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Motherhood penalty for female physicians in Japan: evidence from a medical school's alumni data

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Abstract

Background Female physicians with children often work fewer hours and take fewer shifts due to additional family responsibilities. This can contribute to a gender pay gap in the medical profession. However, limited research in Japan has quantitatively examined the factors contributing to this gap. This study aims to address this gap in the literature.

Methods We analyzed the alumni data from a medical school in Hokkaido, Japan, for 260 physicians (198 males and 62 females). We used multivariable regression models to identify factors influencing earnings from medical practice, with a focus on gender, work schedules, parenthood, and any career interruptions related to childcare.

Results Our analysis revealed a 25.0% earnings gap between male and female physicians. Nearly all female physicians with children experienced career interruptions due to childcare, while this was uncommon for male physicians. When these childcare-related interruptions were factored in, the gender pay gap narrowed by 9.7%. After adjusting for work schedules and specialty choices, female physicians with children still earned 37.2% less than male physicians, while those without children earned only 4.4% less. This suggests that motherhood is a significant driver of the gender pay gap among physicians.

Conclusions These findings highlight the negative impact of motherhood on female physicians' earnings. This emphasizes the need for policy measures to mitigate the disadvantages faced by mothers in the medical profession.

Keywords Motherhood, Career interruption, Childcare, Gender gap, Female physicians

Background

As the number of female physicians in Japan rises, it becomes apparent that mothers in this profession often work fewer hours and take fewer shifts while shouldering more household and childcare responsibilities [1–10]. When balancing careers and family life, female physicians typically make greater career sacrifices than their male counterparts to meet familial obligations [11–14].

The disparity likely contributes to the gender pay gap. Research across numerous countries shows female physicians tend to earn less than their male colleagues [15–21]. However, limited evidence exists in Japan specifically. While female physicians may earn less, it is unclear

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if their reduced work schedules are the sole reason for this gap. Published opinions vary regarding the extent of gender discrimination and the impact of motherhood on earnings disparities [17, 21].

Recent research increasingly explores motherhood's impact on the gender pay gap. Professor Claudia Goldin, the recipient of the 2023 Nobel Prize in Economics, and her colleagues, highlight the significant negative effects (e.g., time out of work due to childcare obligations) on women's earnings, particularly in high-powered professions like law, finance, and corporate America [22, 23]. Given this impact in the US, we investigate its relevance to female physicians in Japan. We hypothesize that childcare-related career interruptions may prevent female physicians from returning to their previous work conditions. This could mean reduced schedules and potentially less significant job roles, often referred to as the "mommy track," ultimately leading to lower earnings compared to male physicians.

This study examines the factors behind the observed gender earnings gap using data from physicians who graduated from Sapporo Medical University in Hokkaido, Japan's northernmost prefecture. We analyze the overall gap, and how much of it is explained by factors like female physicians' work schedules, parenthood, childcare-related career interruptions, and potential gender-based pay differences.

This study utilizes data from a single medical school's alumni, aiming to reduce sample heterogeneity. This refers to variations in academic ability, training program experience, post-graduation ties with the school, and other individual factors that might influence the gender earnings gap. While the generalizability of the findings requires caution, the dataset offers unique strengths. Moreover, it provides separate information on physicians' main and side job earnings and work schedules, along with details on family formation. This comprehensive data helps solidify our exploration of motherhood's impact on female physician earnings in Japan.

Methods

Study sample

Data for this study came from a survey conducted among physicians who graduated from Sapporo Medical University (SAPMED) between 1993 and 2016. The survey was offered in both online and paper formats, with no incentives provided to the respondents. In the fall of 2023, we mailed the questionnaire to 1,452 alumni with work addresses listed in the SAPMED's alumni directory. We received a response rate of 24.7% (359 individuals).

Participants answered detailed questions regarding their primary jobs (the ones with the most annual working hours). This included information on earnings, typical weekly hours, night shifts, day shifts, on-calls, specialty,

and clinic type (hospital doctor vs. private practice). Additionally, we asked about side jobs at other hospitals or clinics, including earnings and typical weekly hours for such positions. Finally, the survey inquired about marital status, the presence of children, and any career interruptions due to childcare or childbirth.

