Community Dental Health (2019) **36,** 195–197
Received 1 January 2019; Accepted 28 February 2019

doi:10.1922/CDH_4530Morita03

Trend in unequal geographical distribution of dentists by age and gender in Japan from 1996–2014

Tomohiro Morita[1], Takayoshi Hashimura[2], Yuki Senoo[3] and Tetsuya Tanimoto[4]

[1]Soma Central Hospital, Soma City, Fukushima, Japan. 976-0016, [2]Medical Governance Research Institute, Tokyo, Japan. 108-0074, [3]Comenius University, Bratislava, Slovakia. P.O.BOX 32, [4]Navitas Clinic, Tachikawa City, Tokyo, Japan. 190-0023

Objectives: To evaluate the relationship between dentists' demographic changes and their uneven geographical distribution. ***Methods:*** Secondary analysis of nationwide government surveys, to assess trends in the geographical distribution of dentists by gender and age from 1996 to 2014 in Japan. ***Results:*** The Gini-coefficient for the number of dentists per population from 47 prefectures decreased from 0.084 in 1996 to 0.069 in 2014. The coefficients for female (0.124–0.144) were higher than for male dentists (0.058–0.081). Coefficients for dentists aged 60 and older were lower than those for dentists younger than 40 in 2014 (male: 0.060 vs. 0.112; female: 0.107 vs. 0.169). ***Conclusion:*** The geographical maldistribution of dentists in Japan has improved. Demographic changes among dentists, including the increasing number of female dentists, could moderate this improvement.

Key words: *Geographic locations, Japan, Public policy, Population Dynamics, Aging*

Introduction

Inequality in the distribution of dentists has been a persistent public health concern. Past reports suggested that previous political efforts to increase the number of dentists have failed to sufficiently mitigate the maldistribution in many countries or regions, including the USA (Krause *et al.*, 2005), Hong Kong (Lo and Wong, 1999) and Japan (Okawa *et al.*, 2011). For example, though numbers of dentists per 100,000 people increased in Japan from 44 in 1980 to 70 in 2000, 25.9% of municipalities had still no dentists as of 2000.

In recent years, two major demographic changes of dentists have been observed globally, which may have affected supply in rural areas. The first major change involves more female dentists. In Japan, the proportion of female dentists increased from 15% (12,007/81,055) in 1994 to 23% (23,428/103,972) in 2014. The other major demographic change involves an aging profession, primarily reflecting population aging. In Japan, one of the most rapidly aging countries in the world, the population of elderly dentists aged 60 and older increased from 18% (14,626/81,055) in 1994 to 26% in 2014 (26,594/103,972). These demographic changes among dentists, along with other incentives for choosing their place of work, may have contributed to the unequal geographical distribution of dentists in Japan (Bowman and Gross, 1986; Matsumoto *et al.*, 2005). Therefore, it is important to determine this maldistribution and take into consideration not only the increase in the number of dentists but also the demographic changes. However, there have been few studies of the distribution of Japanese dentists that have considered such issues longitudinally (Okawa *et al.*, 2011). In this study, we examined the trend in regional imbalances in the number of dentists from 1996 to 2014 using a publicly available population database in Japan. Furthermore, we assessed the uneven distribution of dentists using gender and age data and investigated the relationship between dentists' gender and age and distribution.

Materials and Methods

Data on the number of dentists between 1996 and 2014 are publicly available from the nationwide government "Survey of Physicians, Dentists and Pharmacists" The data used were the latest available at the time of retrieval in October 2017. Japan's Ministry of Health, Labor, and Welfare conducts this survey biennially to describe dentists' work locations (municipalities), gender, age, and specialties. From within this database, we extracted information about dentists at the prefectural level, including the number of males and females and their ages. Whilst age data are published at both the prefectural and municipal levels, gender data are only published at the prefectural level. Therefore, analysis of the 47 prefectures allowed evaluation of the effects of both age and gender.

We used the Gini-coefficient, which is commonly used to measure income inequality (Yitzhaki, 1979). The Gini-coefficient is derived from the Lorenz curve, which is based on a curve fitted to percentile shares of income and population. Coefficient values vary between 0 (complete equity) and 1 (complete inequity). Several research groups have applied this method to investigate the distribution of medical professionals (Gravelle and Sutton, 2001; Morita *et al.*, 2018). We applied the method to the interregional inequality in the number of dentists. The Gini-coefficient concerning the number of dentists, using gender and age groups (20–39, 40–49, 50–59, 60–) per population data, was evaluated. In addition, to determine the gender difference among dentists in urban areas, we calculated the proportion of male and female dentists in Tokyo, Kanagawa, and Osaka, the three most urbanized cities in Japan, in the study period.

Correspondence to: Tomohiro Morita, E-mail: t.morita526@gmail.com (TM)

Results

Between 1996 and 2008 the population in Japan remained almost unchanged at 128 million people. Thereafter, a decline emerged, falling to 127 million in 2014. Meanwhile, the number of dentists increased from 85,518 in 1996 to 103,972 in 2014. The number of dentists per 100,000 population also increased, from 67.9 in 1996 to 81.8 in 2014.

