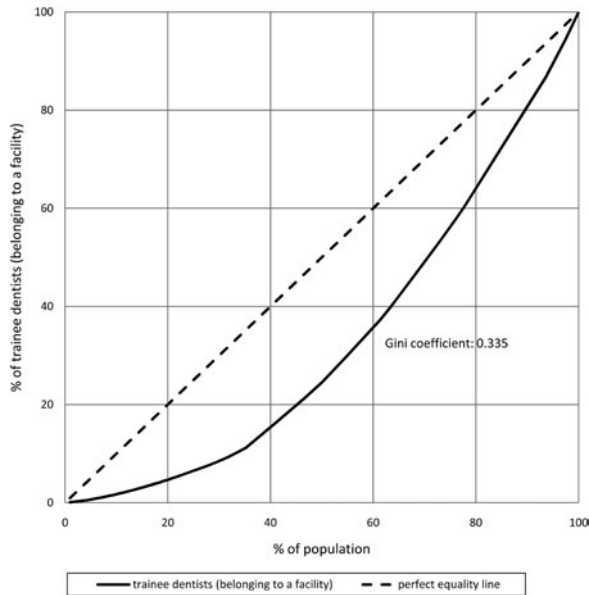


Fig. 2 Lorenz curve of clinical trainee dentists (belonging to a facility) by prefecture

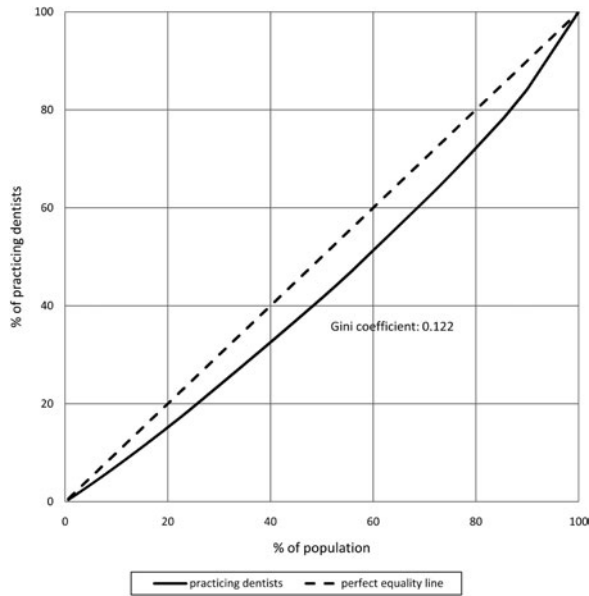


Fig. 3 Lorenz curve of practicing dentists by prefecture

The Lorenz curve for the number of dental trainees belonging to a facility was closer to the perfect equality line than that for the number of dental trainees belonging to a

program, and the Gini coefficient for the former was 0.335, lower than the value of 0.405 for the latter. For the number of practicing dentists, however, the Lorenz curve was closer

to the perfect equality line, and the Gini coefficient was 0.122.

### Discussion

The number of dental trainees belonging to a clinical training program indicates level of acceptance in the prefecture where the program is available. On the other hand, unlike the system of postgraduate clinical training for physicians, under which a clinical training facilities group, in principle, must be formed within the same secondary medical-care area or the same prefecture<sup>9)</sup>, the system of postgraduate clinical training for dentists allows the program-management facility to form a clinical training facilities group with collaborating facilities located in prefectures other than its location. Given the resulting movement of dental trainees across prefectural boundaries under this facilities-group system, the number of dental trainees in each prefecture should be counted on a facility basis, not on a program basis. In other words, the geographic distribution of dental trainees is more accurately reflected in the number of dental trainees belonging to a facility, rather than a program.

In Tokyo, the prefecture with the largest number of dental trainees on a program basis as well as a facility basis, the number decreased from 488 (program-based) to 432.8 (facility-based). In Yamagata and Ibaraki, the prefectures with the fewest dental trainees (2 each) on a program basis, the number increased to 2.7 and 7.3, respectively, on a facility basis. In Kochi, the number of dental trainees decreased from 3 (program-based) to 2.5 (facility-based). As a result, the maximum gap reduced from 244.0 to 173.1 times, and the number of prefectures with 10 or fewer dental trainees also decreased from 26 to 19. These changes may be due to the fact that dental university/school-affiliated hospitals, where most of the dental trainees are accepted, adopt the facilities-group system. It is likely that the resulting movement of dental trainees to prefectures with fewer dental trainees caused their redis-

tribution, reducing disparities in their number among prefectures.

The Gini coefficient for the number of dental trainees also decreased from 0.405 (program-based) to 0.335 (facility-based), with the Lorenz curves not intersecting. This finding demonstrated that disparities in the number of dental trainees among prefectures were partly corrected by their redistribution under the facilities-group system.

