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ORIGINAL PAPER

Gender bias in the medical school admission system in Japan

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Abstract

The 2018 Japanese Ministry of Education, Culture, Sports, Science, and Technology (MEXT) survey revealed discrimination against women in the admissions process of four Japanese medical schools, although it is not known how unusual the trend is for entire medical schools to enroll men and women. Therefore, this paper aims to examine how women are disadvantaged when they take entrance examinations for medical schools in Japan, compared to other academic disciplines. A null hypothesis that the average enrollment rates by gender in each academic discipline from 2015 to 2020 are the same was used to test the population ratio, and *p*-values were calculated. The results showed that no significant gender differences were found in the other disciplines, but the male enrollment rate was significantly higher only in medical schools ($p < 0.01$). This could be because the academic performance of men exceeds that of women in admissions. However, the percentage of women who passed the national examination for medical practitioners has been consistently high since 1997, suggesting that women were subjected to more difficult admission standards than their male counterparts or may have performed better during their years at medical school. As university entrance examinations in Japan are conducted in a closed environment, further information is expected to be disclosed as the matter continues to attract social attention for a better admission system.

Keywords Gender gap · Medical education · Gender discrimination · Medical sociology

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Introduction

A report in 2018 alleged that Tokyo Medical University (TMU) deliberately altered entrance examination scores to restrict the number of female students, thus ensuring that a higher proportion of male students are accepted to their medical school (BBC 2018; Kyodo News 2018). Against the backdrop of the #metoo movement against sexual harassment, the news of such discrimination led many people to join protest movements (Yamashita 2018).

Consequently, the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) started an investigation on all 81 medical universities in Japan; a total of 13 reports were published (MEXT 2018a, b). On December 14, 2018, the final investigation report was published, exposing three more universities for gender discrimination practices: Juntendo University, Kitasato University, and St. Marianna University School of Medicine (MEXT 2018c). In terms of discriminatory practices, each university treated applicants (i.e., those who actually completed the admission process) in the following ways. TMU added extra scores for younger male applicants (Third-Party Committee of Tokyo Medical University 2018a, b), Juntendo University set a higher standard for women and older applicants for at least the last 10 years (Third-Party Committee of Juntendo University 2018), and Kitasato University prioritized male applicants when determining the number of applicants to be carried forward (Third-Party Committee of Kitasato University 2018, 2019). At St. Marianna University School of Medicine, the average score of male applicants was 1.8 to 2.6 times higher than that of female applicants (MEXT 2018c; Third-Party Committee of St. Marianna University School of Medicine 2019).

Since gender discrimination in entrance examinations is a violation of the Constitution, multiple lawsuits have been filed, including by other universities, and some are still ongoing (Jibu 2018; Lawyers Acting to Eliminate Discrimination against Women in Entrance Examination for Medical Faculties 2019; Yamashita and Mishima 2019; Kawai et al. 2020; COJ 2020; Sugiyama 2018; Teller Report 2019).

After this scandal, various organizations have conducted investigations or published their opinions regarding gender discrimination in medical schools. In a survey by the Medical Student Union, more than 14% of medical students responded that they were asked questions that implied gender bias at their entrance examination ($n = 3017$) (Igakuren 2019). Moreover, some newspapers argued that female doctors are unprofessional (Niwa 2015), TV programs justified male privilege in the admissions system (J-Cast News 2018), and a magazine argued that female doctors are unnecessary (Weekly Gendai 2018). In one survey, 65% of doctors said that discrimination was "understandable" ($n = 103$) (M-Stage 2018).

Previous studies have explored the reasons behind the exclusion of women in the admissions process (Oshima et al. 2019; Dyer 2018a, b, 2019; Schieder 2019; Tokuda 2019; Lovett and Ross 2018; Wheeler 2018, 2019; Normile 2018; Yamaguchi 2019). These studies share the view that hospital management tries to maintain a male-dominated work environment with long working hours.

Discrimination against women has long been prevalent as a "necessary evil" in the medical school admissions process (Schieder 2019). Moreover, due to the lack of transparency, female applicants have been systemically disadvantaged (Tokuda 2019). In the first entrance examinations held after the fraud was discovered, female applicants outnumbered male applicants (Dyer 2019). Misogyny is at the heart of such discrimination; it is a social problem in Japanese society which transcends academic medicine (Oshima et al. 2019).

