論　　文

Considerations Regarding Work System Reform in the Situation of Uneven Distribution of Doctors

By Tai TAKAHASHI *

Abstract

The number of younger doctors who put thought into their work-life balance is rapidly increasing due to the new clinical training program that started in 2004. As a result of this condition being left unsolved for more than 15 years, the uneven distribution of doctors and clinical departments has progressed. This research aims to clarify how the uneven distribution of doctors has progressed and to consider the effect of the work system reform for doctors planned to start in 2024, based on the results.

This research reveals changes in the composition of doctor groups of the past 20 years and computes the transitions in the number of doctors by gender, age group, clinical department, place of work, type of workplace (hospital/clinic) using individual form data of the "Survey of Physicians, Dentists and Pharmacists" between 1996 and 2016 and processing data to cope with changes in names of clinical departments or district division.

As a result, three facts have been brought out. First, the total number of doctors increased 33% from 1996 to 2016, however, the number of doctors under 40 years-old did not increase and this is mainly due to the increase in the number of doctors over 50. Secondly, younger doctors in their 30s tend not to work in depopulated areas. Thirdly, it is remarkable that younger male doctors are not likely to choose surgical departments.

The work system reform planned to start in 2024 will have an influence in mostly surgical and emergency doctors, as well as late-stage doctors-in-training working at university hospitals or local base hospitals. As foreseeable conditions resulting from the above, firstly, there will be a significant decrease in the number of medical institutions that accept patients during night time. Secondly, there will be significant extension in the waiting time for surgeries and examinations for cancer and others. Paradoxically, in order to avoid this situation, it is necessary to improve the work system reform, enhance the productivity on-site through digital transformation of medical care or development of the team structure, and to rapidly carry out reforms such as concentration of clinical departments in local areas, especially for surgical or emergency departments.

JEL Classification Codes: I11, I14, I18

Keywords: uneven distribution of doctors, chronological analysis, work system reform

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医師の偏在の実態から働き方改革を考える

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＜要旨＞

2004 年から始まった新臨床研修制度の影響でワークライフバランスを考える若手医師が急増した。この状態が 15 年以上放置された結果、医師の地域偏在と診療科偏在が進んだ。今回の研究の目的は、どのように医師偏在が進んだかを明らかにし、その結果を踏まえて 2024 年開始の医師の働き方改革の影響を考察することである。

本研究では、1996 年から 2016 年の「医師・歯科医師・薬剤師調査」の個票データを用い、診療科名称や地域区分の変更に対応するためのデータ加工を施すことにより、性別、年齢階級別、診療科別、勤務地域別、勤務場所（病院/診療所）別の医師数がどのように推移したかを算出し、過去 20 年の医師集団の構成の変化を明らかにした。

その結果、（１）1996 年から 2016 年にかけて総医師数は 33%増えているが、40 歳以下の医師は増えておらず、主に 50 歳以上の医師の増加による。（２）30 歳代の若手医師が過疎地での勤務を行わなくなってきていること、（３）若手男性医師が外科系の診療科を選択しなくなってきていることが顕著であること等が明らかになった。

2024 年度より始まる働き方改革で影響を受けるのは主に大学病院や地域の基幹病院で勤務する外科、救急、後期研修医である。その結果発生することが予測される事態は、（１）夜間診察してくれる医療機関の大幅な減少、（２）癌など手術や検査までの待ちの期間の大幅延長などである。この状態を回避するには、逆説的であるが、働き方改革は進めること、医療の DX 化やチーム制の推進などの現場での医療の生産性を高めること、地域における外科や救急の集約化などの改革を、外科と救急を中心に急速に進める必要がある。

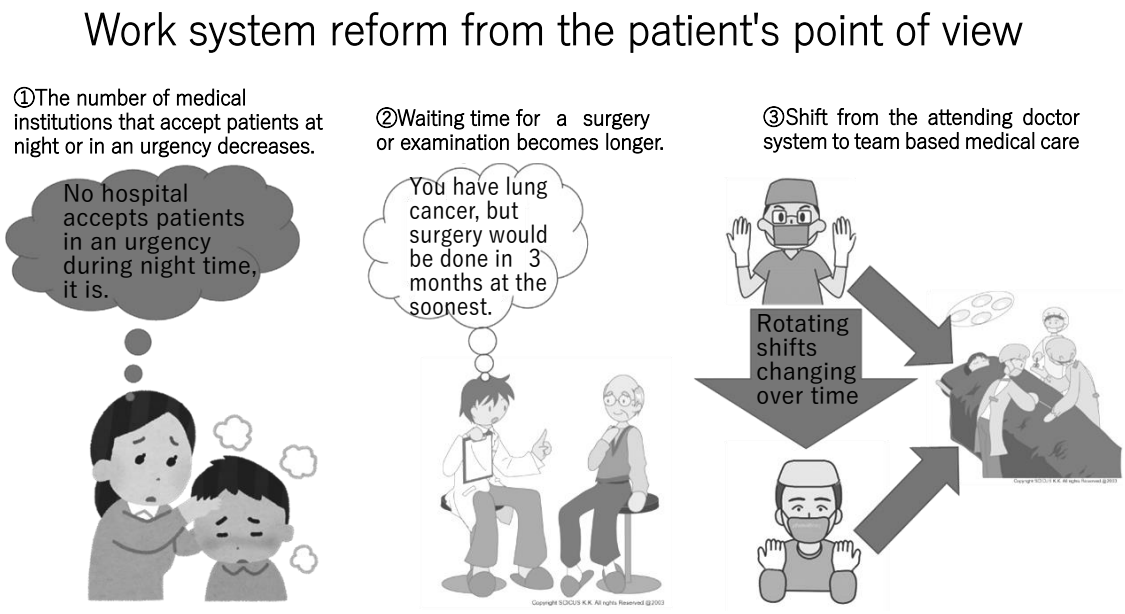
JEL Classification Codes：I11, I14, I18

Keywords：医師の偏在、時系列分析、働き方改革

1. Introduction

Work system reform for doctors, and the related local health care projects and reform regarding the uneven distribution of doctors, are, together, called the Three-part Reform Package. The uneven distribution of doctors and work system reform for doctors are matters that should be discussed at the same time. As part of the work system reform for doctors, an overtime regulation is going to be introduced in the year 2024, thus hospitals with surgical or emergency departments will be forced to change their medical care provision system. In addition, in some regions, this could mean a drastic reform that changes the way surgical and emergency doctors concentrate at one place as well as the medical care provision system itself. Without appropriate preparation toward the situation in 4 years, it should cause great confusion not only to hospitals undertaking acute medical care but also to patients receiving medical care, as shown on Figure 1. Despite this, the sense of danger at this impending crisis is barely shared among the medical community or government, a situation we find concerning.

Figure 1　Likely scenario when work system reform is enacted

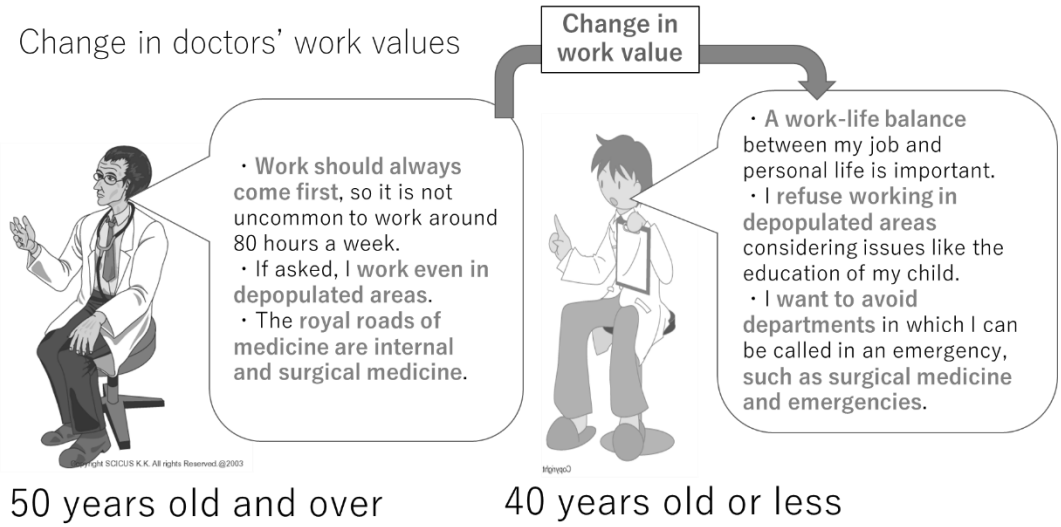


As background for the need for work system reform for doctors, there is a rapidly advancing change in doctors' work values. Most new doctors that pass the national examination undergo a graduate training program to become clinicians. A training style predominant before the beginning of this century was that in which a new doctor joins the medical office of a university right after the examination and undergoes a clinical training program (hereinafter, referred to as the "old clinical training") to become a medical specialist. As shown on the left side of Figure 2, most doctors who completed

their education at a university's medical office based on the old clinical training system, which values selflessness, are now over 50 years old and their work values dictate that: the royal roads of medicine are internal and surgical medicine, work should always come first and one should spend around 80 hours a week at the hospital. If asked, one must work in depopulated areas.

The state of clinical training has significantly changed since 2004, and a brand new clinical training system started, which enables trainees to experience a variety of clinical departments and medical situations. During early clinical training, the 9 AM to 5 PM training hours are to be strictly observed, and doctors under 40 started their first 2 years as doctors without the experiencing the past training that values selflessness, unlike doctors over 50. In addition to the difference of the first 2 years, a higher number of younger doctors consider that a work-life balance is important, as shown on the right side of Figure 2, reflecting how the values have changed with time.

Figure 2 Change in work values significantly affects the medical care provision system



When Hillary Clinton, who devoted herself to health insurance reform in the United States, visited Japan to inspect medical sites, she said that "the Japanese medical care system is maintained by the saint-like self-sacrifice of medical workers." In Japan, the 15 year span since 2004 has seen a decrease in the number of this "saint-like" doctors. There has been an increase in the number of doctors with the same work values as general workers.

Despite those radical changes in doctors' work ethics, doctors finishing clinical training could still choose the clinical department they wished and do consultations wherever they wished for 15 years. Consequently, the problem with the uneven distribution of doctors in regional areas and clinical departments worsened. Since this tendency should increase in the future, the background of the work system reform for doctors can be seen in the need to switch the Japanese medical care system from

being dependent on “saint-like” doctors to one adapted to the way general workers work, which can operate with doctors that hold value in a work-life balance.

