


Original Article

Occupational stress and related factors among childless working women in their 20s–40s: A pregnancy perspective

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Abstract

Objectives: While women are expected to support Japan's labor force, they often quit their jobs because of pregnancy and childbirth. Occupational stress affects reproductive life events unique to women, including pregnancy intention and premature birth. This study aimed to examine occupational stress and its related factors among working women of reproductive age, especially from the perspective of pregnancy. **Methods:** This cross-sectional observational study involved a web survey of childless female workers aged 20–44 years, conducted in April–May 2019 in Japan. The survey items included the Brief Job Stress Questionnaire, demographic characteristics, and work-related variables. Logistic regression analysis was performed with physical and psychological stress reactions as dependent variables and demographic characteristics and work situation as control variables. **Results:** Of the 904 employees, 450 were pregnant. Physical stress reactions indicated that being pregnant and stress risk related to job control, interpersonal conflict, suitable jobs were significantly associated. Further, psychological stress reactions including stress risk related to job overload, job control, interpersonal conflict, and suitable jobs were significantly associated, but being pregnant was not. Among pregnant women, being in the first trimester and maternity harassment were significantly associated with physical and psychological stress reactions. **Conclusions:** To ensure that women in their prime continue working through pregnancy and after childbirth, gender-friendly social systems and workplaces free of harassment are required, as well as workplace support systems appropriate for each stage of pregnancy.

Keywords: life change events, occupational stress, perceived discrimination, pregnant women

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Introduction

The number of women in Japan's labor force has been increasing annually, and in 2021, women formed 44.6% of the total labor force, 2.6% more than the previous decade¹. Particularly, the labor force participation rate of women in the reproductive age group of 20–44 years has increased by approximately 10% compared to 10 years ago, ranging from 76.0% to 86.9%¹. This means that the

number of women who continue to work while pregnant is also increasing. However, Japan's total fertility rate was 1.30 in 2021, falling for the sixth consecutive year; the birthrate is also declining². The age at which Japanese women gave birth to their first child exceeded 30 in 2011 and has slightly increased since then, reaching an average of 30.7 in 2020³. To overcome the declining birthrate while maintaining the labor force, women wishing to have children must be able to conceive and give birth without obstacles and worries.

For such women, balancing work with the life events of pregnancy and childbirth is challenging. Therefore, nearly half of Japanese women (46.9%; 2010–2014) quit

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work after the birth of their first child, 21.9% after the birth of their second child, and 20.9% after the birth of their third child⁴). The reasons include a lack of understanding in the workplace, such as “I couldn’t find a way to work that would allow me to balance work and family,” “The atmosphere was not conducive to balancing work and family,” and “My work hours didn’t seem to suit my life.” Another challenge is the disadvantageous treatment and harassment owing to pregnancy^{5–7}).

An increasing number of women are having children later in life and are undergoing infertility treatment^{8,9}). In a 2017 survey, 95.6% of women with infertility treatment experience while working said it was “difficult to manage both”¹⁰). A 2018 survey found that 7.4% of women who underwent infertility treatment experienced harassment because of it¹¹). Of the women who were working at the start of infertility treatment, 16.7–50.1%, or one in 2–6, had left the workforce^{10,12,13}), with the lack of workplace support being one of the risk factors for leaving^{10,13}). Thus, women are subjected to various occupational stressors owing to pregnancy and childbirth. As high occupational stress is associated with job turnover^{14,15}), to counteract the loss of valuable labor, the issues faced by this generation of female workers must be addressed.

Occupational stress during pregnancy is associated with an increased risk of preterm birth, small for gestational age, and low birth weight¹⁶). A study examining the correlates of presenteeism and absenteeism in working pregnant women reported that occupational stress, such as work overload and job suitability, was significantly associated with presenteeism¹⁷). Meanwhile, a study examining the association between occupational stress and fertility outcomes found that women who perceived their jobs as more demanding were significantly less likely to become pregnant, and women in shift work were less likely to become pregnant¹⁸). Considering the above, the actual conditions must be examined, and occupational stress among women in their reproductive years and during pregnancy must be reduced¹⁹). A 2006 survey on occupational stress among pregnant women and mothers in Japan noted that 10.6% of female workers in their 20s–40s had physical stress responses, while 5.8% had psychological stress responses. Moreover, being pregnant was significantly associated with physical stress reactions²⁰). Although previous studies^{16,17}) have investigated the effects of occupational stress on pregnant women, they have not investigated how pregnancy itself affects occupational stress. Furthermore, some studies²⁰) did not adjust for the number of children or measure the impact of pregnancy alone. Thus, it can be inferred that childcare may impact occupational stress. Additionally, comparing pregnant and non-pregnant women in a group of childless women can clarify the impact of pregnancy on occupational stress, while excluding the effect of childcare.