Even after starting their careers as doctors, women continue to face gender-based obstacles on several fronts. A significantly higher number of female physicians than male physicians are aware of gender-based career obstacles (Yasukawa and Nomura 2014), and about half of all female physicians have been victims of harassment regarding pregnancy and childbirth (Kawase et al. 2019). In addition, both the wages and job titles of female physicians are lower than those of males (Kono et al. 2020), and there is a strong traditional division by gender, with more males in surgical departments and more females in internal medicine departments (Fukuda and Harada 2010; Kawamoto et al. 2016). The gender gap in surgical societies is also significant, with only one female member serving as a councilor as of 2014 (Tomizawa 2015). Internalizing the gender stereotype that women should play a more central role in the family, female physicians are more likely to value family over work (Nomura et al. 2010). As a result, women struggle to pursue specialties in departments with longer working hours and find it challenging to find a satisfactory work–life balance (Nomura et al. 2015). Consequently, there are considerable hurdles in constructing a coherent professional and personal identity for women (Matsui et al. 2019). These phenomena are not limited to Japan and can also be seen in countries with high rates of female doctors (Ramakrishnan et al. 2014). Therefore, the difficulties faced by female physicians are not problems that can be automatically solved by a net increase in the number of female physicians but have their root causes in a culture that excludes women.

Several previous studies have focused on the disadvantages that women experience in medical school admissions, and the analytical perspective ranges from the admissions system, examination subjects, socioeconomic reasons, and psychological load. In Ireland, recent reforms in medical schools have been observed to favor males (O'Flynn et al. 2013); in the US, gender was a basis of discrimination in interview tests (Chatterjee et al. 2020). In a study in Japan, it was observed that female applicants were less likely to pass the exam when the point distribution for mathematics and science subjects was increased (Tsunekawa and Shioiri 2019). Moreover, in Australia, students with disadvantaged socioeconomic attributes, such as women and ethnic minorities, struggle more in entrance examinations (Puddey and Mercer 2013). A study in Pakistan found that among students who applied for medical school, women experienced a heavier psychological burden than men (Irfan et al. 2018). In the US, even though women outperform men in high school, the situation is reversed when it comes to standardized test scores related to university entrance examinations (Saygin 2020). All of these results indicate that women are at a systemic disadvantage. However, it should be noted that the social circumstances and admissions systems in each country are very different.

In contrast, performance in medical licensing and surgery indicates an advantage toward women. A study in South Korea reported that women performed better on medical license examinations (Yim 2015). In Japan, women's pass rates were higher over 20 years, as we will show later, and a single-center study showed that women were most likely to pass the medical licensing exam (Tsunekawa et al. 2020). In addition, a report from a Japanese medical institution revealed that female doctors have better surgical outcomes (Inoue and Izumi 2019). In other words, lower medical school acceptance rates for women do not reflect lower capability but rather suggests the possibility of discrimination, in that women are subjected to higher hurdles during the admissions process. Although some studies in Japan show a short period when female acceptance rates increased after the scandal broke (Dyer 2019), none have investigated trends in medical school admissions as a whole over a long period.

Therefore, this study posits the following research question: "Have women applying for Japanese medical school entrance examinations been discriminated against?" by analyzing the data of these examinations for all disciplines and universities, including medical schools, over several years. Comparisons with other disciplines have never been made in the past, and thus, this study will reveal the unusual nature of medical school entrance examinations.

Materials and Methods

Japan has three types of universities: national, public, and private. As national universities and public universities generally hold their entrance examinations on the same day, applicants can apply to only one of the two. Private universities have multiple entrance exam schedules, and thus, applicants can take as many exams as their financial situation and schedule allow. Among the various selection methods, the most common is to combine the results of the nationally standardized academic achievement test with the results of individual tests administered by each university. In most cases, students take the examinations around the time of their graduation from high school, as a high school degree is a minimum entry requirement. If a student is not accepted, meaning does not receive a letter of permission to enroll, to a university of their choice, they can take the exam again the following year or later.