This research aims to clarify how the uneven distribution of doctors occurred, predict what is going to happen if things are left as is by the time the work system reform kicks in on April 1st, 2024, and predict what kinds of situations could arise, proposing the necessary measures to suppress any potential damage as much as possible.

2. Previous studies and problem setting

I participated in this research project as a medical professional in the non-economic field. During discussions with economists regarding the uneven distribution of doctors, I was surprised to hear that "the decision on the department and place of work of doctors in Japan may be influenced by market trends." At least when I analyze the data of uneven distribution of Japanese doctors, there is no idea of "market" at all, and it seems that many Japanese doctors do not have the concept of "market" when choosing a clinical department or work location.

In economics, research is being conducted to analyze the behavior of doctors on the premise that the behavior of providers changes on the balance between supply and demand. Stano, M. (1987). States that doctors can stimulate demand only if individual doctors provide medical care exclusively, but unlikely in a typical competitive environment. There is. Sloan and Evans (1974) ethically require doctors to provide treatments that require patients, and as the number of doctors in the community increases, they tend not to increase per capita treatment and work hours shorter. is there. Conversely, if there is a shortage of doctors, there is a tendency to reduce the number of consultations. According to these previous studies, doctors in Western countries also show that market trends have little effect on the number of medical treatments and the density of medical treatments per treatment, but this tendency seems to be even stronger in Japan.

The individual data, taken from the *Survey of Physicians, Dentists and Pharmacists* (hereinafter referred to as the Sanshi survey) used in this study is not open to the public, and it is obtained with permission from the Minister of Health, Labour and Welfare after an application done in accordance to the regulations on Article 33 of the Statistics Act (Act No. 53 of 2007) and after a screening regarding handling of data from the Ministry of Health, Labour, and Welfare for a part of individual data of the Sanshi survey. In addition, since complex processing of the data shown on the problem setting frame of the empirical analysis is required in order to do a time series analysis, there is no study researching the transitions of the number of doctors by region, hospital/clinic, or clinical department, except for our research group.

The first problem setting of this research is clarifying how the uneven distribution of doctors in regional areas and clinical departments have advanced from 1996 to 2006 and then 2016 using the

data of the Sanshi survey. We show our method on the outline of data processing and the general condition of the uneven distribution of doctors is indicated in the Results section.

The second problem setting of this research is to figure out what is going to happen as consequence of the work system reform for doctors and what can be a countermeasure for that based on the results, and that is indicated in the Considerations section.

3. Framework of empirical analysis

3.1 Outline of the used data

The Sanshi survey used in this study clarifies distributions of doctors, dentists and pharmacists by gender, age group, function category, place of work, or name of clinical department as of December 31st of the surveyed year, and that is carried out once every 2 years in order to obtain base data for the administration of Ministry of Health, Labour and Welfare. Notification reports are handed in by doctors, dentists, or pharmacists as persons with notification obligation, compiled and submitted by public health centers to the Minister of Health, Labour and Welfare, and the results are published.

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3.2 Data processing for time series analysis

3.2.1 Grouping by clinical department of past data

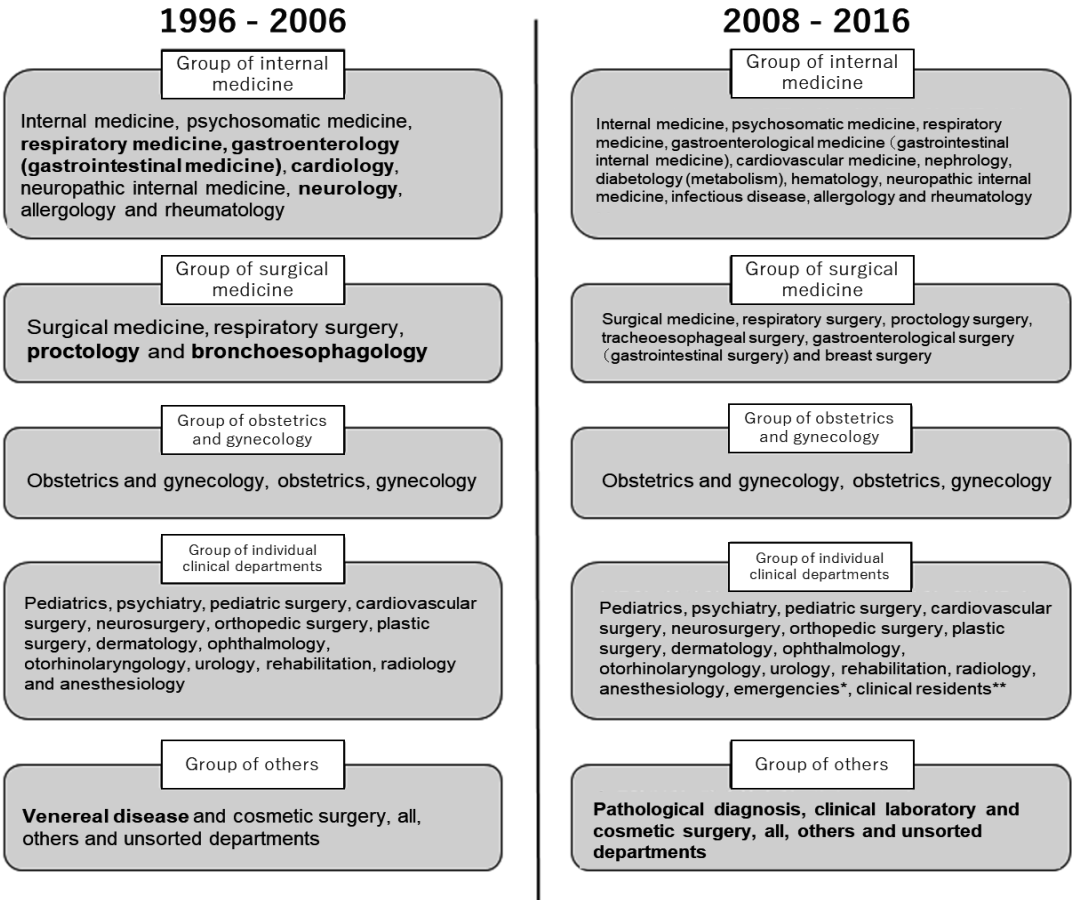
We here indicate how we processed the original data (information on research sheets of the Sanshi survey) in regards of examining the transition of the number of doctors by clinical department.

When examining the transition of the number of doctors by clinical department with use of the Sanshi survey, it is not problematic to find out how many doctors have ophthalmology as their main department between 1996 and 2016, whereas it is not possible to see the transition of the number of doctors having internal medicine as their main department in the same way since there are departments that doctors can select as their main area that don’t change year to year, like ophthalmology, while others may be added or deleted, like hematology, which was newly introduced in 2008. In fact, the professing method of clinical departments has significantly changed due to the revision of the 2008 Orders for Enforcement of Medical Care Act. Options of clinical departments in the Sanshi survey were accordingly modified and the group of internal medicine departments was rearranged

by adding, besides hematology, diabetology (metabolism department) and infectious disease and replacing pulmonology with respiratory medicine. The group of surgical departments was also substantially changed. Internal medicine has been kept as an option each year, however, if a doctor who had selected internal medicine since there was no option for hematology in 1996, selected hematology in 2008 or later, the number of doctors in internal medicine decreased in appearance, however, this is only due to changes in the survey system and not in the number of doctors.

In this research, when examining the transition of the number of doctors by clinical department, in order to analyze with as little influence from the changes in the survey system as possible, we set the general group of clinical departments present in all years (internal medicine, surgical medicine, obstetrics and gynecology, etc.) and see their transition as indicated on Figure 3. Also, departments thought to not have been influenced by name changes are kept the same as in the Sanshi survey.

Figure 3 Transition and grouping of the clinical departments subject to the survey



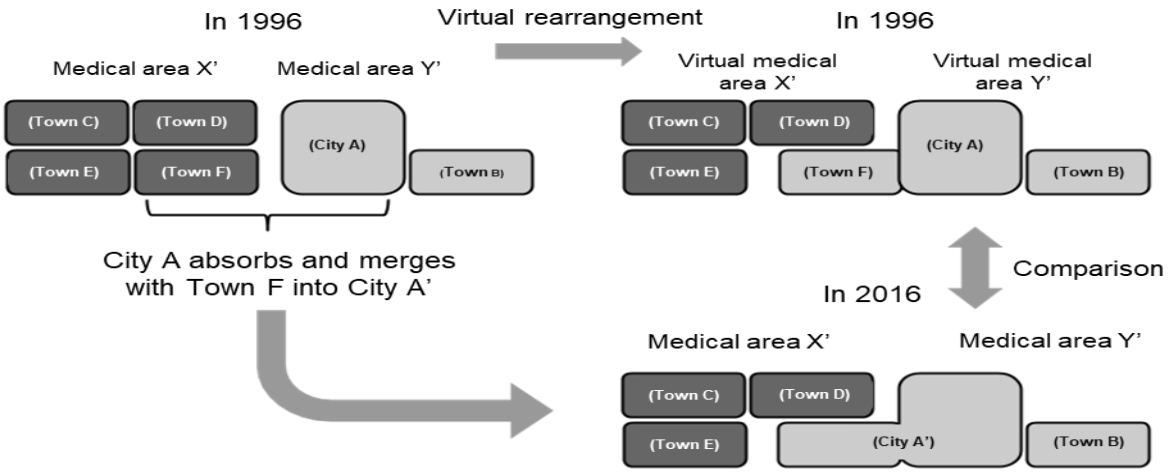
3.2.2 Upgrading past data to secondary medical areas

While it is not demanding to see the transition of the number of doctors in the past 20 years in the 47 prefectures, it is more difficult trying to see the same by secondary medical area in the past, since there were 344 areas in total as of 2016 that have been rearranged several times in the past.

The 347 secondary medical areas that existed in 1996 became 344 by 2016 through segmentation, combination, reclassification, etc. As a result, there were some secondary medical areas that did not exist as of 1996 such as Saitama (Saitama prefecture). In addition, Soya (Hokkaido prefecture) has existed since 1996, however, it was rearranged with a neighboring city of another medical area and it has a geographical border different to the current one. Therefore, the existence of past medical areas will not be informative to see the past transition of the secondary medical areas.