The Lorenz curve, representing the equality level of distribution, is mainly used in the analysis of income gaps. It is a straight diagonal line passing the point of origin if the distribution is perfectly equal, and falls below the diagonal line as the distribution becomes unequal. The Gini coefficient is primarily used as an indicator of inequality in the allocation of resources such as income. It ranges from 0 to 1, with a value closer to 0 indicating a smaller gap, and a value closer to 1 indicating a larger gap. As we have occasionally encountered domestic as well as foreign studies on disparities in the geographic distribution of physicians or dentists using the Lorenz curve and Gini coefficient as indicators<sup>1,8,12,16)</sup>, it seems reasonable to use them as indicators of the geographic distribution of dental trainees. The Gini coefficient has been reported to be 0.129 and 0.123 for the distributions of overall physicians and pediatricians, respectively, by state in the U.S. in 1992<sup>1)</sup>, and 0.340 for the distribution of physicians by municipality in Japan in 1990<sup>8)</sup>. It has also been reported to be 0.209 for the number of dental clinics by municipality in Fukuoka Prefecture in 2000<sup>16)</sup>, and 0.150 for the number of dentists by secondary medical-care area in Chiba Prefecture in 2000<sup>12)</sup>. Although direct comparison of these values with the Gini coefficient values in this study is difficult, this coefficient may be useful in comparatively evaluating the geographic distribution of dentists.

Both the maximum gap and variation coefficient of the number of practicing dentists were smaller than those of the number of dental trainees belonging to a program or a facility, indicating that the current distribution of dental trainees was more widely

dispersed than that of practicing dentists. Likewise, the Gini coefficient was greater for the number of dental trainees belonging to a program or a facility than for the number of practicing dentists, indicating that the current distribution of dental trainees by prefecture was more unequal than that of practicing dentists.

While the principal purposes of the postgraduate clinical training for dentists are described as the implementation of community health and medical care, the understanding and practice of hospital-clinic cooperation, and the realization of medical safety management at clinics, it is recommended that even university hospitals conduct clinical training in cooperation with clinics under the facilities-group system<sup>9)</sup>. As the importance of the roles of dental clinics as clinical training facilities is being recognized among the broader population, some dental clinics have been designated as program-management or single-system facilities, not to mention as collaborating facilities<sup>10)</sup>. These clinical training facilities, however, are not necessarily designated in areas with fewer dental trainees. If they are intensively designated in urban areas as in the postgraduate clinical training for physicians, regional disparities in the number of dental trainees may further expand. Under the system of postgraduate clinical training for physicians, practical measures are being discussed against the concentration of medical interns in urban areas<sup>4,11)</sup>.

When the postgraduate clinical training for dentists became mandatory, Takiguchi *et al.* had already demonstrated that the presence of a national dental university was the most significant factor in increasing the number of dentists per 100,000 of the population by prefecture<sup>15)</sup>. On the other hand, Hirata *et al.*, on the assumption that the number of clinical training programs for dentists in each prefecture reflected its ability to offer such training, reported that prefectures with more dentists or dental clinics had a greater ability to offer the postgraduate clinical training for dentists<sup>7)</sup>. In this study, a comparison between the numbers of dental trainees belonging to a program and those belonging to a facility suggested

disparities in the number of dental trainees among prefectures being corrected under the facilities-group system. A comparison of the above numbers with the number of practicing dentists, however, supported an expectation that the imbalanced distribution of dentists in Japan would grow. Currently, clinical training in a remote area or an isolated island is only available in the form of a short-term dispatch within a month or a business trip to the training facility. Thus, the existing system is less likely to serve as the driving force to preferentially allocate dentists to areas with fewer dentists. This should not be overlooked, now that the excessive supply of dentists has become an issue<sup>3)</sup>. In order to solve this problem, it will be necessary to convert the single-facility system into the facilities-group system and increase the number of collaborating facilities in those areas.

## Conclusion

In this study, postgraduate dental trainees showed a significantly greater imbalance in geographic distribution than practicing dentists. This raises the concern that the system of postgraduate clinical training for dentists might accelerate the imbalance in the distribution of dentists. However, the study also demonstrated that this imbalance in the distribution of dental trainees was partly corrected by the adoption of the facilities-group system at dental university/school-affiliated hospitals, where most of the dental trainees were accepted, and the resulting movement of dental trainees across prefectural borders. As the system of postgraduate clinical training for dentists is to be reviewed within 5 years of its implementation<sup>9)</sup>, further investigation on yearly changes in the number of dental trainees by prefecture should be conducted to identify practical remedies.

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### Reprint requests to:

Dr. SoIchiro Hirata  
 Department of Social Dentistry,  
 Tokyo Dental College,  
 1-2-2 Masago, Mihama-ku,  
 Chiba 261-8502, Japan  
 E-mail: sohirata@tdc.ac.jp