We excluded participants who did not provide information on key variables. Considering the possible skewed distribution of annual earnings and the reliability of the reported data, we further excluded 14 observations with reported earnings of one million JPY or below (including zero), or 100 million JPY or above from the sample. As result, a final sample size was 260 participants (198 males and 62 females).

Variables

The primary outcome of interest was reported annual earnings. The participants were asked to report their pretax annual earnings from their main job and their side job, if any, at other hospitals or clinics. We followed Goldin's specifications for this approach. To explain variations in earnings, we examined the following factors: (i) being female, (ii) having one or more children, and (iii) having a career interruption of one month or more due to childcare. We controlled for additional factors that might influence earnings: (iv) years since medical school graduation, including a squared term to account for potential non-linearity; (v) hours worked per week from the main job (fewer than 40 h, 40–60 h, or more than 60 h) and work schedules (night shifts, day shifts, and/or are on call); and (vi) being a practitioner in private practice and medical specialties (internal medicine, surgery, obstetrics and gynecology, pediatrics, anesthesiology, dermatology, and others).

Data analysis

We began by comparing male and female physicians in our descriptive analysis. A key focus was the gender gap in earnings. Next, we divided physicians into two groups: those with at least one career interruption due to childcare and those without. We compared their earnings to understand the impact of childcare interruptions. Table 1 shows that 90.0% of female physicians with children had at least one career interruption due to childcare, while only 0.6% of male physicians with children experienced the same. Given this imbalance, we further divided female physicians into those with and without children. We then compared their working hours, work schedules, and earnings.

For the regression analysis of earnings determination, we employed multivariable linear regression models. These models estimated the logarithm of earnings as the dependent variable. Applying the log transformation and then multiplying the coefficient of a binary explanatory

Table 1 Key features of the participants ($N=260$)

		Men	Women	Difference	
		(<i>SD</i>)	(<i>SD</i>)	(Men – Women)	
Age (years)	<i>M</i>	46.0	43.6	2.4	
	(<i>SD</i>)	(6.6)	(6.6)		
Background					
Years since medical school graduation	<i>M</i>	20.1	18.2	1.9	*
	(<i>SD</i>)	(6.6)	(6.8)		
Main job					
Hours worked	<i>M</i>	51.1	44.7	6.4	***
	(<i>SD</i>)	(17.2)	(13.8)		
<40 h	%	9.6	19.4	–9.8	**
40–59 h	%	54.9	66.1	–11.2	**
≥60 h	%	35.5	14.5	21.0	**
Type of main job					
Includes night shift	%	61.7	43.5	18.2	***
Includes day shift	%	40.3	29.0	11.3	
Includes on call	%	55.6	30.6	25.0	**
Practitioner in private practice	%	11.9	1.6	10.3	*
Side job					
Having a side job	%	50.3	44.8	5.5	
Hours worked weekly (h) (if having a side job)	<i>M</i>	12.8	8.4	4.4	
	(<i>SD</i>)	(12.8)	(7.6)		
Specialties					
Internal Medicine	%	29.3	24.2	5.1	
Surgery	%	30.8	27.4	3.4	
Dermatology/otolaryngology/ophthalmology	%	9.1	14.5	–5.4	
Obstetrics and Gynecology	%	4.1	11.3	–7.2	*
Pediatrics	%	5.5	3.2	2.3	
Anesthesiology	%	2.6	6.5	–3.9	
Others	%	17.7	12.9	4.8	
Family relationships					
Having a spouse	%	92.6	67.7	24.9	***
Having at least one child	%	84.5	66.1	18.4	***
Number of children (if $n \geq 1$)	<i>M</i>	1.84	1.18	0.7	***
	(<i>SD</i>)	(1.12)	(1.08)		
Having had a career interruption (if $n \geq 1$)	%	0.6	90.0	–89.4	***
<i>N</i>		198	62		

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

variable by 100 provides an approximate percentage change in earnings associated with that variable.

We considered five regression models. All models controlled for years since medical school graduation and its squared term to account for a potential non-linear relationship with earnings. Models I and II focused solely on the impact of being female. Models III and IV added further control variables, including working hours, work schedules, and specialties. Model III estimated the separate effects of being female and experiencing at least one child-care-related career interruption. Model IV

examined the differences among male physicians, female physicians with children, and female physicians without children. We ran these four models for both main job earnings and total earnings.