Data Collection and Study Population

We collected the data for the number of applicants and admissions by academic discipline, as published by the MEXT since 2015 (Table 1). There are 12 categories of academic disciplines: science, engineering, agriculture, medicine, dentistry, pharmacy, nursing, humanities, social sciences, home economics, education, and arts. Notably, the number of applicants was larger than the actual population of applicants because students often apply to multiple universities. Admission refers to the number of students who have actually registered for university, and duplication is rare.

Table 1 The number of applicants and admissions by year, academic discipline, and gender

	Applicants		Admissions		Applicants		Admissions		Applicants		Admissions	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Science				Engineering				Agriculture			
2015	115,289	45,682	13,203	5194	589,515	102,725	77,811	13,556	74,581	54,294	9746	7950
2016	113,144	45,849	12,901	5215	598,932	104,489	73,477	13,060	74,330	53,996	9802	8064
2017	113,248	44,778	13,158	5199	633,945	114,320	75,961	13,919	75,069	55,674	9575	8223
2018	114,088	45,588	12,727	5311	668,683	124,079	74,792	14,197	72,466	53,691	9648	8209
2019	125,975	49,668	13,257	5382	721,000	131,893	74,889	14,489	70,915	53,314	9999	8363
2020	129,016	49,106	13,137	5251	764,486	133,669	75,889	14,485	74,603	55,585	10,214	8385
	Medicine				Oncology				Pharmacy			
2015	89,059	52,047	5769	2957	7138	4750	1362	1067	48,098	63,249	5399	7686
2016	85,648	50,603	5868	2990	6864	4508	1331	1024	47,613	63,710	5234	7431
2017	89,084	53,656	5837	3176	6733	4303	1274	1007	45,625	61,755	5152	7604
2018	88,700	54,627	5874	3128	7297	5059	1273	995	44,018	61,082	4933	7460
2019	83,297	52,925	5659	3348	7518	5622	1256	1050	40,757	57,225	4855	7233
2020	79,099	51,596	5647	3257	7091	4878	1281	1016	37,812	52,993	4914	7168
	Nursing				Humanities				Social Sciences			
2015	13,197	97,498	2212	18,301	208,820	348,508	29,908	57,097	856,982	433,515	130,752	70,432
2016	13,048	108,506	2160	18,894	220,357	361,517	30,223	57,207	925,875	469,117	130,738	71,874
2017	12,101	114,723	2066	19,972	238,830	383,594	30,357	57,717	1,021,525	514,013	132,258	74,073
2018	13,439	123,269	2096	20,975	265,851	414,768	29,764	58,447	1,139,982	554,481	130,554	72,797
2019	12,553	123,240	2019	21,313	295,579	441,000	30,015	57,278	1,239,653	578,159	129,169	72,212
2020	11,973	124,670	1967	21,666	290,549	419,746	30,506	56,701	1,186,194	540,392	129,959	72,298
	Home Economics				Education				Arts			
2015	8782	78,841	1883	16,343	103,026	127,994	19,229	28,375	19,215	40,058	5119	12,540
2016	9091	78,569	1748	16,006	98,539	125,018	18,744	27,633	19,859	41,521	5264	12,597

Table 1 (continued)

	Applicants		Admissions		Applicants		Admissions		Applicants		Admissions	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2017	9557	78,821	1684	16,262	100,703	126,518	18,999	27,992	20,669	42,148	5513	12,730
2018	9223	79,360	1771	16,254	97,109	124,440	19,074	27,717	23,406	44,102	5796	12,731
2019	10,574	77,081	1874	16,319	104,544	131,471	19,176	28,136	27,689	46,636	6116	13,100
2020	10,576	70,092	2116	15,750	104,395	126,390	19,371	28,013	28,943	49,332	6118	13,368

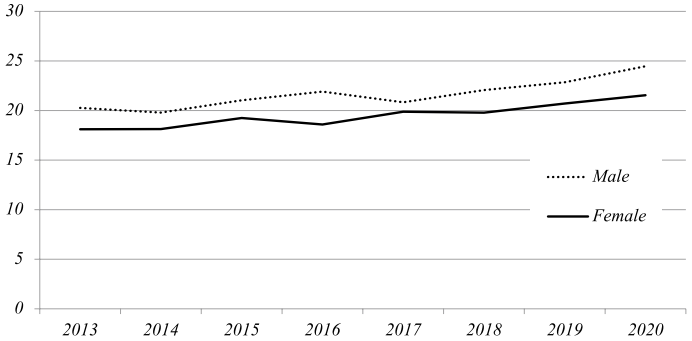

Fig. 1 Average acceptance rate to medical school (%)

