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Short Communication

Trend in unequal geographical distribution of doctors by age and sex in Japan from 2004 to 2014

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ABSTRACT

Objectives: In Japan, the proportion of female doctors and elderly doctors is increasing as in other countries. We investigated the relationship between doctors' demographic changes and their geographical distribution.
Study design: A national database study.
Methods: We assessed trends in unequal geographical distribution of the number of doctors by sex and age from 2004 to 2014 in Japan.
Results: The Gini coefficient values for the number of female doctors (0.18) were larger than those for male doctors across all generations (0.13–0.14). The Gini coefficient values for the number of elderly doctors aged 60 years and older (male: 0.12, female: 0.18–0.23) were larger than those for majority age groups aged 40–59 years (male: 0.10, female: 0.16–0.17).
Conclusion: The persisting geographical maldistribution of doctors may be associated with demographic changes, such as increase in the number of female doctors.

Introduction

Inequality in the national geographical distribution of doctors has been a persistent political concern in many countries.[1] However, past political efforts to increase the number of doctors have failed to sufficiently mitigate the maldistribution.[2] The situation is similar in Japan. Despite constantly increasing numbers of doctors, from 152,000 in 1980 to 256,000 in 2005, inequality in geographical distribution seems to have not improved during this period.[3]

Moreover, in recent years, two major global demographic changes of doctors have been observed that may have affected the geographical distribution of doctors. The first major change involves an increasing proportion of female doctors. The total proportion of female doctors in all Organisation for Economic Co-operation and Development (OECD) countries increased from 38% in 2000 to 45% in 2013.[4] While Japan has the lowest proportion of female doctors among the OECD countries, the proportion of female doctors has increased from 17% (44,628/270,371) in 2004 to 20% (63,504/311,205) in 2014. The other major demographic change involves the aging

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of the doctors themselves. In 29 OECD countries, the number of doctors aged 55 years and older increased from 21% in 2000 to 33% in 2013.[4] In Japan, the proportion of elderly doctors aged 60 years and older increased from 21% (57,191/270,371) in 2004 to 24% in 2014 (76,213/311,205). These demographic changes of doctors, along with other various incentives for choosing their place of work, may have contributed to the unequal geographical distribution of doctors in Japan.[5,6]

Therefore, it is important to evaluate the impact of this demographic change of doctors on geographical distribution. In this study, we examined the trend in geographical distribution of doctors, from 2004 to 2014, using a public database in Japan. Furthermore, we assessed the temporal change of the degree of geographical maldistribution of doctors using sex and age data and investigated the relationship between doctors' demographic changes and their geographical distribution. This study could contribute to policy implications of doctor distribution by sex and age.

Methods

Data sources

Data on the number of doctors were obtained from a publicly available nationwide government survey entitled 'a survey of doctors, dentists, and pharmacists.' The data were the latest available at the time of retrieval in October 2017. The Ministry of Health, Labour and Welfare of Japan conducts this survey biennially and includes data concerning doctors' work locations (municipalities), sex, age, and specialties. From this database, we extracted the demographic data of doctors at prefecture level, including the numbers of male and female doctors and their ages. The demographic sex data for doctors are published only at the prefecture level, while the data concerning age are published at both the prefecture and municipality levels. Therefore, we used the data compiled in 47 prefectures to evaluate the effects of both age and sex.

Furthermore, the population of each municipality was extracted from the publicly available database of the Basic Resident Register, and the number of doctors and the population of each municipality were tabulated for 344 secondary medical areas (SMAs) throughout Japan. SMAs are defined as medical administrative areas working under the Medical Care Law, in which each prefectural government is expected to provide general medical care supplies, such as hospital beds, for inpatients.[7]

To evaluate the trend in geographical maldistribution of doctors, we used the Gini coefficient, which has been most commonly used to measure inequality in the distribution of incomes. The Gini coefficient has also been widely used for the analysis of geographic distribution of doctors.[2] The Gini coefficient is derived from the Lorenz curve, which is based on a curve fitted to the cumulative proportion of doctors and that of the population for each region (Fig. S1 [see the supplementary material]). The Gini coefficient varies between 0 (complete equity) and 1 (complete inequity) according to the degree of variation in doctor-to-population ratios.

First, we determined the trends in the Gini coefficients of the number of doctors per population in SMAs during the study period. Second, using sex and age group data (younger than 40 years, between 40 years and 65 years, older than 65 years), the number of doctors in each prefecture was counted. The Gini coefficient concerning the number of doctors, using sex and age group per population data, was evaluated in the prefectures, as demographic data detailing doctors' age and sex were not available in the SMAs.

Results

During this survey period between 2004 and 2014, the population of Japan was between 127 and 128 million people. Meanwhile, the number of doctors has consistently increased, from 270,371 in 2004 to 311,205 in 2014, and the number of doctors per population of 100,000 has also increased, from 212 in 2004 to 245 in 2014. The number of female doctors increased, from 44,628 (17%) in 2004 to 63,504 (20%) in 2014. From 2004 to 2014, the number of doctors younger than 60 years increased from 213,180 (79%) to 234,992 (76%). On the other hand, the number of doctors older than 60 years increased from 57,191 (21%) to 76,213 (24%).

Among the 344 SMAs, the median number of doctors per population of 100,000 increased from 167 (range, 69–1295) in 2004 to 186 (range, 83–1409) in 2014. The minimum value of the Gini coefficient was 0.21 in 2006, and the maximum value was 0.22 in 2014 (Fig. S1).

Fig. 1 shows trends in the Gini coefficient concerning the number of doctors and the number of doctors per population from 47 prefectures, according to the subgroups of each sex and age group. The Gini coefficient values for the number of female doctors were higher than those for male doctors across all generations, and the Gini coefficient value for the number of male doctors during the study period ranged from 0.13 to 0.14, while that for female doctors was 0.18.

The Gini coefficient values for the number of elderly doctors aged 60 years and older (male: 0.12, female: 0.20–0.26) were larger than those for majority age groups aged 40–59 years (male: 0.10, female: 0.16–0.17). The Gini coefficient for elderly female doctors decreased from 0.26 in 2004 to 0.20 in 2014, while that for the other age groups did not change throughout the study period.

Discussion

This study clarified that the Gini coefficient for the number of doctors has not decreased in Japan, suggesting that the geographical maldistribution of doctors in Japan did not improve but worsened slightly over the 10-year study period despite the implementation of mitigation policies including the increase in the number of doctors. This result is consistent with past studies that have suggested that increasing the number of doctors might not be the straightforward solution to geographical maldistribution of medical resources.[1]

This study also suggests the sex and age difference in geographical distribution of doctors. First, in all generations, the Gini coefficients concerning the number of female

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