Results

Table 1 summarizes the key features of the study participants. Female participants were slightly younger than males (by an average of 2.4 years). Males had a slightly longer time since graduation (by 1.9 years). Compared to females, male physicians were more likely to work longer hours (over 60 h per week, 21% points), have night shifts or on-call duties at their main job (18.2 and 25% points, respectively), and work in private practice (10.3% points).

Nearly half of all physicians, regardless of sex, held a side job at other hospitals or clinics, reflecting a common practice in Japan facilitated by regional medical service networks. Regarding specialties, the most significant gender difference emerged in obstetrics and gynecology, where women predominated (11.3% of females vs. 4.1% of males).

Male physicians were 18.4% points more likely to have at least one child compared to females. Additionally, male physicians with children had, on average, 0.7 more children than their female counterparts. However, the most striking gender difference was in career interruptions due to childcare (applicable only to those with children). Approximately 90% of female physicians with children had experienced at least one such interruption, averaging 14.5 months of leave. Conversely, only 0.6% of male physicians with children had experienced a career interruption.

The percentage of physicians who worked 60 or more hours per week was 35.5% for males and 14.5% for females. For the entire sample, the percentage was 30.5%, which was higher than the 21.2% reported in an official nationwide survey conducted in 2022 [24]. This indicated that the participants in our survey worked longer hours than the general physician population.

To understand the potential selection bias, we examine the characteristics of the study sample. First, the average number of years since graduating from medical school at the time of the survey was 19.6 years for the overall SAPMED alumni population, which was consistent with our study sample. Second, while private practitioners were less likely to report their income, there was no significant difference in the working styles between physicians who reported earnings and those who did not. Third, the national statistics for 2022 [25] showed a lower proportion of female physicians (23.8%), a higher average age (50.3 years), and a higher proportion of physicians in private practice (32.8%) compared with our sample.

Table 2 highlights substantial differences in annual earnings between male and female physicians. For their

Table 2 Annual earnings (million JPY)

	Main job		Side job (if any)		Total			
	M	SD	M	SD	M	SD		
Males (N=198) (A)	16.5	(9.0)	2.5	(3.8)	19.2	(8.7)		
Females (N=62) (B)	10.9	(4.9)	1.9	(2.7)	12.7	(3.9)		
Difference (A–B)	5.6	***	(1.2)	0.6	(0.5)	6.5	***	(1.2)
Males								
With at least one child (C)	16.4	(8.5)	2.4	(3.8)	19.3	(7.9)		
With no children (D)	15.2	(5.9)	1.0	(2.4)	16.6	(6.0)		
Difference (C–D)	1.2	(1.6)	1.3	(0.7)	2.7	(1.7)		
Females								
With at least one child (E)	10.1	(5.0)	1.8	(2.6)	12.2	(4.3)		
With no children (F)	12.4	(4.2)	1.9	(3.2)	14.0	(2.7)		
Difference (E–F)	–2.4	(1.3)	–0.1	(7.0)	–1.7	(1.1)		
Career interruption (CI)	9.5	(4.9)	1.9	(2.6)	11.9	(4.3)		
No career interruption (NCI)	13.0	(4.3)	1.5	(2.9)	14.0	(2.9)		
Difference (CI–NCI)	–3.5	**	(1.2)	0.4	(0.6)	–2.1	*	(1.0)