From 2006 to the present, the environment surrounding

Japanese female workers has changed significantly. In 2006, Japan’s Equal Employment Opportunity Law was revised to prohibit dismissal or other disadvantageous treatment based on reasons such as pregnancy and childbirth²¹). Additionally, the 2015 Law for the Promotion of Women’s Activities²²) requires companies to assess the status of issues regarding women’s activities and analyze them, formulate action plans, including numerical targets based on this assessment, and publicize the plans internally. In 2010, the Japanese government launched the “Ikumen” Project²³), a public awareness campaign to foster social momentum for men to undertake childrearing responsibilities. As a result, the prevalence of male parental leave increased from 0.5% in 2005 to 7.48% in 2019²⁴).

Given these changes in social conditions, the workplace environment for women should be analyzed, particularly for pregnant women. In this regard, with the addition of men’s increased interest in childcare, occupational stress among working women of reproductive age is expected to be lower than that in 2006.

Thus, women’s work styles and positions in the workplace appear to have changed in recent years. Therefore, we determined the need to clarify the impact of pregnancy itself to add to the study conducted in 2006 and to include only first-time pregnant women. A systematic investigation of occupational stress among working women aged 20–44 in Japan is required to address women-specific issues including declining fertility rates and increasing rates of infertility treatment.

Therefore, this study aimed to examine the reality of occupational stress reactions among childless female workers in their reproductive years, together with their correlates. Specifically, we aimed to understand the factors affecting working women during pregnancy.

Methods

Study design and setting

A cross-sectional observational study was conducted with childless working women aged 20–44 years, from April to May 2019 in Japan. To obtain a large number of responses, the survey was not limited to a few companies or regions but covered all of Japan. Female workers were also recruited, regardless of region or company. The inclusion criterion for pregnant women was those experiencing pregnancy for the first time, and the exclusion criteria were multiple pregnancies, previous pregnancy or miscarriage, a pregnancy of fewer than 10 weeks, and being on prenatal leave. For non-pregnant working women, the inclusion criteria were being of a comparable age to pregnant women and having no children.

When conducting logistic regression analysis with stress response as the dependent variable, the proportion of those at high risk of stress was estimated to be 10–20%

from a previous study²⁰⁾, with a significance level of 0.05, an effect size of 0.8, resulting in a sample size of 405 persons per group (G*Power 3.1.9.2). In this study, we decided to recruit 500 pregnant and non-pregnant women each, anticipating that the final analysis would be conducted separately for the pregnant and non-pregnant groups and that the web survey would include apathetic or inappropriate responses.

Variables and measurements

All variables were measured using an online self-report questionnaire.

Occupational stress

Occupational stress was assessed using the 57-item Brief Job Stress Questionnaire (BJSQ)²⁵⁾, which measures physical and psychological stress reactions separately. Stress responses, job stressors, and social support were assessed based on the NIOSH Job Stress Model²⁶⁾. The BJSQ is widely used in Japan, at the recommendation of the Japanese Ministry of Health, Labour and Welfare^{25,27)}. Each response is rated on a scale of 1–4 (very much so, moderately so, somewhat, not at all), and dichotomized into “Yes” or “No.” By counting the number of items corresponding to “Yes,” the respondents are classified as a high-risk group with a high probability of suspected stress problems. Job overload, job control, interpersonal conflict, and suitable jobs were assessed as job stressors; physical and psychological stress reactions were assessed as stress reactions; and workplace support was assessed as a factor relevant to these relationships. Higher scores on the 1–4 scale indicate better stress status and lower stress. For items assessing stress reactions, respondents reporting 6/11 or more and 13/18 or more symptoms for physical stress reactions and psychological stress reactions, respectively, were categorized in the high-risk group.

Demographics and occupational characteristics

Data on age, education, marital status, gestational weeks (pregnant women only), employment status, number of employees in the workplace, shift work, work position, working hours per week, and information on maternity harassment (pregnant women only) were collected. The respondents were asked to indicate their experience of any “maternity harassment (pregnancy discrimination)” during their pregnancy, by selecting yes,” “a little,” “almost no,” or “no.” Those who selected “yes” or “a little” were considered to have maternity harassment.

Analysis

Descriptive statistics for the demographic characteristics and work factors were computed for the total population and separately for non-pregnant and pregnant women. Group comparisons were made to determine any

differences in physical and psychological stress responses with respect to demographic characteristics and occupational characteristics. After confirming normality with the Kolmogorov–Smirnov test, a t-test or one-way analysis of variance was performed for normally distributed variables and a Mann–Whitney U test or Kruskal–Wallis test for whenever the normality assumption was violated.