For this research, after fixing the 344 secondary medical areas set as of 2016 shown on Figure 4 as geographical borders, the number of doctors within those geographical borders in 1996 and 2006 based on the data of doctors of each city both in 1996 and 2006 is computed.

Figure 4 Schematic chart of virtual medical area setting in the past
(City A and town F were merged and the secondary medical area changed)



As of 1996, in city A, town B, C, D, E, and F, city A and town F correspond to city A' of 2016. Since city A' in 2016 belongs to medical area Y', city A and town F as of 1996 are considered as components of medical area Y', which has been virtually set at that time and should be compared to the collected results of the medical care area Y' of 2016.

While the number of cities that conform the second medical areas (designated cities are recorded by ward) was 3,376 in total in 1996, due to the influence of municipal mergers, the so-called great merger of Heisei, the number has decreased to 1,979 cities in 2006 and to 1,902 in 2016. By thor-

oughly investigating which cities the past ones belong to at the moment, one can figured out which geographical borders are the same for the past cities and the secondary medical areas as of 2016. In this study, based on the information on the abolition of cities, wards, towns and villages of the Statistics Bureau of the Ministry of Internal Affairs and Communications, a mapping table was created matching all the cities, wards, towns and villages as of 2016 for all the cities, wards, towns and villages in each target year of the Sanshi survey and the National Census. According to information on abolition, for example, Iwatsuki City in Saitama Prefecture as of 1996 merged with Saitama City in 2005, which was newly established in 2001 and became an ordinance-designated city in 2003, and since then it has become Iwatsuki Ward, Saitama City. In the actual data processing work, we prepared two tables, a city/ward/town/village mapping table for each target year based on information about abolitions, etc., and a secondary medical area-composite city/ward/town/village correspondence table as of 2016. The data for each target year of the Sanshi Survey and the National Census are tabulated by the corresponding secondary medical area as of 2016.

Furthermore, in this study, 344 secondary medical areas are classified into three types, 1) metropolitan type, 2) local city type, and 3) depopulated area type, based on the population and population density shown below.

1) Metropolitan type: (Population of 1 million or more)
or (population density is 2,000/km2 or more)
2) Local city type: (Population of 200,000 or more)
or (population of 100-200,000 and population density 200/km2 or more)
3) Depopulated area type: When not belonging to neither metropolitan nor local city type

3.3 Overview of data analysis

First, in order to clarify the number of doctors produced each year, the annual transition of the number of people who passed the national examination for medical practitioners was tabulated.

Next, in order to clarify how doctors as a group have changed over time, we used the time series data that had undergone the above pretreatment, and by gender and age group in 1996, 2006 and 2016. We then calculated the annual transition by regional characteristics (metropolitan cities, local cities and depopulated areas), work locations (hospitals/clinics), and clinical departments.

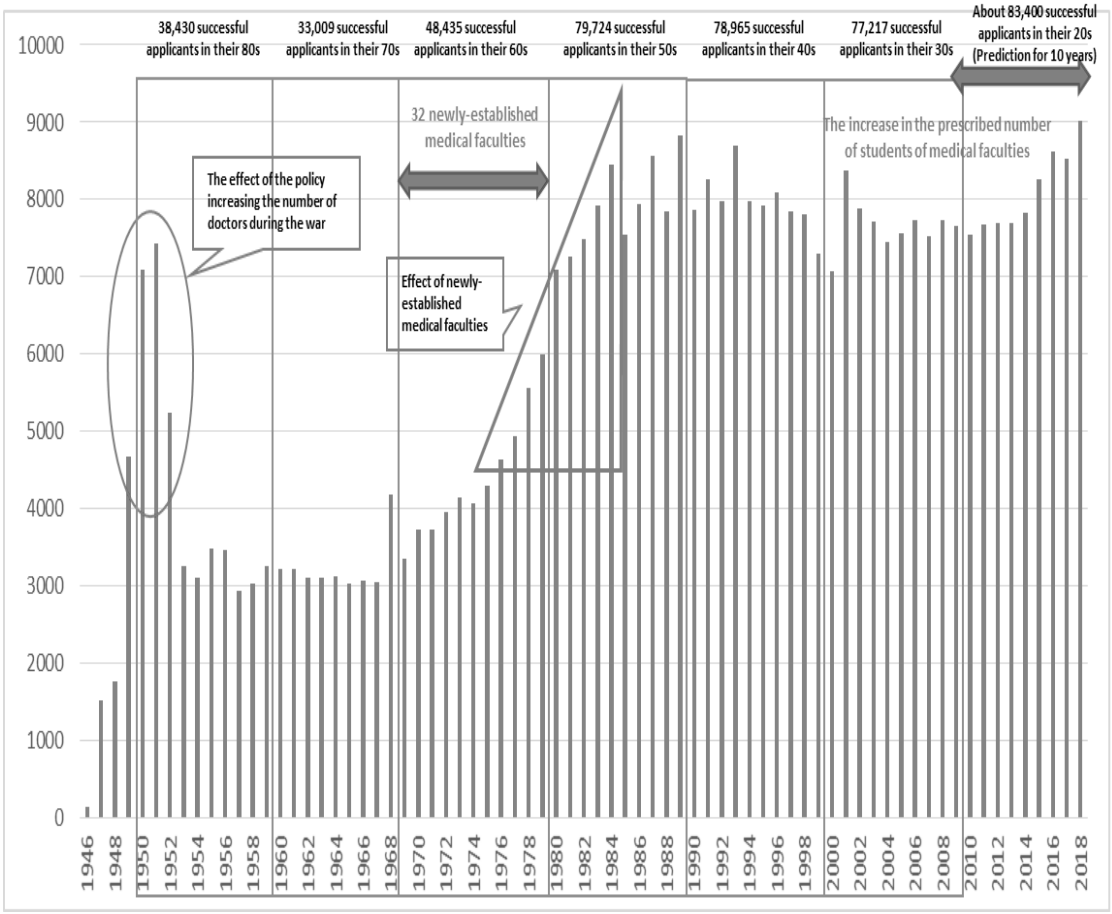
Furthermore, in order to clarify how the uneven distribution of doctors progressed, different tabulations were made by combining items that were considered to be closely related (e.g., work ratio in depopulated areas by gender and age group).

4. Results

4.1 Transition of people passing the national examination

As for the change in the number of doctors in Japan, the inflow and outflow of doctors from other countries is small, and it can be assumed that accordingly, a pattern in which those who passed the national examination for medical practitioners in one year joined the ranks of doctors, the number of retirements and deaths decrease, this remaining the same in the following years.

Figure 5 Transition of the number of people passing the national examination



Notes: Created by the author based on "Transition of Number of Passed National Examinations for Medical Practitioners" obtained from http://pediatrics.news.coocan.jp/kokushi.pdf

Figure 5 shows the annual changes in the number of people who passed the national examination for medical practitioners. From the 1946 national examination for medical practitioners to the 112th examination in 2018, 436,309 successful applicants were produced. From 1952 to 1974, doctors were produced every year at a pace of 3,000 to 4,000. Starting with the formation of new medical schools in Akita, Kyorin, Kitasato and Kawasaki Medical Schools in 1970 and ending in Ryukyu University

in 1979, 32 new medical faculties were established in the 1970s. From 1976, when the first graduate of a medical school established in 1970 graduated, to 1985, when the first graduates of a medical school established in 1979 graduated, the number of people who passed the national medical examination increased rapidly from 4,000 to 8,000. After that, during the 30 years from 1985 to 2015, the number was around 8,000 ± 500. After that, in 2009, the capacity of medical schools increased, and from 2018, when the results fully reflected this, with about 9,000 successful applicants produced.

4.2 Change over time of doctors as a group

4.2.1 Transition of the number of doctors by gender

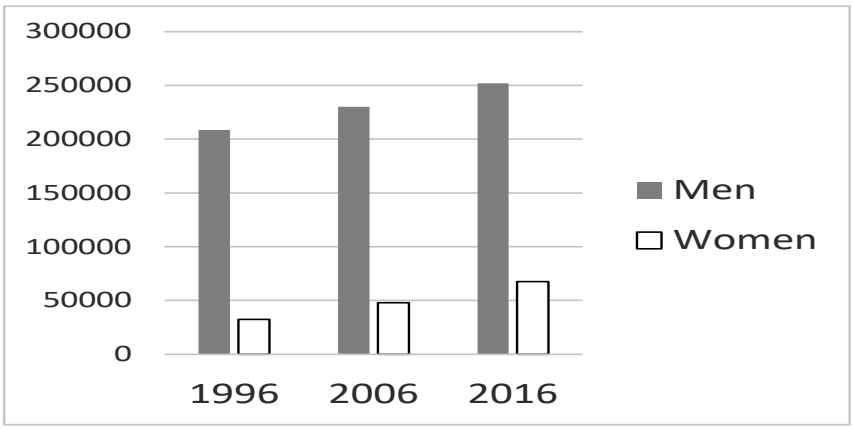
Figure 6 shows the time series transition of the number of doctors that reported to the Sanshi survey by gender (hereinafter referred to as for the number of reported doctors).

The number of reported doctors increased from 240,908 in 1996 to 277,927 in 2006, showing an increase of 15% during this period. It reached 319,480 in 2016, an increase of 15% and a 33% increase in the 20 years between 1996 and 2016.

Looking at the increase in doctors by gender, the number of male doctors increased by 21% from 208,649 in 1996 to 251,987 in 2016, while the number of female doctors increased from 32,259 to 67,493, showing a larger, 109% increase. As a result, the ratio of female doctors to the entire number of doctors increased from 13% in 1996 to 17% in 2006 and 21% in 2016.

Figure 6 Time series transition of gender/reported number of doctors

		1996	'96 -> '06 Rate of change	2006	'06 -> '16 Rate of change	2016	'96 -> '16 Rate of change
Nationwide	**Total**	**240,908**	**15%**	**277,927**	**15%**	**319,480**	**33%**
	Male	208,649	**10%**	229,998	**10%**	251,987	**21%**
	Female	32,259	**49%**	47,929	**41%**	67,493	**109%**
	% of female	13%		17%		21%	



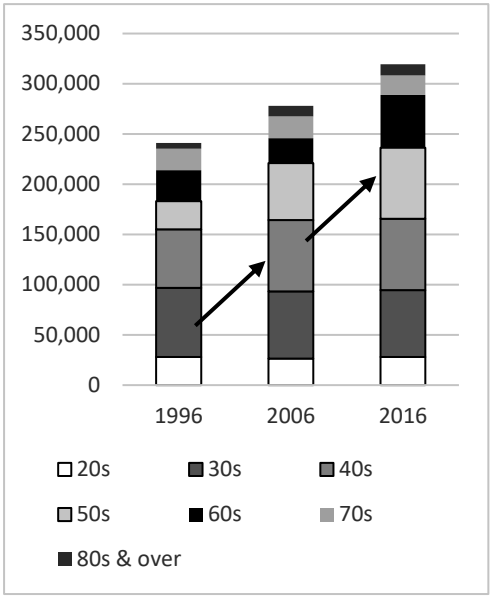
Notes: The author aggregates and processes the statistics of doctors, dentists, and pharmacists in 1996, 2006, and 2016.