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

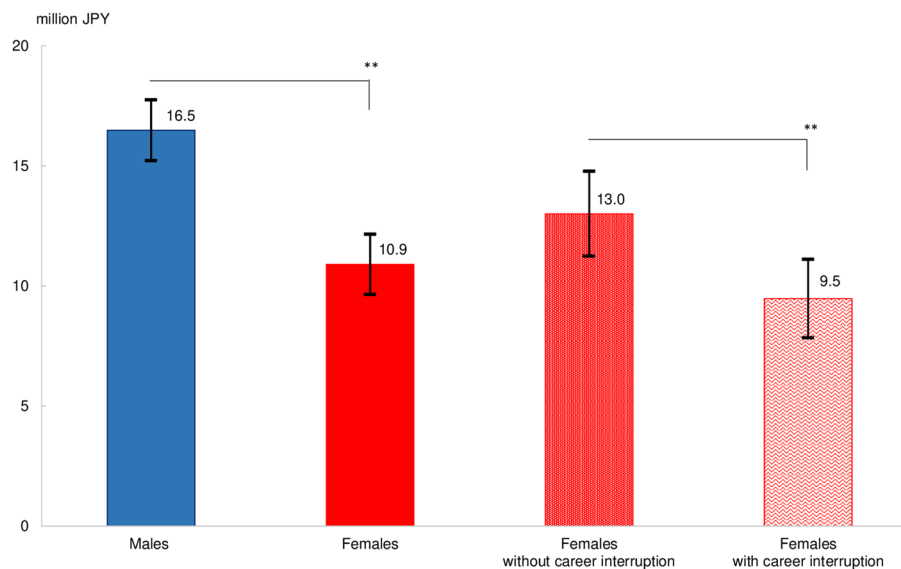


Fig. 1 The gender gap in annual earnings from the main job. Note: Error bars indicate 95% confidence intervals. ** $p < 0.01$

main job, females earned on average 10.9 million JPY (approximately \$73,000), which is 33.9% lower than the male average of 16.5 million JPY. While the gender gap in side job earnings was smaller, males still earned more, leading to a larger overall difference: 12.7 million JPY for females and 19.2 million JPY for males. According to government statistics [25], the average annual earnings of male and female physicians working in hospitals in 2023 were 15.2 million JPY and 11.5 million JPY, respectively.

We observed substantial earnings differences between female physicians who had at least one career interruption due to childcare and those who did not experience such an interruption. Females with at least one career interruption earned on average 9.5 million JPY, which was 27.1% lower than females without any career

interruption (13.0 million JPY on average). The difference in total earnings (i.e., from the main job plus the side job) was smaller than the difference in earnings from the main job. This is explained by two factors: (i) females with career interruptions tended to work more hours in their side job, and (ii) if they worked in a side job, they earned more than those without any career interruption.

Figure 1 graphically compares earnings from the main job between males and females, and between females with and without a career interruption based on the entire sample. This visual representation reinforces the notion that the gender gap in earnings from the main job is mainly attributable to at least one career interruption due to childcare.

Table 3 Key features of the female participants (N=62)

		Women with children	Women with no children	Difference (with children - with no children)	
Main job					
Hours worked	M	41.0	51.3	-10.2	**
	(SD)	(14.0)	(10.7)		
<40 h	%	27.5	4.6	23.0	*
40-59 h	%	65.0	68.2	-3.2	
≥60 h	%	7.5	27.3	-19.8	*
Type of main job					
Includes night shift	%	37.5	54.6	-17.1	
Includes day shift	%	25.0	36.4	-11.4	
Includes on call	%	32.5	27.3	5.2	
Side job					
Having a side job	%	53.9	26.3	27.5	*
Hours worked weekly (h)	M	8.4	8.5	-0.1	
(if having a side job)	(SD)	(8.1)	(6.3)		
N		40	22		

***p<0.001, **p<0.01, *p<0.05

Table 4 Estimation results of regression models to predict log-transformed earnings from the main job (N=260)

Model	I	II	III	IV
Female	-0.354*** (0.077)	-0.250* (0.084)	-0.097 (0.102)	
Having had a career interruption due to childcare			-0.283* (0.125)	
Female with at least one child				-0.372*** (0.100)
Female with no child				-0.044 (0.111)
Controls				
Years since graduation	Yes	Yes	Yes	Yes
Work hours for the main job	No	Yes	Yes	Yes
Work schedules for the main job	No	Yes	Yes	Yes
Specialties	No	Yes	Yes	Yes
R-squared	0.199	0.277	0.289	0.291

***p<0.001, **p<0.01, *p<0.05

Table 3 examines the role of children in affecting disparities in work schedules among female physicians. Compared to female physicians without children, female physicians with at least one child were 23.0% points more likely to work fewer than 40 h/week, 19.8% points less likely to work more than 60 h/week, and 27.5% points more likely to have side jobs.