Figure 1 illustrates the average acceptance rate to medical school in the 2013–2020 period by gender, as surveyed by MEXT in 2018, immediately following the scandal reports. Additional new results were released in 2020 (MEXT 2020). We calculated the male and female acceptance rates by dividing the number of applicants by the number of accepted applicants. The data cover almost all medical schools in Japan, but figures for the Defense Medical College, which is under the jurisdiction of the Ministry of Defense, were not included. Further, data from Tokyo Women's Medical University were also not included in our analysis because it is a women's university. Excluding these 2, the number of universities with medical schools nationwide was 78 in 2013–2015, 79 in 2016, and 80 in 2017–2020.

Figure 2 indicates the pass rates by gender for the national examination for physicians published by the Ministry of Health, Labour and Welfare (MHLW 2010, 2014, 2019). The data for 2004 and earlier were obtained from Igaku Shoin, which deals with medical publications (Igaku Shoin 2001, Igaku Shoin 2003, Igaku Shoin 2004), and the data for the most recent 2 years were obtained from a private company that supports the preparation for the national medical examination (TECOM 2021).

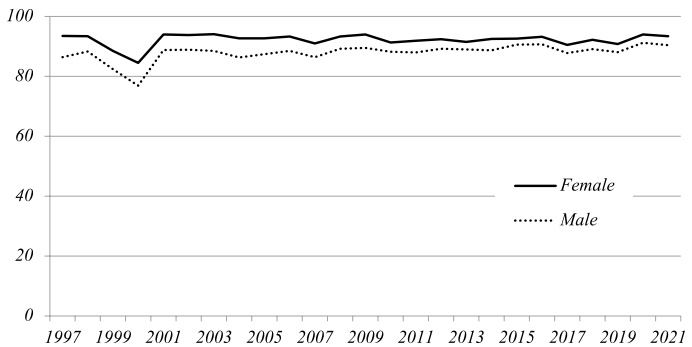

Fig. 2 Pass rate of national examinations for medical practitioners (%)

Statistical Analysis

Average enrollment rates for 6 years, from 2015 to 2020, were estimated by discipline and gender, and the corresponding 99% confidence intervals were calculated. The enrollment rate is defined as the number of admissions to the number of applicants. A null hypothesis that the enrollment rates are the same for males and females was used to test the population ratio, and *p*-values were calculated. The results of the test for each academic discipline were determined at the 1% significance level. Data analysis was conducted in September 2021 using Microsoft Excel for Windows (statistical software version 14.0.7268.5000, Microsoft Corp). The graphic charts in Figs. 1 and 2 were created using the same program.

Results

Demographic Data

Table 1 summarizes the number of male and female applicants, male and female admissions, and examination results by academic discipline from 2015 to 2020. The number of male applicants exceeded the number of female applicants in science, engineering, agriculture, medicine, oncology, and social sciences. The number of female applicants was higher in pharmacy, nursing, humanities, home economics, education, and arts. The enrollment rate of female students exceeded that of male students in almost all years in all disciplines except medicine.

A Statistical Analysis of the Average Enrollment Rate

Table 2 summarizes the average enrollment rate for the 6-year period, the 99% confidence intervals, and the *p*-values as a result of testing the population ratio against the enrollment rate by academic discipline. The test is based on the null hypothesis that the average enrollment rates of males and females are equal; the significance level was set at 1%. The average enrollment rate over the 6 years was about 10–20%, with medicine having the lowest rate at 6.74% for males and 5.98% for females. The enrollment rate and the corresponding range of confidence intervals by gender was higher for females than males in all disciplines except medicine. The test results for the average enrollment rate showed that among all 12 disciplines, only in medicine was there was a significant difference between male and female enrollment rates.

Figure 1 shows the average medical school acceptance rate by gender. The male acceptance rate was higher than the female acceptance rate at all time points, although the difference was only about two percentage points. Clearly, men are more likely than women to pass the test consistently.