4.2.2 Transition of the number of doctors by age group

Figure 7 shows the time series transition of the number of reported doctors by age group.

Figure 7 Transition of the number of reported doctors by age group

	1996	2006	2016	1996 -> 2016
Total	240,908	277,927	319,480	33%
20s	27,967	26,350	27,951	0%
30s	68,835	67,059	66,714	-3%
40s	58,346	70,795	70,873	21%
50s	27,993	56,603	70,728	153%
60s	30,910	24,931	52,537	70%
70s	21,391	21,792	19,241	-10%
80s & over	5,466	10,397	11,436	109%



Notes: The author aggregates and processes the statistics of doctors, dentists, and pharmacists in 1996, 2006, and 2016.

Looking at the changes in the number of doctors by age group, as shown in the rightmost column of Table 2, the number of doctors in their 20s showed no significant change; 27,967 to 27,951 from 1996 to 2016. However, the number of doctors in their 30s decreased by 3% from 68,835 to 66,714. On the other hand, the number of doctors in their 40s increased by 21% from 58,346 to 70,873, the number of doctors in their 50s increased by 153% from 27,993 to 70,728, and the number of doctors in their 60s showed a significant increase of 70% from 30,910 to 52,537. In addition, doctors in their 70s decreased by 10% from 21,391 to 19,421, while doctors in their 80s showed a significant increase of 109% from 5,466 to 11,436.

From 1996 to 2016, **the entire number of doctors increased by 33%**, but it was confirmed that **most of the increase in the number of doctors by age group was due to the increase in doctors in their 50s and 60s.**

As shown in Figure 7, the number of doctors in their 50s increased rapidly from 27,993 to 56,603 and then 70,728 from 1996 to 2016, probably because of the reasons below.

First, in 1996, the 50s group corresponded to the current 70s group, and as shown in Figure 1, they received medical education during the period when the medical school capacity was low, before the formation of new medical schools, and passed the national examination of that generation. This is because the number of people that passed was only 33,309.

From 1996 to 2006, the number of people in their 50s doubled from 27,993 to 56,603. In 1996, the 40s group corresponds to the current 60s group, and as shown on Figure 5, new medical schools were established. The number of people who passed the national examination of the relevant generation was 48,435, which was significantly higher than that of the generation 10 years older, this could be because they received medical education in an era when the number of medical students increased rapidly.

From 2006 to 2016, the number of people in their 50s increased dramatically from 56,603 to 70,728. In 1996, the number of people in their 30s corresponds to the current 50s group, and as shown on Figure 5, new medical schools were established. This is probably due to the fact that 79,724 people passed the national examination of the same generation and received their medical education when the increase in the number of medical students settled down.

In this way, the change in the number of doctors by age group is considered to be greatly affected by the change in the number of doctors in medical school. When studying future changes in the number of doctors, even if there isn't as much change due to the influence of the rush of newly established medical schools in the 1970s, the increase in the number of doctors after 2009, the retirement time of elderly doctors, maternity leave of female doctors, work system reform for doctors, and other changes in physicians' career paths will need to be considered.

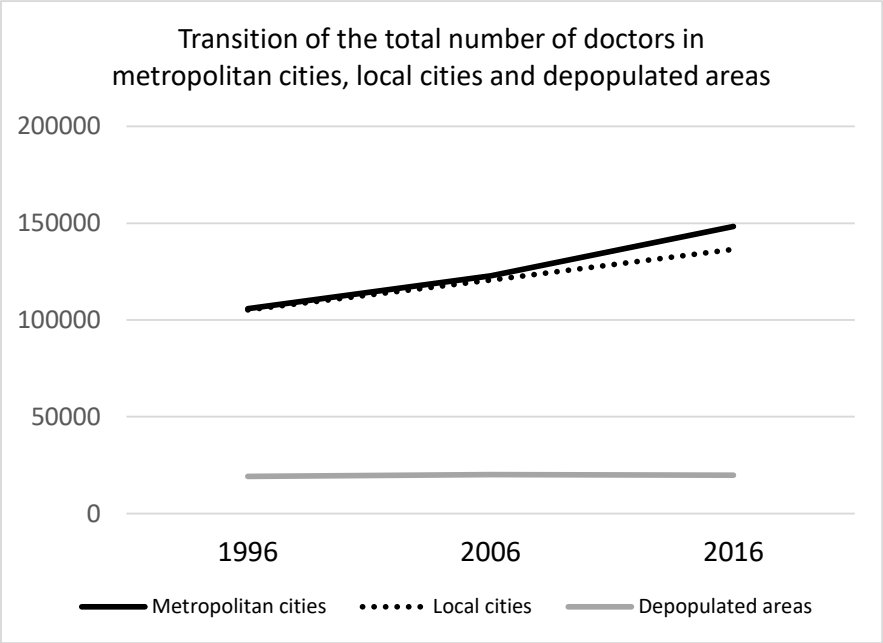
4.2.3 Transition of the number of doctors by regional characteristics (metropolitan cities, local cities and depopulated areas)

Figure 8 shows the time series transition of the number of doctors by regional characteristics (metropolitan cities, local cities, depopulated areas). From 1996 to 2016, the number of doctors increased by 33% nationwide. Comparing the rate of change by regional characteristics, it was 41% for metropolitan cities and 30% for local cities, while it was only 4% for depopulated areas.

Looking at the changes in gender and age group by regional characteristics, it is expected that the number of doctors in depopulated areas will decrease, the aging of doctors will progress rapidly in the future, and as such, urgent measures are considered to be necessary.

Figure 8 Transition of the number of doctors by metropolitan city, local city and depopulated area

Total number of doctors	1996		1996 -> 2006	2006		2006 -> 2016	2016		1996 -> 2016
District division	Total number of	Ratio	Rate of change	Total number of	Ratio	Rate of change	Total number of	Ratio	Rate of change
Nationwide	240,908	52%	15%	277,927	52%	15%	319,480	100%	33%
Metropolitan cities	111,080	46%	17%	130,061	47%	20%	156,252	49%	41%
Local cities	109,974	46%	15%	126,906	46%	12%	142,551	45%	30%
Depopulated areas	19,854	8%	6%	20,960	8%	-1%	20,677	6%	4%



Notes: The author aggregates and processes the statistics of doctors, dentists, and pharmacists in 1996, 2006, and 2016.

4.2.4 Transition of the number of doctors by place of work (hospitals/clinics)

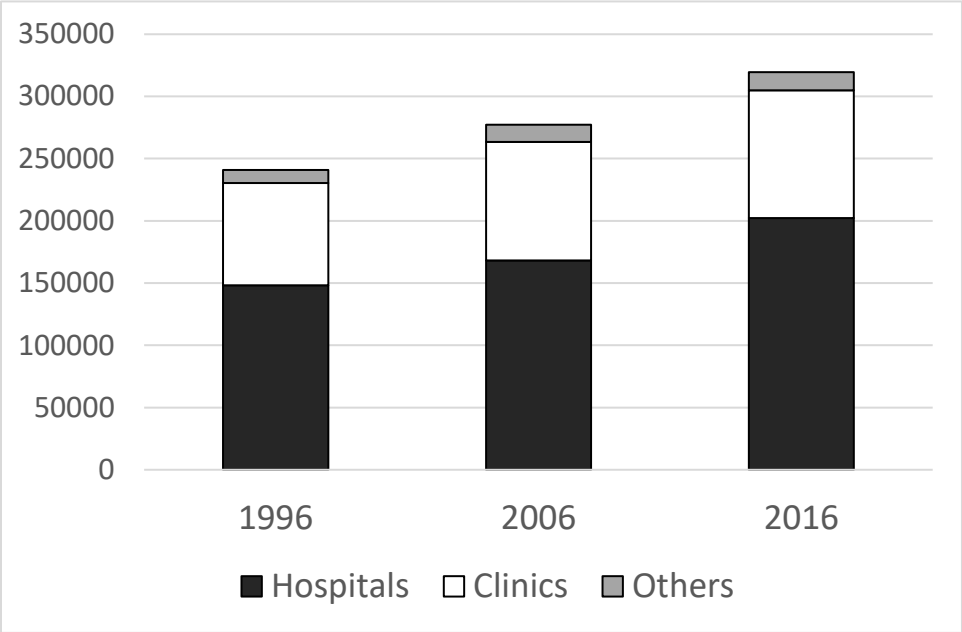
Figure 9 shows the time series transition of the number of registered doctors by place of work.

The number of doctors working in hospitals was 148,199 in 1996, which represents 62% of the reported doctors in 1996. From 1996 to 2006, the number of doctors working in hospitals increased by 14% to 168,327, which represents 61% of the doctors. From 2006 to 2016, the number of doctors working in hospitals increased by two tenths to 202,302, representing 63% of the doctors.

In this way, looking at the number of hospital doctors and clinic doctors, both seem to have increased steadily over the past 20 years, but comparing the transition of the number of hospital and clinic doctors by age group shown in the comparison of hospitals and clinics, with that of clinic doctors, the number of clinic doctors in the future, which cannot be read from Figure 4, may decrease, especially in depopulated areas.

Figure 9 Transition of the number of doctors by place of work

Year	1996		'96 -> '06 Rate of increase	2006		'06 -> '16 Rate of increase	2016	
	Number of doctors	Component ratio		Number of doctors	Component ratio		Number of doctors	Component ratio
Total number of doctors	240,908	100%	15%	277,927	100%	15%	319,480	100%
Hospital doctors	148,199	62%	14%	168,327	61%	20%	202,302	63%
Clinic doctors	82,098	34%	16%	95,213	34%	8%	102,457	32%
Others	10,611	4%	36%	14,387	5%	2%	14,721	5%



Notes: The author aggregates and processes the statistics of doctors, dentists, and pharmacists in 1996, 2006, and 2016.