Table 4 reports the estimation results of regression models to explain (log-transformed) annual earnings from the main job. Model I, which included only the binary variable for being female, showed that female physicians earn 35.4% less than their male counterparts. This result is roughly consistent with the data in Table 2;

Fig. 1. When we move to Model II, where variables for working hours, work schedules, and specialties are added as covariates, the gender earnings gap narrows only slightly to 25.0%. This suggests that while labor supply factors (working hours, work schedules, and specialties) influence earnings, they do not fully explain the gender disparity.

However, the addition in Model III of a binary variable for any career interruption due to childcare reduces the gender earnings gap substantially to just 9.7%, which is statistically insignificant. Experiencing a career interruption due to childcare incurs a substantial earnings penalty of 28.3%. One might suspect that the results depend on the definition of career interruption. We defined career interruption as one month or more, while Japan's maternity leave policy allows for up to one year of leave. To ensure the robustness of the estimation results, we estimated Model III with two alternative lengths of career interruption: three months or more and six months or more. The estimated coefficients for career interruption were -24.8% (standard error [SE]: 12.3%) and -28.7% (SE: 22.2%), respectively, both of which were significant (p<0.01) and close to the result for an interruption of one month or more (-28.3%). The estimated coefficients for being female were -11.6% (SE: 10.1%) and -10.4% (SE: 9.7%), respectively, and both were non-significant. These results underscore the importance of career interruptions rather than their duration.

Model IV specifically examined the influence of having children by including separate binary variables for female physicians with and without children. Female physicians with at least one child continued to experience a substantial earnings penalty, earning 37.2% less than the average male physician. In contrast, female physicians without children showed only a small and statistically insignificant decrease in earnings (4.4%) compared to their male counterparts. These results highlight that the overall gender gap in earnings is primarily driven by the disparity between male physicians and female physicians with children, rather than between all male physicians and all female physicians.

Table 5 reports the estimation results for total annual earnings, which includes income from both the main job and the side job. Similar to the findings for the main job earnings (Table 4), total earnings were significantly lower for female physicians compared to males. Model I showed a 34.2% reduction, and Model II showed a 25.5% reduction. However, unlike main job earnings, the negative association with being female persists even after controlling for career interruptions in Model III (19.7%).

Furthermore, the negative association between total earnings and being female with children (30.5%) was less pronounced compared to main job earnings. However, the negative association between total earnings and

Table 5 Estimation results of regression models to predict log-transformed total earnings ($N = 239$)

Model	I	II	III	IV
Female	-0.342*** (0.053)	-0.255*** (0.056)	-0.197* (0.069)	
Having had a career interruption due to childcare			-0.105 (0.085)	
Female with at least one child				-0.305*** (0.068)
Female with no child				-0.168* (0.068)
Controls				
Years since graduation	Yes	Yes	Yes	Yes
Work hours for all jobs	No	Yes	Yes	Yes
Work schedules for the main job	No	Yes	Yes	Yes
Specialties	No	Yes	Yes	Yes
R-squared	0.250	0.341	0.341	0.343

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

being female without children (16.8%) was statistically significant and even larger than what was observed for main job earnings (Table 4, Model IV). These findings suggest that having a side job mitigates the earnings loss for female physicians with children, but exacerbates it for those without children.

A higher proportion of female physicians with children (53.9%, Table 3) engaged in a side job compared to both male physicians (50.3%, Table 1) and female physicians without children (26.3%, Table 3). This suggests that female physicians with childcare responsibilities are more likely to seek side jobs, potentially due to the flexibility these positions provide. The side jobs enable them to compensate for their lower earnings from their main job.

Discussion

This study investigated the gender pay gap among physicians who graduated from a Japanese medical school, along with the factors contributing to it. Our key findings and their practical and policy implications are summarized as follows:

First, we confirmed a gender pay gap in physician salaries, mirroring findings of similar studies in other countries [15–21]. Female physicians earned approximately 75% of what male physicians did.

More importantly, our research revealed that motherhood plays a significant role in the overall gender pay gap. Female physicians with children experienced a substantial decrease (37.2%) in main job earnings compared to the average physician. In contrast, female physicians without children saw only a minor reduction (4.4%). The gender gap in main job earnings narrowed significantly

to 9.7% when we factored in career interruptions due to childcare.