Next, to identify factors associated with occupational stress reactions, logistic regression analysis was conducted with physical and psychological stress reactions as dependent variables (group with high stress = 1, group with low stress = 0), and job overload, job control, interpersonal conflict, suitable jobs, and workplace support as independent variables. In the pregnant population, the period of pregnancy and maternity harassment were additional independent variables. Demographic and occupational characteristics were control variables. For multicollinearity among dependent variables, the absolute value of the correlation coefficient was < 0.8, and the variance inflation factor was < 10. A p-value < 0.05 indicated significance. All analyses were conducted using SPSS ver. 28 for Windows (IBM Corp., Armonk, NY, USA). The Tohoku University Graduate School Ethics Review Committee approved this study (2020-1-86).

Results

Responses were obtained from 918 participants who met the inclusion criteria. The final sample included 904 participants after excluding, as inappropriate responses, those who provided the same number of responses to all questions.

Table 1 shows the participants’ characteristics. The working women’s mean age was 32.3 (standard deviation [SD], 5.7) years; non-pregnant women’s mean age was 35.0 (SD, 6.0; range, 22–44) years, while that of pregnant women was 29.7 (SD, 3.9; range, 21–42) years. The mean number of weeks of pregnancy among pregnant women was 23.2 (SD, 7.2; range, 10–40) weeks, with 90 (20%), 212 (47.1%), and 148 (32.9%) in the first, second, and third trimesters, respectively. Approximately half (n = 512, 56.6%) were married: 98 (21.6%) non-pregnant and 414 (92.0%) pregnant women.

Regarding occupational stress, 22.8% (n = 206) of the total respondents had a physical stress reaction, while 27.8% (n = 125) of the pregnant women had a physical stress reaction. Psychological stress reactions were present in 20.9% (n = 189). Those with interpersonal conflict and job suitability were 249 (27.5%) and 184 (20.4%) overall, respectively. A slightly higher respondents’ rate (n = 153 [33.7%] and n = 113 [24.9%], respectively) was in the non-pregnant female workers. Additionally, while 417 (46.1%) of the total respondents noted the need for workplace support, 252 (55.5%) of the non-pregnant women, over half of the total respondents, called for it.

Table 1. Demographics of the participants

	All (n = 904)		Non-pregnant women n = (454)		Pregnant women (n = 450)	
	n	%	n	%	n	%
Age, years						
20s	334	36.9	97	21.4	237	52.7
30s	428	47.3	223	49.1	205	45.6
40s	142	15.7	134	29.5	8	1.8
Married (including common-law marriage)	512	56.6	98	21.6	414	92.0
Educated up to 12 years	436	48.2	203	44.7	233	51.8
Work more than 40 hours a week	524	58.0	274	60.4	250	55.6
Job type						
Clerical, civil servant	353	39.0	197	43.4	156	34.7
Professional, technical	144	15.9	58	12.8	86	19.1
Sales, service	259	28.7	129	28.4	130	28.9
Transport, production process, etc.	148	16.4	70	15.4	78	17.3
Full-time employment	464	51.3	226	49.8	238	52.9
Over 300 employees	276	30.5	135	29.7	141	31.3
Having job position	77	8.5	43	9.5	34	7.6
Shift work	199	22.0	93	20.5	106	23.6
Pregnancy period						
1st trimester					90	20.0
2nd trimester					212	47.1
3rd trimester					148	32.9
Maternity harassment						
Yes					81	18.0
BJSQ						
Job overload stress risk	357	39.5	175	38.5	182	40.4
Job control stress risk	375	41.5	187	41.2	188	41.8
Interpersonal conflict stress risk	249	27.5	153	33.7	96	21.3
Suitable jobs stress risk	184	20.4	113	24.9	71	15.8
Workplace support risk	417	46.1	252	55.5	165	36.7
Physical stress response high risk	206	22.8	81	17.8	125	27.8
Psychological stress response high risk	189	20.9	103	22.7	86	19.1

BJSQ, Brief Job Stress Questionnaire.

Table 2 shows a comparison of the physical and psychological stress response scores for each characteristic. Overall, significant differences were found for age and marital status in physical stress response scores, working hours in the psychological stress response score, and for stress risk related to job overload, job control, interpersonal conflict, suited jobs, and workplace support in both scores. Significant differences were found among non-pregnant women for workplace support and stress risk related to job overload, job control, interpersonal conflict, and suitable jobs in both scores.

For pregnant women, significant differences were found for working hours, number of employees in psychological stress response score, shift work, period of pregnancy, maternity harassment, stress risk related to job overload, job control, interpersonal conflict, and suitable jobs, and workplace support in both scores.