4.2.5 Transition of the number of clinicians by clinical department

Table1 shows the transition of the number of clinicians by clinical department from 1996 to 2016.

From 1996 to 2006, the entire number of doctors (clinicians) increased by 33,243 (14.4%) from 230,297 to 263,540, while the entire number of surgeries decreased by 10.9% from 26,070 to 23,224. The entire number of departments of obstetrics and gynecology decreased by 5.1% from 12,422 to 11,783. Otorhinolaryngology was almost flat at 0.8%, general internal medicine increased by 6.0%, pediatrics increased slightly by 6.7%, and other clinical departments increased by more than 10%. In particular, plastic surgery and rehabilitation increased sharply by 46.1% and 105.2% respectively.

From 2006 to 2016, the entire number of doctors (clinicians) increased by 41,219 (15. 6%) from 263,540 to 304,759. During this period, the number of doctors increased in all clinical departments. While the entire number of surgeries increased slightly by 3.7%, 6.3% for ophthalmology, and 4.1% for otorhinolaryngology, the number of emergencies increased remarkably by 91.0%.

Table1 Transition of the number of clinicians by clinical department

Classification of clinical departments	Total number								
	1996	1996 -> 2006		2006	2006 -> 2016		2016	1996 -> 2016	
		Transition	Rate of change		Transition	Rate of change		Transition	Rate of change
Entire number of doctors	230,297	33,243	14.4%	263,540	41,219	15.6%	304,759	74,462	32.3%
Internal medicine departments	94,495	5,702	6.0%	100,197	13,491	13.5%	113,688	19,193	20.3%
Pediatrics	13,781	919	6.7%	14,700	2,237	15.2%	16,937	3,156	22.9%
Psychiatry	10,093	2,381	23.6%	12,474	3,135	25.1%	15,609	5,516	54.7%
Surgical medicine departments	**26,070**	**-2846**	**-10.9%**	**23,224**	849	3.7%	**24,073**	-1997	**-7.7%**
Pediatric surgery	554	107	19.3%	661	141	21.3%	802	248	44.8%
Cardiovascular surgery	2,027	558	27.5%	2,585	552	21.4%	3,137	1,110	54.8%
Neurosurgery	5,634	607	10.8%	6,241	1,119	17.9%	7,360	1,726	30.6%
Orthopedic surgery	16,423	2,447	14.9%	18,870	2,423	12.8%	21,293	4,870	29.7%
Plastic surgery	1,307	602	46.1%	1,909	684	35.8%	2,593	1,286	98.4%
Dermatology	6,796	1,049	15.4%	7,845	1,257	16.0%	9,102	2,306	33.9%
Ophthalmology	10,982	1,380	12.6%	12,362	782	6.3%	13,144	2,162	19.7%
Otorhinolaryngology	8,834	75	0.8%	8,909	363	4.1%	9,272	438	5.0%
Urology	5,174	959	18.5%	6,133	929	15.1%	7,062	1,888	36.5%
Obstetrics and gynecology	**12,422**	-639	**-5.1%**	**11,783**	1,371	11.6%	13,154	732	5.9%
Rehabilitation	**904**	951	**105.2%**	**1,855**	629	33.9%	**2,484**	1,580	**174.8%**
Radiology	4,192	691	16.5%	4,883	1,704	34.9%	6,587	2,395	57.1%
Anesthesiology	5,046	1,163	23.0%	6,209	2,953	47.6%	9,162	4,116	81.6%
Emergencies	0	1,698	-	1,698	1,546	91.0%	3,244	3,244	-
Clinical residents	0	14,402	-	14,402	2,299	16.0%	16,701	16,701	-
Others	5,563	1,037	18.6%	6,600	2,755	41.7%	9,355	3,792	68.2%

Notes: The author aggregates and processes the statistics of doctors, dentists, and pharmacists in 1996, 2006, and 2016.

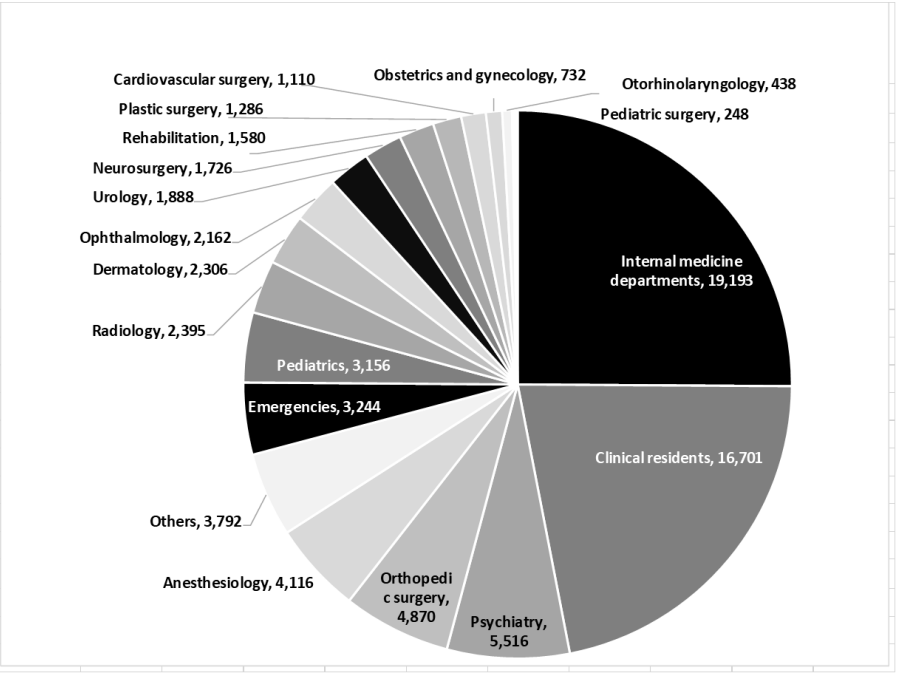
Looking at the transition from 1996 to 2016, it increased in most clinical departments, but only the entire number of surgeries decreased to 7.7%. Rehabilitation, plastic surgery, anesthesiology, other departments, radiology, cardiovascular surgery and psychiatry increased significantly, with oto-rhinolaryngology by 5.0% and obstetrics and gynecology by 5.9%.

From 1996 to 2016, there was an increase of 74,462 clinicians and the entire number in surgery decreased by 1,997, with other departments increasing by 76,459. Figure 10 shows the breakdown of the composition ratio of the increase in doctors by clinical department from 1996 to 2006. Internal

medicine has increased by 19,193 over the last 20 years, covering 25.1% of the increase in the number of doctors. The number of clinical residents increased by 16,701 (21.8%), psychiatry by 5,516 (7.2%), orthopedics by 4,116 (6.4%), and anesthesiology by 4,116 (5.4%). It accounts for two-thirds of the increase in doctors during the period. As shown on Table 1, the rate of increase in the rehabilitation and emergency departments is very high, but the actual numeric increase is not large.

Figure 10 Composition comparison of the clinical departments with increases in the number of doctors from 1996 to 2016

	1996 -> 2016 Rate of change	Component ratio
Entire number of doctors	74,462	
Internal medicine departments	19,193	25.1%
Clinical residents	16,701	21.8%
Psychiatry	5,516	7.2%
Orthopedic surgery	4,870	6.4%
Anesthesiology	4,116	5.4%
Others	3,792	5.0%
Emergencies	3,244	4.2%
Pediatrics	3,156	4.1%
Radiology	2,395	3.1%
Dermatology	2,306	3.0%
Ophthalmology	2,162	2.8%
Urology	1,888	2.5%
Neurosurgery	1,726	2.3%
Rehabilitation	1,580	2.1%
Plastic surgery	1,286	1.7%
Cardiovascular surgery	1,110	1.5%
Obstetrics and gynecology	732	1.0%
Otorhinolaryngology	438	0.6%
Pediatric surgery	248	0.3%
Surgical medicine	-1,997	



Notes: The author aggregates and processes the statistics of doctors, dentists, and pharmacists in 1996, 2006, and 2016.

4.3 Changes over time thought to be greatly related to the uneven distribution of doctors

Several doctors who have passed the national examination choose their major clinical department after completing postgraduate clinical training in their 20s, and when they are in their 30s, they perform clinical practice in their specialized, and then continue with clinical activities for a number of decades. Accordingly, the clinical department and work location the group in their 30s chose will have a great influence on the future medical care provision system.

In this section, in order to investigate the causes of uneven distribution of doctors and clinical departments, the transition of the number of doctors, mainly in the 30s bracket, by gender, age group, region (metropolitan city/local city/depopulated area), work location (hospital/clinic), and clinical department will be discussed.

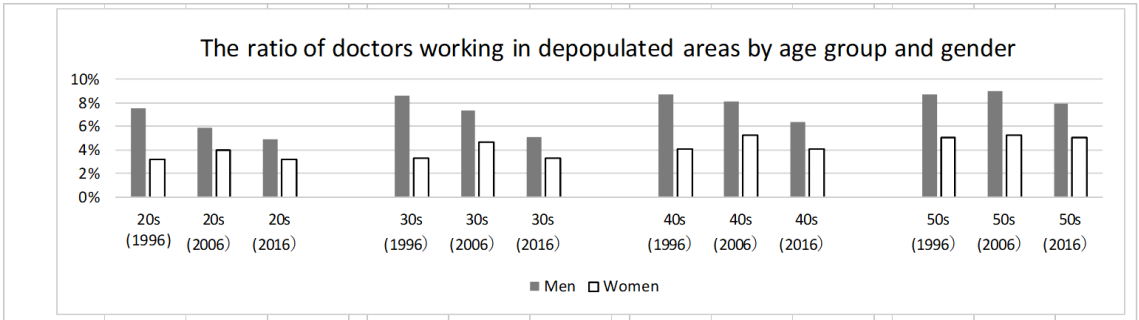
4.3.1 Transition of work ratios by gender and age group in depopulated areas and metropolitan cities

Figure 11 shows changes in the work ratio in depopulated areas by gender and age group. This figure shows, for example, that in 1996, 8% of male doctors and 3% of female doctors in their 20s worked in depopulated areas. From this figure, it is implied that:

1) From 1996 to 2016, the ratio of women working in depopulated areas is consistently lower than that of men.
2) In recent years, the ratio of new male doctors working in depopulated areas has declined sharply.

The number of new doctors in depopulated areas is rapidly decreasing due to the increase in the number of female doctors who originally have a low working ratio in depopulated areas and the rapid decline in the ratio of a new male doctors working in depopulated areas.