Figure 2 shows the pass rate of the national examination for medical practitioners to obtain a medical license, by gender. This examination is taken after 6 years of medical school study. If a student does not pass this exam, the student will not be allowed

Table 2 The figures show the average enrollment rate over the 6 years (2015–2020) by academic discipline and by gender, with a 99% confidence interval

	Average enrollment rate	*p*-value		Average enrollment rate	*p*-value
Science			Engineering		
Male	11.06 (CI 10.11–12.00)	0.77819537	Male	11.49 (CI 9.47–13.51)	0.73775595
Female	11.26 (CI 10.60–11.91)		Female	11.86 (CI 10.33–13.38)	
Agriculture			Medicine		
Male	13.35 (CI 12.57–14.14)	1.00000000	Male	6.74 (CI 6.34–7.14)	0.00000002
Female	15.07 (CI 14.44–15.69)		Female	5.98 (CI 5.52–6.44)	
Oncology			Pharmacy		
Male	18.27 (CI 16.54–20.00)	0.99992126	Male	11.60 (CI 10.37–12.84)	0.98728685
Female	21.29 (CI 18.21–24.38)		Female	12.42 (CI 11.38–13.45)	
Nursing			Humanities		
Male	16.42 (CI 15.56–17.27)	0.99991369	Male	12.10 (CI 9.24–14.96)	0.99906917
Female	17.55 (CI 16.53–18.56)		Female	14.64 (CI 12.44–16.84)	
Social Sciences			Home Economics		
Male	12.53 (CI 9.38–15.67)	0.96721309	Male	19.20 (CI 16.83–21.57)	0.99815285
Female	14.16 (CI 11.81–16.52)		Female	20.98 (CI 19.69–22.26)	
Education			Arts		
Male	18.85 (CI 18.10–19.60)	1.00000000	Male	24.63 (CI 20.58–28.69)	0.99999118
Female	22.04 (CI 21.52–22.56)		Female	29.32 (CI 26.72–31.91)	

The *p*-value results from tests in which the null hypothesis predicts that the average enrollment rates are the same between both genders

*$p < 0.01$, indicating a statistically significant difference between genders

to practice as a doctor. Contrary to the situation shown in Fig. 1, the pass rate for the national examination for medical practitioners is always higher for women than men, with a difference of between two and nine percentage points.

Discussion

In examining the possibility of disadvantages for women in medical school entrance examinations, the study results show that only in the medical discipline, is the male enrollment rate higher than that of the female, and that there is a significant difference in the average enrollment rate between the two genders, only in the medical discipline.

After the story of the scandal of discrimination against women in medical school admissions broke, studies investigating sexism in admissions have revealed persistent sexism in Japanese society, focusing especially on the TMU fraud (Dyer 2018a, b; Lovett and Ross 2018; Wheeler 2018, 2019; Normile 2018). Moreover, previous research has revealed the existence of underlying misogyny (Oshima et al. 2019) and a disposition to believe that sexism is a "necessary evil" (Schieder 2019). Although some communities have shared informally that women may be disadvantaged in medical school admissions (M-Stage 2018), empirical evidence formally establishes that female applicants have been unilaterally disadvantaged (Tokuda 2019). However, studies have also reported that gender discrimination has declined after the scandal, based directly on the results of the entrance examinations before and after the scandal (Dyer 2019). Japanese studies have shown that female applicants are less likely to pass when the number of points allocated to mathematics and science subjects in the entrance examinations increases (Tsunekawa and Shioiri 2019). However, as shown in the comparison with other disciplines, in this study, the enrollment rate of female applicants exceeds that of male applicants in other natural science disciplines. Hence, while the issue of subject matter cannot be ignored, other factors should be considered in the fact that female applicants face difficulties only in medical school entrance exams.

For instance, studies in the US have shown that women are disadvantaged in interviews (Chatterjee et al. 2020), and the same may be true in Japan. Medical school admissions typically require an interview, unlike admissions for other faculties, and at many universities, female applicants are asked uncomfortable questions based on their gender (Igakuren 2019). For example, the Juntendo University Team gave an *interesting* reason for adjusting the interview scores in their entrance evaluation for female applicants. Quoting a paper, they said that women have better communication skills than men, and thus adjusting for this gender gap was necessary to be "fair" (Inagawa and Sooryeon 2018). Nevertheless, the author of the said paper claimed that he had never conducted such a study (Nakamura et al. 2018).