To determine the role of stress reactions within the high-risk group, logistic regression analysis was conducted with the physical and psychological stress reaction high-risk groups as dependent variables, and job overload, job control, interpersonal conflict, suitable jobs, and workplace support as independent variables. Pregnancy was considered an independent variable for the overall analysis; then, the pregnancy period and the presence of maternity harassment were considered independent variables in the pregnant women's group. Additionally, age, marital status, education, hours worked, job type, employment status, employee size, job position, and shift work were considered adjustment variables (see Table 3 and Table 4).

A high physical stress response was significantly associated with job control (odds ratio [OR] 1.93; 95% confidence interval [CI], 1.36–2.74), interpersonal conflict

Table 2. Characteristic-specific comparison of scores for physical and psychological stress reactions

	All (n = 904)						Non-pregnant women (n = 454)						Pregnant women (n = 450)					
	Physical stress response			Psychological stress response			Physical stress response			Psychological stress response			Physical stress response			Psychological stress response		
	mean	SD	<i>p-value</i>	mean	SD	<i>p-value</i>	mean	SD	<i>p-value</i>	mean	SD	<i>p-value</i>	mean	SD	<i>p-value</i>	mean	SD	<i>p-value</i>
All	2.97	0.65		2.70	0.63		3.06	0.65		2.68	0.65		2.87	0.63		2.71	0.61	
Age, years																		
20s	2.91	0.65	0.023 ^a	2.66	0.61	0.322 ^a	3.06	0.61	0.776 ^a	2.63	0.57	0.343 ^a	2.85	0.66	0.856 ^a	2.67	0.63	0.385 ^a
30s	2.96	0.65		2.71	0.63		3.03	0.69		2.67	0.67		2.89	0.60		2.75	0.58	
40s	3.10	0.61		2.74	0.65		3.10	0.61		2.75	0.66		3.00	0.54		2.59	0.46	
Marriage																		
Married (including common-law marriage)	2.90	0.64	<0.001 ^b	2.72	0.62	0.264 ^b	3.07	0.63	0.602 ^b	2.67	0.64	0.348 ^b	2.97	0.92	0.214 ^b	2.55	0.72	0.336 ^b
Single	3.07	0.64		2.66	0.64		3.01	0.72		2.72	0.68		2.87	0.61		2.71	0.60	
Education																		
Educated up to 12 years	2.95	0.63	0.149 ^b	2.67	0.64	0.388 ^b	3.05	0.61	0.404 ^b	2.68	0.67	0.892 ^b	2.82	0.62	0.068 ^b	2.67	0.62	0.278 ^b
Educated less than 12 years	2.99	0.67		2.72	0.61		3.06	0.69		2.69	0.63		2.92	0.64		2.74	0.60	
Working hours																		
Work less than 40 hours a week	2.97	0.64	0.708 ^b	2.73	0.63	0.008 ^b	3.05	0.67	0.795 ^b	2.70	0.66	0.260 ^b	2.90	0.60	0.176 ^b	2.75	0.60	0.007 ^b
Work more than 40 hours a week	2.94	0.67		2.59	0.62		3.09	0.59		2.63	0.63		2.77	0.72		2.55	0.62	
Job type																		
Clerical, civil servant	2.96	0.66	0.162 ^a	2.70	0.60	0.847 ^a	3.05	0.66	0.543 ^a	2.71	0.60	0.745 ^a	2.85	0.64	0.438 ^a	2.69	0.61	0.874 ^a
Professional, technical	2.97	0.61		2.71	0.59		3.12	0.56		2.69	0.63		2.87	0.63		2.72	0.58	
Sales, service	3.02	0.65		2.70	0.66		3.10	0.62		2.69	0.68		2.93	0.66		2.72	0.64	
Transport, production process, others	2.87	0.64		2.65	0.67		2.94	0.73		2.58	0.74		2.81	0.55		2.72	0.59	
Employment state																		
Full-time employment	2.94	0.66	0.438 ^b	2.67	0.61	0.277 ^b	3.04	0.67	0.882 ^b	2.68	0.65	0.914 ^b	3.04	0.67	0.455 ^b	2.68	0.65	0.136 ^b
Part-time employment	2.99	0.63		2.72	0.65		3.07	0.63		2.69	0.65		3.07	0.63		2.69	0.65	
Employee size																		
Less than 300 employees	2.97	0.63	0.719 ^b	2.68	0.63	0.162 ^b	3.09	0.60	0.258 ^b	2.69	0.64	0.999 ^b	2.85	0.64	0.306 ^b	2.67	0.61	0.044 ^b
Over 300 employees	2.95	0.68		2.74	0.63		2.98	0.75		2.68	0.67		2.93	0.60		2.79	0.58	
Job position																		
No	2.96	0.64	0.657 ^b	2.69	0.63	0.671 ^b	3.05	0.64	0.443 ^b	2.67	0.65	0.216 ^b	2.88	0.63	0.650 ^b	2.71	0.61	0.421 ^b
Yes	2.99	0.69		2.72	0.63		3.11	0.70		2.79	0.66		2.84	0.65		2.63	0.59	