In the 47 prefectures, the median number of dentists per 100,000 people in the population increased from 56.4 (range: 42.2–119.3) in 1996 to 71.8 (range: 53.3–122.4) in 2014. The Gini-coefficient for the number of dentists per population from 47 prefectures was 0.084 in 1996. It peaked at 0.087 in 2000 and decreased to 0.069 in 2014.

Figure 1 shows trends in the Gini-coefficient for the number of dentists per population among the 47 prefectures, for each gender and age group. The coefficients for the female dentists were higher than those for male dentists across all generations. The coefficients for the number of male dentists during the study period ranged from 0.058 to 0.081, while those for female dentists ranged from 0.124 to 0.144.

By age, the Gini-coefficients for the distribution of dentists aged 60 and older were the highest in 1996 and 1998 (male: 0.118–0.121; female: 0.176–0.186), but decreased from 2000 and were lower than those for dentists younger than 40 years in 2014 (male: 0.060 vs 0.112; female: 0.107 vs 0.169).

The proportion of female dentists working in urban areas was almost unchanged (35.6% in 2002 and 35.0% in 2008 and 2012), while the proportion of male dentists decreased from 29.8% in 1994 to 28.8% in 2014.

Discussion

This study suggests that the geographical maldistribution in the number of dentists in Japan has slightly improved during the 20-year study period when assessed using prefecture data. Access to dental care among the Japanese population may have improved during the study period.

However, this study also clarified the gender difference in the geographical distribution of dentists in Japan. In all age groups, the inequality in the number of female dentists per population was larger than those for male dentists, suggesting that the maldistribution of female dentists was more than males. In addition, proportionately more female dentists were working in urban areas than males. These findings are consistent with previous studies of medical doctors, indicating that fewer female doctors work in rural areas than males (Doescher *et al*., 2000) and that the regional distribution of female dentists may be more unevenly distributed than that of males (Morita *et al*., 2018). A similar gender difference for preferring urban areas may be applied to dentists (Toyokawa and Kobayashi, 2010). Thus, it is possible that the geographical maldistribution of Japanese dentists may increase in future as the number of female dentists steadily increases. Few studies have proposed workable incentives for female dentists regarding their work location. Gender-focused studies are required to improve the geographical maldistribution of dentists.