Conversely, we can also address the possibility that the academic performance of men exceeds that of women in medical school admissions. In terms of age, medical school are more difficult to pass, sometimes taking several years. As men are less resistant to the idea of spending more years studying, they are more likely to continue trying for many more years until they pass. Thus, they may have higher levels of academic achievement than women. Women taking entrance exams in universities close to their parental homes and trying to pass them as early as possible are also indications of gender bias in Japanese society.

Importantly, the low admission and pass rates of female applicants in medical school admissions (Table 2; Fig. 1) do not mean female doctors are less competent. Recent studies have shown that the surgical outcomes of female doctors are good (Inoue and Izumi 2019), and female medical students have historically had consistently higher pass rates for the medical license examination than males (Fig. 2). In fact, being female has been identified as one of the key factors for obtaining a medical license (Tsunekawa et al. 2020), and our analysis supports this. This could be the result of women outperforming their male counterparts due to better educational efforts during medical school (de Silva et al. 2004; Yim 2015). However, considering the minority status of women in medical schools, the reports of academic and sexual harassment against women, and the large percentage of doctors who understand sexism, it is clear that female medical students do not have the best educational environment (Igakuren 2019; M-Stage 2018). They might be negatively affected, especially given the circumstances such as serious academic harassment against female medical students (Igakuren 2019), facing gender-based career obstacles (Yasukawa and Nomura 2014), and many female physicians have been victims of harassment with regard to childbirth (Kawase et al. 2019). Furthermore, women often struggle to identify as physicians (Matsui et al. 2019), and there is a lack of female physicians in positions of authority (Tomizawa 2015).

The following limitations must be noted. First, the data do not directly prove discrimination. As mentioned earlier, students are likely to apply to more than one university, but no data is available on the application trends. Therefore, in this paper, it is assumed that people who take the entrance examinations for the same field of study will show the same trend in applying, and the results of the number of applicants and the number of admissions are summed for all universities, without distinguishing between national, public, and private universities. That is, in this analysis, we have not considered differences in the number, difficulty level, location, or type of schools to which applicants apply. Therefore, the following points should be noted: the number of applicants is considerably larger than the actual population of applicants; there are multiple cases where students do not go on to universities even though they have been accepted, and there are cases where students do not take the entrance examination even though they have applied. A second limitation is the inadequacy of data in terms of definition. In principle, the statistical classification of "medicine" in Table 1 refers to educational programs that aim to obtain a medical license, but in recent years, various courses have been newly established, such as integrated health sciences, human health sciences, and public health. In rare cases, educational programs that have nothing to do with obtaining a medical license are also included. The number of such fields of study is expected to increase in the future.

Conclusions

This paper examined the possibility of discrimination against women appearing for the medical school entrance examinations by comparing male and female enrollment rates. Using data gathered by MEXT, we conducted a test under the null

hypothesis that there is no difference in the enrollment rates between the two genders and determined the significance of the test results. The results showed that the male enrollment rate was significantly higher only in medical schools than other disciplines, thus empirically demonstrating the peculiarity of medical school admissions in Japan. It adds to previous studies that have mostly focused on individual cases at some universities or generalized overall gender discrimination. In addition, the acceptance rate for medical school entrance tests is consistently higher for men, while the pass rate for the national examination is consistently higher for women, suggesting that women may be discriminated against during the entrance examinations. Although the results strongly suggest the possibility of discrimination against women, they do not directly prove discrimination. For further research to progress, citizens and researchers must continue to pay attention to this issue.

Author Contributions KF, KO, and YT conceived the presented study. KO and YT encouraged KF to investigate discriminatory entrance examinations. KF collected data and performed the computations. All authors discussed the results and contributed to the final manuscript.

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Data Availability All data and materials supporting the conclusions of this article are available via the Internet. Information on unfair examinations was obtained from individual university websites and the Ministry of Health, Labour and Welfare (MHLW) website. Information on acceptance rates was obtained from the MHLW website. Information on legal actions and other social movements was obtained from newspapers.

Code Availability Not applicable.

Declarations

Conflict of interest No potential competing interest was reported by the authors.

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