Table 2. (Continued)

	All (n = 904)						Non-pregnant women (n = 454)						Pregnant women (n = 450)					
	Physical stress response			Psychological stress response			Physical stress response			Psychological stress response			Physical stress response			Psychological stress response		
	mean	SD	p-value	mean	SD	p-value	mean	SD	p-value	mean	SD	p-value	mean	SD	p-value	mean	SD	p-value
Shift work																		
No	2.97	0.65	0.582 ^b	2.71	0.63	0.216 ^b	3.06	0.67	0.708 ^b	2.70	0.66	0.197 ^b	2.88	0.62	<0.001 ^b	2.72	0.60	<0.001 ^b
Yes	2.95	0.63		2.65	0.62		3.06	0.58		2.60	0.61		2.86	0.66		2.68	0.62	
Pregnancy period																		
1st trimester													2.73	0.61	0.004 ^a	2.54	0.63	0.005 ^a
2nd trimester													2.97	0.62	1st < 2nd	2.79	0.61	1st < 2nd
3rd trimester													2.82	0.63		2.69	0.57	
Maternity harassment																		
No													2.93	0.59	<0.001 ^b	2.78	0.57	<0.001 ^b
Yes													2.60	0.72		2.40	0.67	
Job overload stress risk																		
No	3.01	0.65	0.002 ^b	2.77	0.61	<0.001 ^b	3.09	0.66	0.046 ^b	2.78	0.63	<0.001 ^b	2.92	0.64	0.026 ^b	2.77	0.60	0.006 ^b
Yes	2.90	0.63		2.57	0.64		3.00	0.64		2.54	0.66		2.80	0.61		2.61	0.61	
Job control stress risk																		
No	3.05	0.60	<0.001 ^b	2.82	0.58	<0.001 ^b	3.13	0.60	0.016 ^b	2.82	0.60	<0.001 ^b	2.97	0.60	<0.001 ^b	2.81	0.57	<0.001 ^b
Yes	2.85	0.69		2.52	0.65		2.96	0.71		2.48	0.67		2.74	0.65		2.56	0.63	
Interpersonal conflict stress risk																		
No	3.02	0.64	<0.001 ^b	2.79	0.61	<0.001 ^b	3.12	0.65	<0.001 ^b	2.80	0.63	<0.001 ^b	2.93	0.61	<0.001 ^b	2.78	0.59	<0.001 ^b
Yes	2.83	0.65		2.46	0.62		2.94	0.64		2.46	0.64		2.67	0.65		2.45	0.60	
Suitable jobs stress risk																		
No	3.01	0.61	<0.001 ^b	2.78	0.60	<0.001 ^b	3.12	0.62	0.001 ^b	2.78	0.62	<0.001 ^b	2.92	0.60	0.002 ^b	0.57	0.03	<0.001 ^b
Yes	2.78	0.73		2.36	0.64		2.88	0.70		2.39	0.64		2.63	0.75		0.64	0.08	
Workplace support																		
No	3.04	0.61	<0.001 ^b	2.81	0.60	<0.001 ^b	3.17	0.62	<0.001 ^b	2.84	0.63	<0.001 ^b	2.94	0.58	0.012 ^b	2.57	0.64	<0.001 ^b
Yes	2.89	0.68		2.56	0.64		2.96	0.66		2.56	0.64		2.76	0.69		2.71	0.61	

SD, standard deviation.

Physical stress response and psychological stress response (range: 1–4, higher scores indicate lower stress)

^a Kruskal-Wallis test^b Mann-Whitney U test

Table 3. Odds ratios for physical stress response by high risk (= 1) and non-risk (= 0)