Figure 11 Transition of work ratios by gender and age group in depopulated areas



	20s (1996)	20s (2006)	20s (2016)	30s (1996)	30s (2006)	30s (2016)	40s (1996)	40s (2006)	40s (2016)	50s (1996)	50s (2006)	50s (2016)
Men	8%	6%	5%	9%	7%	5%	9%	8%	6%	9%	9%	8%
Women	3%	4%	3%	3%	5%	3%	4%	5%	4%	5%	5%	5%

Notes: The author aggregates and processes the statistics of doctors, dentists, and pharmacists in 1996, 2006, and 2016.

4.3.2 Transition of hospital and clinic work ratios by gender and age group

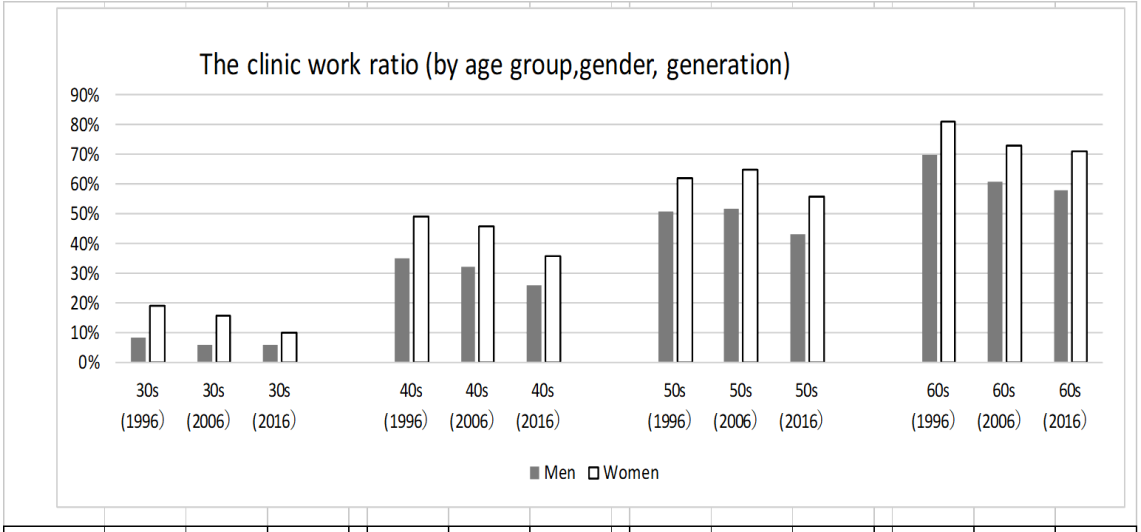
Figure 12 shows the changes in the clinic work ratio by gender, which is thought to have a significant influence on the hospital/clinic work ratio. This figure indicates:

1) The ratio of women working in clinics is higher than that of men regardless of the time of the survey or age.
2) Except for 52% of men and 65% of women in their 50s in 2006 due to the temporary private practice boom from 1996 to 2006, the ratio of clinic work is declining for both men and women. In particular, from 2006 to 2016, the rate of decline in women in their 30s, men and women in their 40s and 50s was large, and it seems that the tendency of new doctors to start their own practice is lower than before.

Although there are regional differences, the private practice boom in the mid-2000s has subsided,

and new doctors are becoming more likely to choose to work in hospitals in the city. If new doctors continue not to choose to open practices in local cities and depopulated areas, it would represent a major hindrance to maintaining both community health care and comprehensive community care in 10 years due to the aging and decline in number of private practitioners.

Figure 12 Transition of the clinic work ratio by gender and age group



	30s (1996)	30s (2006)	30s (2016)	40s (1996)	40s (2006)	40s (2016)	50s (1996)	50s (2006)	50s (2016)	60s (1996)	60s (2006)	60s (2016)
Men	9%	6%	6%	35%	32%	26%	51%	52%	43%	70%	61%	58%
Women	19%	16%	10%	49%	46%	36%	62%	65%	56%	81%	73%	71%

Notes: The author aggregates and processes the statistics of doctors, dentists, and pharmacists in 1996, 2006, and 2016.

4.3.3 Transition in the number of clinicians by clinical department in doctors in their 30s

Figure 13 shows the number of doctors by department and gender in their 30s in 1996 and 2016. The number of clinicians decreased by 2% from 66,307 in 1996 to 64,878 in 2016. The number of men decreased by 21% from 56,653 in 1996 to 44,523 in 2016. On the other hand, it should be noted that the number of women increased by 111% from 9,654 in 1996 to 20,355 in 2016. There are different possible reasons why the entire number is declining, but one is that while the number of female doctors increases, the number of clinicians is decreasing due to maternity and childcare leave.

From 1996 to 2016, the clinical departments that greatly exceeded the decrease rate (21%) of all male doctors were surgery, neurosurgery, ophthalmology, otorhinolaryngology, obstetrics and gynecology, and rehabilitation. On the other hand, the departments that have increased significantly beyond the overall growth rate of female doctors (111%) are surgery, pediatric surgery, cardiovascular surgery, neurosurgery, plastic surgery, urology, obstetrics and gynecology, anesthesiology, and others.

Figure 13 Comparison by clinical department and gender of the number of doctors in their 30s in 1996 and 2016

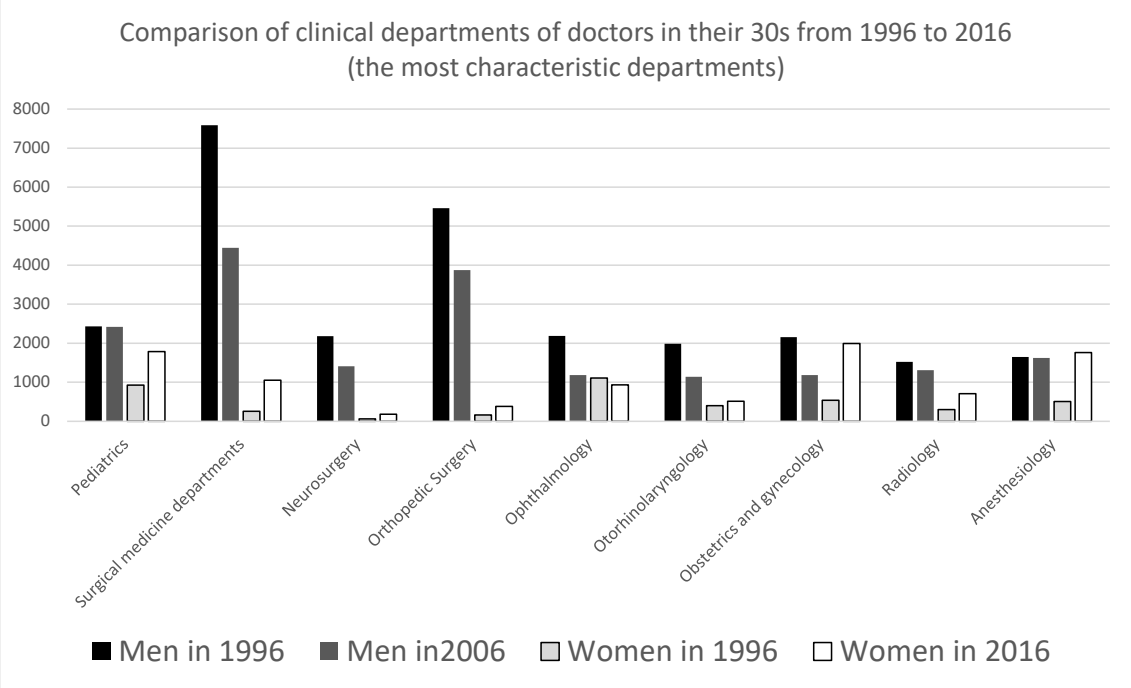
	Total					Male					Female				
	1996		2016		'96 -> '16	1996		2016		'96 -> '16	1996		2016		'96 -> '16
	Number of doctors	Ratio	Number of doctors	Ratio	Rate of change	Number of doctors	Ratio	Number of doctors	Ratio	Rate of change	Number of doctors	Ratio	Number of doctors	Ratio	Rate of change
Entire number of doctors	66,307	100%	64,878	100%	-2%	56,653	100%	44,523	100%	-21%	9,654	100%	20,355	100%	111%
Internal medicine departments	24,365	37%	22,471	35%	-8%	20,717	37%	16,065	36%	-22%	3,648	38%	6,406	31%	76%
Pediatrics	3,354	5%	4,204	6%	25%	2,431	4%	2,421	5%	0%	923	10%	1,783	9%	93%
Psychiatry	3,221	5%	3,101	5%	-4%	2,594	5%	2,075	5%	-20%	627	6%	1,026	5%	64%
Surgical medicine departments	7,843	12%	5,495	8%	-30%	7,586	13%	4,442	10%	-41%	257	3%	1,053	5%	310%
Pediatric Surgery	177	0%	290	0%	64%	152	0%	208	0%	37%	25	0%	82	0%	228%
Cardiovascular Surgery	933	1%	962	1%	3%	916	2%	858	2%	-6%	17	0%	104	1%	512%
Neurosurgery	2,239	3%	1,593	2%	-29%	2,181	4%	1,411	3%	-35%	58	1%	182	1%	214%
Orthopedic Surgery	5,618	8%	4,251	7%	-24%	5,460	10%	3,873	9%	-29%	158	2%	378	2%	139%
Plastic Surgery	645	1%	944	1%	46%	554	1%	542	1%	-2%	91	1%	402	2%	342%
Dermatology	1,849	3%	1,918	3%	4%	1,158	2%	642	1%	-45%	691	7%	1,276	6%	85%
Ophthalmology	3,295	5%	2,116	3%	-36%	2,188	4%	1,186	3%	-46%	1,107	11%	930	5%	-16%
Otorhinolaryngology	2,387	4%	1,651	3%	-31%	1,987	4%	1,140	3%	-43%	400	4%	511	3%	28%
Urology	1,935	3%	1,528	2%	-21%	1,886	3%	1,340	3%	-29%	49	1%	188	1%	284%
Obstetrics and gynecology	2,697	4%	3,170	5%	18%	2,158	4%	1,181	3%	-45%	539	6%	1,989	10%	269%
Rehabilitation	327	0%	320	0%	-2%	260	0%	159	0%	-39%	67	1%	161	1%	140%
Radiology	1,822	3%	2,018	3%	11%	1,523	3%	1,311	3%	-14%	299	3%	707	3%	136%
Anesthesiology	2,154	3%	3,376	5%	57%	1,648	3%	1,619	4%	-2%	506	5%	1,757	9%	247%
Emergencies	0	0%	1,403	2%		0	0%	1,181	3%		0	0%	222	1%	
Clinical residents	0	0%	2,238	3%		0	0%	1,714	4%		0	0%	524	3%	
Others	1,446	2%	1,829	3%	26%	1,254	2%	1,155	3%	-8%	192	2%	674	3%	251%

Notes: The author aggregates and processes the statistics of doctors, dentists, and pharmacists in 1996, 2006, and 2016.