These findings support Goldin's argument about the negative impact of motherhood on earnings in high-power professions, particularly due to childcare-related career interruptions [22, 23]. This partly stems from the unequal distribution of domestic responsibilities observed in our study: (i) 97.6% of female physicians have working spouses, compared to only 48.3% of male physicians; (ii) when the physician's spouse works, female physicians' spouses work an average of 51.4 h per week, while male physicians' work 27.6 h per week; and (iii) the average earnings of spouses for female physicians is 12.5 million JPY, whereas for male physicians' spouses it's 5.7 million JPY.

These findings indicate that female physicians often have spouses actively engaged in the labor market, while this is less common for male physicians' spouses. This gender disparity in domestic responsibilities undeniably hinders women, especially mothers, from reaching their full potential as physicians. Generally, married women in Japan bear the significant burden of housework and childcare. According to a study [26], the monetary value of health losses for women with multiple roles was 1.47 times the equivalent household income, which is higher than that for men with multiple roles. Therefore, reducing health losses for women in multiple roles may be possible if their spouses share the housework with them.

Third, the gender gap in total earnings provides a different picture when side job earnings are considered. While motherhood still leads to a significant reduction in earnings (30.5% compared to average male physicians), the negative impact is less pronounced compared to main job earnings alone. This difference likely stems from mothers working shorter hours in their main jobs and face disadvantages in promotions and opportunities [22, 23, 27]. Side jobs, offering more flexibility, become a viable option to compensate for the earnings shortfall in their main job. However, even with side jobs included, the gender gap in total earnings persists. This underscores the need for policy measures and workplace initiatives that especially address the challenges faced by female physicians with children in their primary jobs.

Several limitations are important to consider. First, the generalizability of our findings may be limited due to the relatively small sample size and the fact that data were collected from graduates of a single medical school. Specifically, the estimation results may be influenced by the characteristics of the current survey, including the overrepresentation of hospitalists and underrepresentation of physicians working in their private clinics. Considering previous studies that examined preferences and choices in the medical profession [28–30], such as the decision to work in a hospital versus private practice, it is possible

that graduates from SAMPED, a public medical university, may be more inclined to work as hospitalists than as physicians in private practice. This lower proportion of physicians in private practice in our study sample may have led to an underestimation of the gender pay gap, because physicians in private practice are more likely to be older men and tend to have higher annual earnings compared to hospitalists. Additionally, our study sample lacked information on the choice of medical facility, which has been found to be associated with increased selectivity for medical school admissions [30].

Second, while motherhood showed a significant negative impact on earnings, the specific mechanisms behind this penalty require further explanation. Our analysis suggests that gender differences in family responsibilities play a key role. Female physicians, especially those with children, tend to be assigned less demanding jobs and are expected to take on more family responsibilities, which likely leads to lower earnings compared to male physicians. Third, we did not fully address potential reverse causation. Female physicians with a stronger commitment to work may be less likely to have children or experience childcare interruptions. To mitigate this, we controlled for physician specialty and work schedules. Fourth, the impact of career interruptions on earnings might differ between generations. Younger cohorts may face fewer disadvantages due to more family-friendly workplace practices compared to older generations.

Despite these limitations, this study offers valuable insights into the gender gap in the Japanese medical profession. By exploring the negative impact of motherhood on female physicians' earnings, our findings resonate with research on women in high-power professions in other countries. This suggests that persistent constraints continue to limit the potential contributions of these women to society.

Conclusions

These results highlight the persistent negative impact of motherhood on female physicians' earnings in their primary jobs within the Japanese medical system. Remedial policy measures, such as enhanced childcare provisions and institutional support for returning to work, are necessary to address the disadvantages faced by these female medical professionals.

Abbreviation

SAPMED Sapporo Medical University

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Authors' contributions

SN and EU designed the research and collected and analyzed the data. EU and TO were the major contributors to the manuscript writing. NM and KT supervised and supported the study. All the authors have read and approved the final manuscript.

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Availability of data and materials

The datasets generated and analyzed during this study are not publicly available because they were licensed to the authors for use restricted to this study; however, they are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki and was approved by the SAPMED Ethics Committee (Approval No. 4-1-77). Participants provided informed consent, either electronically or in written form, before completing the questionnaire.

Consent for publication

Each participant was asked to provide a consent agreement allowing their data to be used in this study's publication.

Competing interests

The authors declare no competing interests.

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