	All (n = 904)					Non-pregnant women (n = 454)					Pregnant women (n = 450)				
	B	<i>p-value</i>	OR	95% CI		B	<i>p-value</i>	OR	95% CI		B	<i>p-value</i>	OR	95% CI	
				Lower	Upper				Lower	Upper				Lower	Upper
Job overload stress risk	−0.04	0.814	0.96	0.67	1.38	0.11	0.710	10.11	0.63	1.97	−0.21	0.415	0.81	0.48	1.35
Job control stress risk	00.66	<0.001	1.93	1.36	2.74	00.75	0.008	2.11	1.21	30.67	0.57	0.017	1.77	1.11	2.84
Interpersonal conflict stress risk	0.71	<0.001	2.03	1.41	2.92	0.47	0.084	10.60	0.94	2.72	0.91	<0.001	2.49	1.45	4.27
Suitable jobs stress risk	0.53	0.008	1.70	1.15	2.52	0.41	0.161	10.51	0.85	2.69	0.63	0.031	1.89	1.06	3.36
Workplace support	00.23	0.204	1.25	0.89	1.77	00.43	0.137	1.53	0.87	20.69	0.04	0.877	1.04	0.65	1.66
Pregnancy (no = 0, yes = 1)	0.78	0.004	2.18	1.28	3.71										
Pregnancy period															
1 st trimester											0.97	0.001	2.64	1.47	4.72
2 nd trimester (ref)											—	—	—	—	—
3 rd trimester											0.47	0.073	1.60	0.96	2.69
Maternity harassment (no = 0, yes = 1)											0.65	0.031	1.92	1.06	3.47
Coefficient of determination 77.7%					Coefficient of determination 81.3%					Coefficient of determination 76%					

CI, confidence interval; OR, odds ratio.

As control variables, age, marriage, education, working time, job type, employment state, employee size, job position, shift work

Table 4. Odds ratios for psychological stress response by high risk (= 1) and non-risk (= 0)

	All (n = 904)					Non-pregnant women (n = 454)					Pregnant women (n = 450)				
	B	<i>p-value</i>	OR	95% CI		B	<i>p-value</i>	OR	95% CI		B	<i>p-value</i>	OR	95% CI	
				Lower	Upper				Lower	Upper				Lower	Upper
Job overload stress risk	0.57	0.003	1.77	1.21	2.57	0.45	0.097	1.57	0.92	2.67	0.69	0.024	1.99	1.10	3.63
Job control stress risk	0.50	0.008	1.64	1.14	2.36	0.57	0.032	1.76	1.05	2.95	0.47	0.096	1.61	0.92	2.80
Interpersonal conflict stress risk	0.65	<0.001	1.91	1.32	2.76	0.80	0.002	2.28	1.35	3.63	0.24	0.453	1.27	0.68	2.39
Suitable jobs stress risk	0.93	<0.001	2.54	1.71	3.78	0.96	<0.001	2.61	1.51	4.52	1.13	<0.001	3.10	1.63	5.88
Workplace support	0.25	0.181	1.28	0.89	1.84	0.14	0.598	1.15	0.68	1.94	0.27	0.324	1.31	0.76	2.26
Pregnancy (no = 0, yes = 1)	0.07	0.807	1.07	0.63	1.82										
Pregnancy period															
1st trimester											0.97	0.004	2.65	1.36	5.15
2nd trimester (ref)											—	—	—	—	—
3rd trimester											0.12	0.714	1.12	0.60	2.09
Maternity harassment (no = 0, yes = 1)											1.01	0.002	2.75	1.45	5.21
Coefficient of determination 78.9%					Coefficient of determination 79.3%					Coefficient of determination 82.2%					

CI, confidence interval; OR, odds ratio.

As control variables, age, marriage, education, working time, job type, employment state, employee size, job position, shift work

(OR 2.03; 95% CI, 1.41–2.92), suitable jobs (OR 1.70; 95% CI, 1.15–2.52), and being pregnant women (OR 2.18; 95% CI, 1.28–3.71). Contrastingly, a high psychological stress reaction was significantly associated with job overload (OR 1.77; 95% CI, 1.21–2.57), job control (OR 1.64; 95% CI, 1.14–2.36), interpersonal conflict (OR 1.91; 95% CI, 1.32–2.76), and suitable jobs (OR 2.54; 95% CI, 1.71–3.78), while being pregnant was not significantly associated.

For the next analysis, we divided the participants into two groups: non-pregnant and pregnant women. Among non-pregnant women, only job control (OR 2.11; 95% CI, 1.21–3.67) was significantly associated with a high physical stress reaction. Job control (OR 1.76; 95% CI, 1.05–2.95), interpersonal conflict (OR 2.28; 95% CI, 1.35–3.63), and suitable jobs (OR 2.61; 95% CI, 1.51–4.52) were significantly associated with a high psychological stress reaction.

Among pregnant women, a high physical stress response was significantly associated with job control (OR 1.77; 95% CI, 1.11–2.84), interpersonal conflict (OR 2.49; 95% CI, 1.45–4.27), suitable jobs (OR 1.89; 95% CI, 1.06–3.36), period of pregnancy (first trimester, OR 2.64; 95% CI, 1.47–4.72), and maternity harassment (OR 1.92; 95% CI, 1.06–3.47). A tendency, toward higher physical stress in the third trimester compared with the second trimester was noted, but it was not statistically significant.

A high psychological stress reaction was significantly associated with job overload (OR 1.99; 95% CI, 1.10–3.63), suitable jobs (OR 3.10; 95% CI, 1.63–5.88), period of pregnancy (first trimester, OR 2.65; 95% CI, 1.36–5.15), and maternity harassment (OR 2.75; 95% CI, 1.45–5.21).