Figure 14 shows changes in the number of doctors by extracting clinical departments that are likely to have a significant influence on the future medical care provision system. For example, the entire number of pediatricians in their 30s increased by 25% between 1996 and 2016, due to the increase in female pediatricians. Within the entire number for surgery (entire number of doctors who elect surgery, breast surgery, gastroenterological surgery (gastrointestinal internal surgery), proctology tracheoesophageal surgery and respiratory surgery), neurosurgery and orthopedic surgery, male doctors have decreased significantly and the number of female doctors has increased by a factor of two to three, but it has not compensated for the decrease in male doctors. The number of ophthalmologists and otorhinolaryngologists in their 30s decreased by 36% and 31% overall, but the decrease of male doctors was particularly remarkable. Obstetrics and gynecology and radiology are increasing overall, but it is a result of the increase in female doctors, which outweighs the significant decrease

in male doctors. In the anesthesiology department, the number of men decreased by 2%. On the other hand, the number of female doctors increased by 247%, and the number of female doctors exceeded the number of male doctors in their 30s.

Figure 14 Transition of the number of doctors in their 30s by clinical department and gender (extract of the most characteristic departments)



Notes: The author aggregates and processes the statistics of doctors, dentists, and pharmacists in 1996, 2006, and 2016.

Finally, we here indicate the emergency department, which is one of the focal points of work style reform. The emergency department is a clinical department newly established by the change of the specialty clinical department in the 2006 Sanshi survey. Prior to that, the emergency center was run by a team of doctors dispatched from general surgery, neurosurgery, cardiology, anesthesiology, etc. In the Sanshi survey, it is presumed that doctors simply chose their clinical department to which they belong as their specialty. Due to the change of the specialties in 2006, 1,698 doctors chose the emergency department as their specialty. After that, young doctors who completed clinical training began to enter the critical care center directly, and in 2016 the number of doctors specialized in the emergency department increased to 3,244, an increase of 1,546 (increased by 91%) compared to 2006. Although the rate of increase is high, considering the average working hours of emergency doctors, the number of emergency doctors is still far from the required number, and the emergency department is expected to be greatly affected by the work style reform described in the section of considerations.

5. Considerations

5.1 Digest of the results

From 1996 to 2016, the number of doctors increased by more than 30%, the rate of increase of female doctors is especially high, and by age group, doctors in their 50s and 60s increased by 80%. Due to this, the general increase of new doctors is limited. By regional characteristics, the number of doctors is increasing in metropolitan cities and local cities because new doctors dislike working in depopulated areas, while the number of doctors is hardly increasing in depopulated areas. By place of work, new doctors are less likely to open practices, and as a result, the rate of increase is slightly higher in hospitals than in clinics.

The number of a new doctors (in their 30s) decreased by 2% from 66,307 in 1996 to 64,878 in 2016, and breaking this down, male doctors decreased by 21% from 56,653 in 1996 to 44,523 in 2016, while the number of female doctors increased by 111% from 9,654 in 1996 to 20,355 in 2016.

From the perspective of regional characteristics, the ratio of female doctors working in depopulated areas is lower than that of male doctors, and the ratio of work in metropolitan cities is high. In addition, the ratio of work in clinics is higher than that of male doctors, but the ratio tends to decrease as years go by. The number of female doctors who choose surgical departments is increasing rapidly, but the selection ratio for surgical departments is lower than that of men. The increase in the number of female doctors who choose depopulated areas and surgical departments, and the decrease in the ratio of a new male doctors who choose depopulated areas and surgical departments in recent years seems to be contributing to the uneven distribution in the different regions and clinical departments.

From the perspective of uneven distribution of clinical departments, it has become clear that surgery is in the most critical situation. The number in other departments increased from 1996 to 2016, but that of surgery alone decreased by 1,997 (-7.7%). Although the number of female surgeons is on the rise, it has not been able to make up for the decline in new male surgeons. Looking at the characteristics of surgeons by region, they started to increase in metropolitan cities and local cities from 2006 to 2016, but continued to decrease in depopulated areas, decreasing by more than 25% in 20 years.

The next department to watch out for is obstetrics and gynecology. From 1996 to 2006, it showed a large decrease nationwide, but from 2006 to 2016, it recovered significantly in large cities and showed increase in local cities as well. However, the number in depopulated areas continues to decrease, showing that obstetrics and gynecology continues to concentrate.

Otorhinolaryngology is on the rise nationwide, but it has declined in metropolitan cities and depopulated areas from 1996 to 2006, and depopulated areas equally declined from 2006 to 2016. 11% in 20 years.

On the other hand, psychiatry increased by 5,516 (54.7%) and anesthesiology increased by 4,116

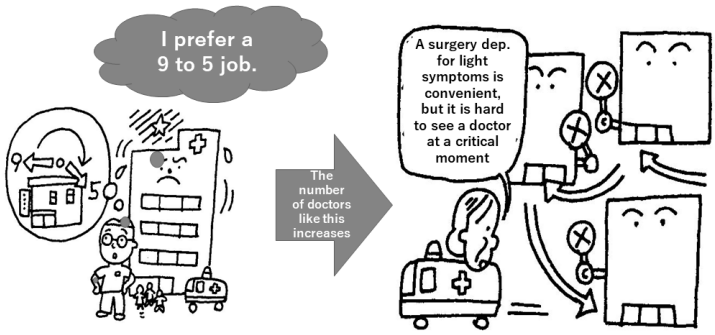
(81.6%), especially in large city areas. Internal medicine, which accounts for the largest proportion of clinicians, increased by 19,193 (20.2%) from 1996 to 2006, while depopulated areas decreased by 235 (-2.7%).

The number of emergency departments newly established in 2006 has a high rate of increase from 2006 to 2016, and the number of doctors aiming to become emergency doctors directly after graduation is increasing, but the number is still less than required.

5.2 The direction medicine in Japan is headed due to clinical department choice and uneven distribution

For the past 15 years, in Japan, no drastic measures have been taken against the problems of uneven distribution of clinical departments and doctors, and the situation has been close to a state of neglect. During this period, doctors' views on labor have changed rapidly, and as shown on the left of figure 16, the number of younger generation doctors who desire a 9 to 5 consultation schedule without nightshifts is steadily increasing. The reason why this problem has not become apparent is that doctors over 50, of the former clinical training generation, have continued to support surgical and medical care in depopulated areas. However, all of the old clinical training generation will be over 60 in 2030, the retirement of this generation will be very noticeable, and the new clinical training generation will be responsible for the medical care provision system in Japan. As a result, as shown on figure 16, visiting clinics for mild cases in large cities will become convenient, but the number of surgeons to operate in cancer cases or doctors working the ER that will tend to sudden heart attacks and strokes is decreasing, turning medical care in Japan in a direction in which a doctor may not be available to see someone at a crucial, life or death moment. In addition, the number of doctors who work in depopulated areas will decrease sharply in the future, and it will be difficult for medical care in these areas to continue.

Figure 16 The direction medical care in Japan is currently headed



5.3 Work system reform and the uneven distribution of doctors

5.3.1 Work system reform is necessary to change the shape of surgery and emergency medical care into something sustainable

According to the work system reform to be implemented from April 2024, the maximum number of overtime hours for doctors is to be 960 hours a year and 1,860 a year in some cases. A special case of 2 standards. Based on a 40 hours work week, the maximum of 960 hours per year is 58 hours per week, and the maximum of 1860 hours per year is 75 hours per week.

According to the 100,000 Doctors Survey conducted in 2016, which is often used as a base document for work system reform, the recovery rate is expected to be as low as 15.7%, but 40% of hospital doctors work more than 58 hours a week and a tenth exceeds 75 hours a week. Medical institutions with doctors who work more than 75 hours a week account for about 30% of all hospitals, about 90% of university hospitals, and 30% of hospitals with emergency functions (80% of hospitals with critical care centers). In terms of weekly average working hours by clinical department, emergencies, (55.9 hours), surgery (54.7 hours), and clinical residence (53.8 hours) were the top three. Based on the above, doctors affected by the work system reform will concentrate in certain types of hospitals such as universities and regional core hospitals, so it is very important to recognize that particularly emergency medical care, surgery, and residence will be greatly affected by this reform.

On the other hand, looking at the overtime rules from a different angle, this means that doctors not doing more than 58 hours overtime a week do not need to change their working style. According to a survey by the Ministry of Health, Labour and Welfare, on the shortage of working doctors and working styles in 2019, 8.9% of doctors work more than 50 hours overtime per month (equivalent to working 52 hours a week). The proportion of doctors subject to the work system reform is by no means high. What is surprisingly important in advancing the work system reform is to recognize that for doctors in many hospitals and clinical departments, it will have little direct effect.

5.3.2 What will happen if there is a work style reform for doctors?

1) A decrease in the number of hospitals giving night time and out-of-hours support and a sudden drop in the ability to provide local emergency medical care

When the work system reform is implemented, if long working hours are left unattended, it will be a violation of the Labor Standards Law, and if this happens, management will be subject to penalties that could include arrest. What will happen within a hospital with the work system reform? The cases of St. Luke's International Hospital and St. Mary's Hospital are the best references when considering this problem since these institutions have already started implementing work system reform after an inspection by the Labor Standards Office. Measures taken at these hospitals include suspending outpatient work on Saturdays and reduction in the number of doctors assigned to nightshift. As a result, the monthly average overtime hours at St. Luke's decreased from 95 to 35 hours. When work system

reforms are implemented, it is likely that several hospitals will concentrate their doctors' work during daytime and will halt or reduce attention on holidays and during nighttime.

What is most worrying about the start of the work system reform in 2024 is that several medical institutions that have been in charge of local emergency services will reduce their emergency response on holidays and at night all at once, and the ability to provide local emergency care will be sharply reduced. If this actually happens, it is likely that too many patients will flock to hospitals that do provide holiday and nighttime attention and make them collapse. Advance preparation and measures are required to prevent such a situation from occurring.