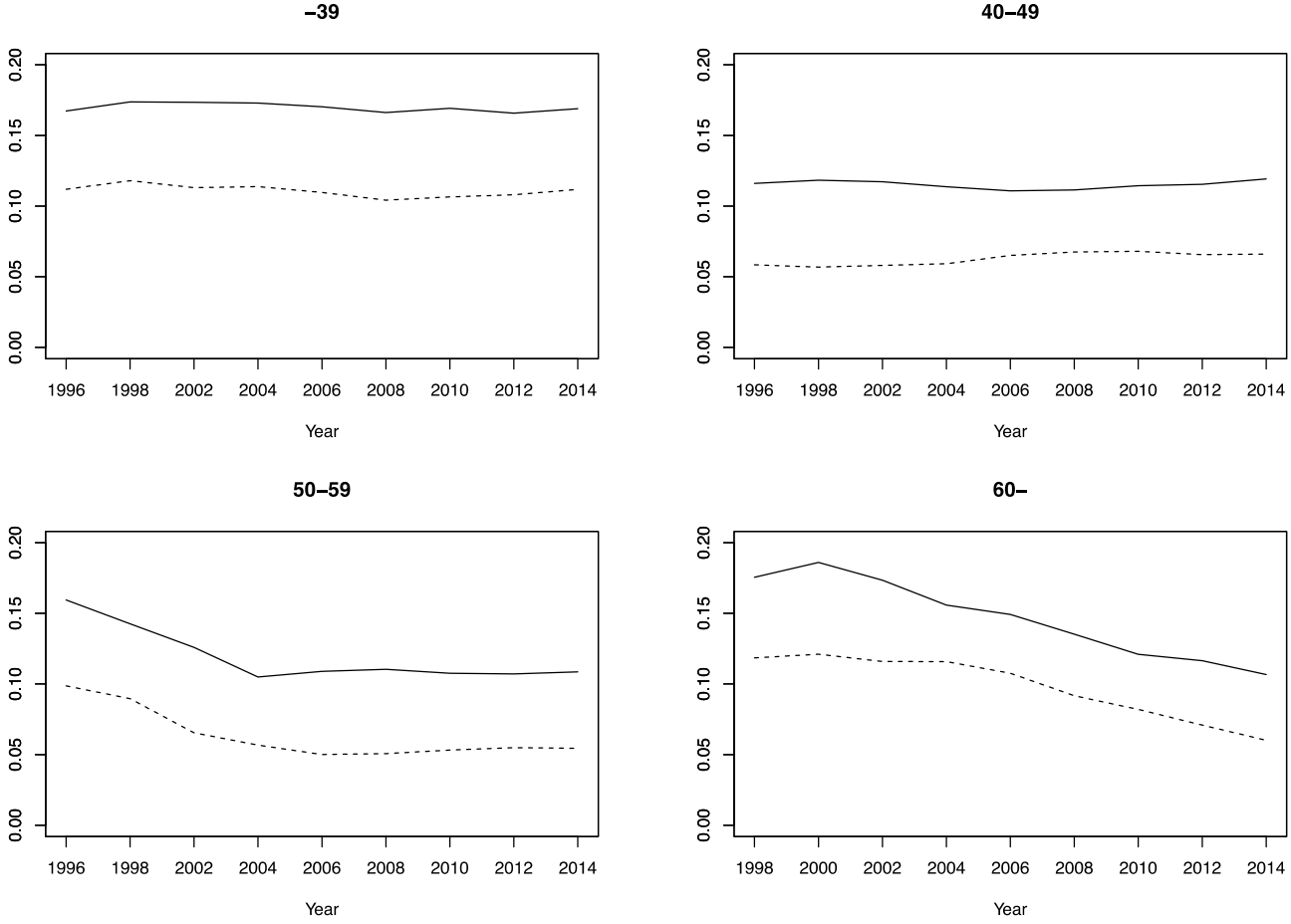

Figure 1. Age and gender trends of the Gini-coefficients for the distribution of dentists by age and gender between 1996 and 2014
Solid lines = female dentists
Dotted lines = male dentists

The unequal distribution of dentists aged 60 and older decreased during the study period. These findings for dentists contrast with those for medical doctors in Japan. A previous report suggested that the maldistribution of older doctors has consistently been greater than for the majority age group. A possible reason for the trend in the more equal distribution of dentists may be that the supply of dentists in Japan may have reached a level necessary to generate geographical diffusion (Toyokawa and Kobayashi, 2010).

These findings suggest that the demographic changes observed in dentists, including an increase in number of female dentists, could moderate improvements in the geographical maldistribution of dentists. Further research to understand gender differences in geographical distribution is needed to inform policy-making to address the unequal geographical distribution of dentists.

Conclusion

This study showed that the geographical maldistribution of dentists in Japan improved between 1996 and 2014. The demographic changes observed in dentists, including an increase in female dentists, could moderate this improvement.

Limitations

This research has several limitations. First, the government survey of the number of dentists is mandatory, but there is a possibility that some dentists were not captured sufficiently. For example, dentists who work as locums are not sampled. Second, we were not able to analyze the age differences in the geographical distribution of dentists in districts smaller than prefectures, as the public database for age groups and gender was compiled at only prefecture level.

Author Statements

Ethical approval was not required for this study as it is a secondary analysis of existing data.

Funding

No funding was received to support the writing of this paper.

Competing interests

TM reports director's fee from miup Inc., outside the submitted work. TT reports personal fees from Medical Network Systems, MNES Inc., outside the submitted work. Other authors declare no competing interests.

References

Bowman, M. and Gross, M.L. (1986): Overview of research on women in medicine--issues for public policymakers. *Public Health Reports* **101**, 513-521.

Doescher, M.P., Ellsbury, K.E. and Hart, L.G. (2000): The distribution of rural female generalist physicians in the United States. *Journal of Rural Health* **16**, 111-118.

Gravelle, H. and Sutton, M. (2001): Inequality in the geographical distribution of general practitioners in England and Wales 1974-1995. *Journal of Health Services Research and Policy* **6**, 6-13.

Krause, D., Frate, D.A. and May, W.L. (2005): Demographics and distribution of dentists in Mississippi: a dental work force study. *Journal of the Amercan Dental Association* **136**, 668-677.

Lo, E.C. and Wong, M.C. (1999): Geographic distribution of private dentists in Hong Kong in 1989 and 1998. *British Dental Journal* **186**, 172-173.

Matsumoto, M., Okayama, M., Inoue, K. and Kajii, E. (2005): Factors associated with rural doctors' intention to continue a rural career: a survey of 3072 doctors in Japan. *Australian Journal of Rural Health* **13**, 219-225.

Morita, T., Tanimoto, T., Morita, M., Tsubokura, M. and Kami, M. (2018): Trend in unequal geographical distribution of doctors by age and sex in Japan from 2004 to 2014. *Public Health* **159**, 95-98.

Okawa, Y., Hirata, S., Okada, M. and Ishii, T. (2011): Geographic distribution of dentists in Japan: 1980-2000. *J Public Health Dentistry* **71**, 236-240.

Toyokawa, S. and Kobayashi, Y. (2010): Increasing supply of dentists induces their geographic diffusion in contrast with physicians in Japan. *Social Science and Medicine* **71**, 2014-2019.

Yitzhaki, S. (1979): Relative deprivation and the Gini coefficient. *The Quarterly Journal of Economics*, 321-324.