Discussion

This study investigated occupational stress in 904 female workers, including 450 pregnant women. Accordingly, the physical stress reaction score indicated that being pregnant and stress risk related to job control, interpersonal conflict, and suitable jobs were significantly associated. Furthermore, psychological stress reaction scores, including stress risk related to job overload, job control, interpersonal conflict, and suitable jobs, were significantly associated with pregnancy. Among pregnant women, being in the first trimester and maternity harassment were significantly associated with physical and psychological stress reactions.

Overall, 22.8% ($n = 206$) of the respondents had a physical stress reaction, while 27.8% ($n = 125$) of the pregnant women had a physical stress reaction. Psychological stress reactions were present in 20.9% ($n = 189$) of the total respondents. These figures are considerably higher than those reported in a 2006 Japanese study of

approximately 2,600 working women under 45 years of age, in which 10.6% and 5.8% had physical and psychological stress responses, respectively²⁰. The physical stress response score in a 2012 survey of Japanese female workers was 2.89 (SD, 0.61), while the psychological stress response score was 3.18 (SD, 0.54)²⁸. The physical stress reaction score of 2.97 (SD, 0.65) for female workers in this study is higher than those for female workers nationwide, indicating a low stress state. However, the psychological stress reaction score was low at 2.70 (SD, 0.63), indicating a high state of psychological stress. We predicted that Japanese women's workplace stress would be lower owing to activities for men's participation in childcare (Ikumen Project²³) since 2010. However action guidelines for promoting work–life balance²⁹ and numerical targets by 2020 were established in 2010, and the enactment of the Act on Promotion of Women's Participation and Advancement in the Workplace in 2015²². Accordingly, contrary to what we expected, a higher percentage of participants were at high risk for physical and psychological stress, a slightly lower percentage for physical stress, and a higher proportion for psychological stress. In a 2017 survey of 600 small and medium-sized companies³⁰, only 1.5% of the companies felt that they were making progress in promoting women's activities, and the lack of a workplace environment where they help each other was the primary challenge. Furthermore, a 2018 survey of 4,600 full-time employees aged 25–45³¹ found that 60–70% of female and male employees felt that their workplaces are making efforts to promote women's activities. However, approximately 30% of female and male employees, especially 40% of male managers, deemed these efforts ineffective. That is, despite establishing various systems, these efforts have not penetrated into the workplace culture, suggesting that the workplace environment is not conducive for women, due to which they are likely to experience psychological stress.

In addition to interpersonal conflict and suitable jobs, being pregnant was associated with factors related to the high risk of physical stress reactions, similar to a 2006 study²⁰. The difference is that the OR for being pregnant was 1.61 in 2006, compared to 2.18 in the current survey. One would expect the workplace environment for pregnant women to be well maintained, but this is not the case, indicating that pregnant women are experiencing physical stress. Additionally, the age at which women give birth to their first child has increased from 28.2 years (2006) to 30.7 years (2020), suggesting that the physical burden of pregnancy on women may be increasing owing to the trend toward later childbearing.

Stress risks related to job overload, interpersonal conflict, and suitable jobs were significantly associated with a high risk of psychological stress reactions, while being pregnant was not. These results were similar to those of the 2006 survey. The results clarify the significant physi-

cal burden of being pregnant on working women. Interpersonal conflict and suitable jobs were commonly associated with physical and psychological stress responses as high-risk factors. Job suitability was significantly associated with work engagement among working women under 40 years of age¹⁴. Furthermore, interpersonal stress among working women is associated with the presence of depression⁵. There is, hence, a clear need to provide support for work compatibility and interpersonal stress.

This study identified a new factor in physical and psychological stress reactions (job control) that was not identified in the 2006 study²⁰. Job control stress is related to the ability to decide the order and manner of one's work, to work at one's own pace, and to ensure that one's opinions are reflected in work policies. There are two possible reasons for this result: first, the employment status of the respondents differed. In the 2006 study, 83.4% of the respondents worked full-time, whereas in this study, only 51.3% worked full-time. This means that approximately half of the women were working part-time, and part-time workers experience difficulties related to working at their own pace and reflecting their own opinions on work policies. Another reason is that the increase in the labor force participation rate of women aged in their 20s and 30s — for whom marriage, pregnancy, and childcare are major life events — may have increased the number of women with relative stress related to job control. Women of these age groups must balance household and workplace. To do so, they must finish their work in a limited amount of time. This may cause stress related to job control due to the inability to work at their own pace. Significantly, women are more likely than men to have trouble balancing household and workplace³², and the percentage of women in management remains low at 14.8%³³, suggesting that stress is caused by the inability to control work in an environment dominated by male bosses.