2) Surgery will shift from having a treating doctor to a team system

From the Labor Standards Law point of view, it has become difficult to continue the attending doctor system employed in surgical departments, where a single doctor performs surgery, stays at the hospital on the day, and also manages post-operative matters. In order to maintain the number of operations that hospitals provide while also complying with the Labor Standards Law, it seems like the only choice is to shift from the attending doctor system to a team system in which several surgeons form a team and take charge of one patient. In addition, before implementing the work system reform, the government will need to sufficiently explain to patients why it is necessary for municipalities and hospitals to shift from the attending doctor system to team based medical care, including that there could be situations in which the doctors at the beginning of a long-term surgery may not be the same ones by the end of it.

3) There could be areas in which consolidation would occur, mainly in emergency and surgery

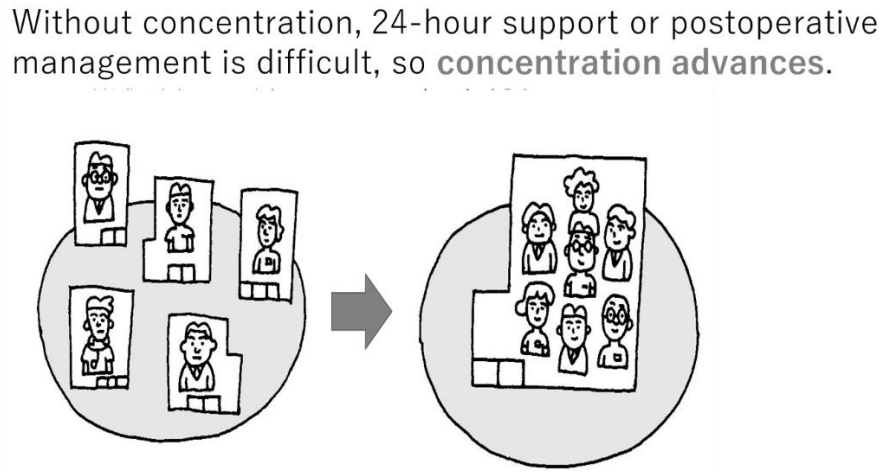
In order for university hospitals to maintain the same number of surgeons after work system reforms, they may, for example, determine that eight surgeons return to the university, consequently removing eight surgeons from local hospitals. The chances of this happening are not low. Conversely, unpaid medical office doctors who so far have been making a living by working part-time night shifts will outflow from universities that cannot pay enough and some of these university hospitals may become unable to conduct their medical care, education, and research functions. It is not unlikely that surgeons and doctors involved in emergency medical care will begin to shift as a result of work system reforms.

On the other hand, in hospitals where it is not possible to procure surgeons and emergency doctors required for forming a team, and in hospitals that rely on part-time doctors for most of the nighttime medical care, when the work system reform kicks in, some of these may be forced to make painful decisions like reduce or discontinue surgery, holiday and nighttime consultation, and consequently reduce medical care in general.

There are several regions where the medical care provision system will be almost unchanged after

the work system reform is implemented, but there is a possibility that in some regions, in order to protect local medical care, discussions are held at regional medical concept meetings, etc., the on-duty system for emergency response is strengthened by dispatching doctors to other hospitals and the consolidation shown in Figure 17 advances. As shown on the left of Figure 17, if the doctors and surgeons in charge of emergency are dispersed into each hospital in the area, in many cases doctors need, for example, to be woken up every time for the small number of patients that come at night, and their efficiency is low. On the other hand, if the consolidation shown on the right of Figure 17 progresses, more patients will gather in a wider area, but by forming a team, it will be possible to work within a wider margin which is one of many advantages that would allow to provide more specialized medical care.

Figure 17 Flow of the concentration that would happen with work system reform for doctors in regions and clinical departments



5.3.4 What will happen if no concrete measures are taken before reforms kick in?

As mentioned above, efforts are underway to shorten working hours without degrading the medical care performance of each hospital by 2024, and regional cooperation and concentration of emergency and surgery in the region are systematically promoted as required. If the surgery and emergency medical care communities need is maintained, it may be possible to go through with work system reform without major confusion.

On the other hand, the worst case scenario would be that 2024 arrives, barely any of the mentioned preparations have been made, and one day, all of a sudden, the working hours of emergency doctors and surgeons are cut short, or the residents that have sustained the night shift of a hospital through part-time cannot come to work.

Figure 1 at the beginning summarizes the worst case scenarios from the patient's perspective which could derive in a life or death situation: 1) fewer hospitals will accept them at night or during

emergencies, 2) they will not be available to undergo surgery immediately if they have cancer and waiting times and periods for tests and procedures will become longer. In addition, 3) surgery would change from the attending doctor system to a team system, which would be disagreeable for patients accustomed to have a single attending doctor.

5.4 Countermeasures

As a first measure, incentives for doctors who practice in clinical departments subject to work system reforms and depopulated areas should be expanded, increasing the number of doctors engaged in surgery, emergency, and depopulated areas as much as possible. To do this, effective measures would be to promise to reduce the working hours of surgeons and emergency physicians to 60 hours or less per week, and provide incentives with clear economic benefits, such as doctor fees (paying medical fees for surgery and emergency services directly to doctors rather than hospitals). Regarding the dispatch of doctors to depopulated areas, one idea is that clinical experience in areas with insufficient medical care could become a requirement for directors, including those at clinics.

In order to maintain the ability to answer to local surgery and emergency care, it is effective to concentrate hospitals that handle surgery and emergency. To do this, it would be necessary to first simulate how much the number of surgeries and emergency services will decrease if each hospital follows the rules of the work system reform, aggregate the results by region and discuss regarding the necessary number of doctors at the regional level, the number of operations that can be provided and emergency capability. Based on the results, making a regional framework for consolidation and conversion, and procuring public funds to do this for each hospital would be required. It is well risky to proceed with work system reform without conducting such simulations and preparations. Considerations should be had to gradually promote work system reform based on the preparation status of medical institutions and the region.

At the same time, it is important to strive to improve the productivity of doctors by increasing the number of operations performed by one surgeon through communication technology and transfer of duties. It is required to inform the public that the reform of the working system of doctors is directly linked to their own lives and to give thought to the appropriate utilization of the limited resources of medical care. At the same time, it is important to boost the momentum to ensure that administrative support and reforms within the hospital are implemented to reduce side effects.

6. Conclusions

The number of a new doctors who are giving thought to their work-life balance is increasing rapidly, and young doctors are no longer choosing surgical departments where they are forced to work long

hours in depopulated areas. As a result of leaving this situation untouched for more than 15 years, the uneven regional distribution of doctors and clinical departments has advanced.

The work system reform set to start in 2024 will directly hit the above-mentioned, surgery, emergency, and late residence doctors working long hours at university hospitals and regional core hospitals, likely creating problems that also greatly affect patients like: 1) a significant decrease in the number of medical institutions that provide medical care during nighttime and 2) a significant extension of the waiting period for surgery or examinations for things like cancer.

To avoid this situation, the fundamental solution is to increase the number of a new doctors who desire to work on surgery or emergency. For that purpose, since it is indispensable for doctors in these clinical departments to fulfill their work-life balance, work system reform must be advanced. In addition, in order to reduce the side effects of work system reforms, there should be reforms to increase the productivity of medical care in the field (increasing the number of patients that can be treated by one doctor) such as DX conversion of medical care and promotion of the team system as well as consolidation at the regional level, with emphasis on surgery and emergency.

References

Stano, M. (1987), "A further analysis of the physician inducement controversy," *Journal of Health Economics*, 6(3), pp.227-238.

Evans, R. G. (1974), "Supplier-induced demand: some empirical evidence and implicationsm," In The economics of health and medical care (pp.162-173). Palgrave Macmillan, London.

Sloan, F. A. (1975), "Physician supply behavior in the short run," *ILR Review*, 28(4), pp.549-569.

McGuire, T. G., & Pauly, M. V. (1991), "Physician response to fee changes with multiple Payers," *Journal of health economics*, 10(4), pp.385-410.

Delattre, E., & Dormont, B. (2003), "Fixed fees and physician-induced demand: A panel data study on French physicians," *Health economics*, 12(9), pp.741-754.

J. Sørensen, R., & Grytten, J. (1999), "Competition and supplier-induced demand in a health care system with fixed fees," *Health Economics*, 8(6), pp.497-508.

Takahashi T., Ishikawa M., Kashiwabara J. (2011), "Considering the medical care provision system in Japan based on secondary medical areas", 3rd Classification of secondary medical areas based on regional characteristics and medical care provision situation levels, *Shakai Hoken Shunhou*, Feburary 1st vol., pp.12-19

Sekimoto M., Ii M, (2013), "Regional differences and transitions of medical resources assessed from the balance in the number of doctors, medical institutions, beds and patients," *Kousei no Shihyou (Welfare indicators)*, Vol. 60, No. 11, pp.1-8

Maeda Y. (2015), "The medical care provision system to this day", *JMARI working paper No. 348*.

Fukuda S., Watanabe T., Takahashi T. (2018), "Research on the regional differences and movements

in the number of doctors by clinical department," *Japan Society for Healthcare Administration magazine 55 (1)*, pp.9-18

Takahashi T., Ishikawa M., Watanabe T., Eguchi N., Fukuda S. (2018), "How did the uneven regional distribution of doctors and uneven distribution of clinical departments advance?" (1), *Shakai Hoken Shunhou,* August 21st, pp.10-15

Takahashi T., Ishikawa M., Eguchi N. (2018), "Data compilation of doctor's numbers by secondary medical areas – Report by area regarding the uneven regional distribution of doctors and uneven distribution of clinical departments and estimate of its future," *JMARI working paper No. 419* 1-2700, 2018-11-13

Takahashi T., How to think the trinity reform (2020), What will happen when work system reform is implemented (Vol. 1), *Shakai Hoken Shunhou*, August 21st Volume, 6-11 2020

Takahashi T., How to think the trinity reform (2020), What will happen when work system reform is implemented (Vol. 2), *Shakai Hoken Shunhou*, September 1st Volume, 6-11 2020

Kobayashi Y., and Takaki H. (1992), "Geographic distribution of physicians in Japan," *Lancet 340 (8832)*, pp.1391-3.

Toyabe S. (2009), "Trend in geographic distribution of physicians in n Japan," *Int J Equity Health.*