The results revealed that being in the first or third trimester and maternal harassment were associated with a high risk of physical and psychological stress reactions among pregnant women. This is the first study to identify occupational physical and psychological stress reactions by period of pregnancy, thus enhancing the literature on this topic.

The first trimester is when the first physical changes of pregnancy are experienced, especially by first-time mothers. It involves rapid hormonal changes, including increases in human chorionic gonadotropin, estrogen, and progesterone, which cause morning sickness, fatigue, poor sleep, and daytime sleepiness³⁴⁻³⁶. In addition to physical changes, the first trimester is a period of increased anxiety owing to various factors, including the threat of miscarriage^{37,38}. First-time mothers also need to adjust to balancing pregnancy and work. The first trimester is, therefore, a particularly stressful period, both physically and psychologically. Furthermore, pregnancy

disclosure may not be easy at the workplace³⁹. Based on the above aspects, employers need to create a workplace atmosphere that facilitates pregnancy disclosure, includes occupational stress assessments at each period of pregnancy, and provides a support system tailored to each period.

Interestingly, while the third trimester is a physically strenuous period owing to factors such as abdominal enlargement, compared to the second trimester, there was no significant difference or a trend association in physical stress responses. This lack of difference could be explained by women taking prenatal leave before being significantly affected by abdominal enlargement. Additionally, several pregnancy-related screening items suggest that the course of pregnancy varies widely depending on the background risks faced by the individual^{40,41}. This means that some women have more physical stress responses in the third trimester than in the second trimester, while others have a more stressful response during the first/second trimesters. Thus, a support system is needed for each period of pregnancy. Simultaneously, the course of the pregnancy and the factors that are perceived as stressful must be addressed on an individual basis.

Among pregnant women, experiencing maternity harassment was significantly associated with a high risk of physical and psychological stress reactions. Maternity harassment still exists, with 26.3% of women experiencing it in recent surveys⁶. The surveys further noted that 69.2% of women felt angry, frustrated, or anxious due to the harassment, and 52.9% felt less motivated to work. Additionally, some gave up access to social resources, such as light duty changes and healthcare measures during pregnancy, owing to harassment (16.3% and 15.2%, respectively). This means that social programs to reduce the burden on working pregnant women are not being utilized. A study of 199 working pregnant women reported that perceived pregnancy discrimination is associated with perceived stress, as well as postpartum depressive symptoms⁴². In sum, the presence of maternity harassment is associated with both physical and psychological stress reactions in working pregnant women, although the effects vary, making it important to address maternity harassment.

A limitation of this study is that we did not include women who resigned after pregnancy. Therefore, these women's occupational stress has not been clarified and is a subject for future study. Additionally, we did not include women who resigned owing to infertility treatment; this factor should also be researched in the future. Third, the cross-sectional nature of this study precludes causal inferences. Furthermore, the survey was conducted before the novel coronavirus disease 2019 outbreak. During the pandemic, work styles changed in various ways; for example, working from home became increasingly common⁴³. It is, therefore, possible that the occupational stress of women of reproductive age now differs, in line with the different

work styles; this must be considered when interpreting the current results.

Despite these limitations, we could elucidate the current occupational stress among working women in their reproductive years related to pregnancy and childbirth in Japan. Specifically, we identified factors related to occupational stress among pregnant women, which are difficult to grasp at the company level. Moreover, this is the first report in Japan to show that occupational stress differs by period of pregnancy and that maternity harassment is significantly associated with physical and psychological stress reactions, even after adjusting for age and occupation. The study findings may guide companies to provide support and reduce occupational stress for pregnant women. As occupational stress can lead to retirement^{14,15}, we expect that measures to address the identified factors will help women continue working even after pregnancy and childbirth.

Conclusion

This study clarified the current situation of occupational stress and related factors among Japanese working women in their reproductive years, focusing on the life event of pregnancy. Accordingly, being pregnant and stress risk related to job control, interpersonal conflict, and suitable jobs were factors associated with a high risk of physical stress reactions. Contrastingly, stress risk related to job overload, job control, interpersonal conflict, and job suitability was associated with a high risk of psychological stress reactions. Among pregnant women, the period of pregnancy (first trimester) and maternity harassment were associated with physical and psychological stress reactions. Therefore, support measures addressing specific periods of pregnancy are required for working pregnant women, and a workplace free of maternity harassment must be created. In Japan, the Law for the Promotion of Women's Activities was revised in 2019, making the disclosure of information on women's activities obligatory. From April 2022, the law was expanded to employers with 101 or more full-time workers. This means that many companies will be required to report their performance regarding the development of work environments conducive to balancing work and family life for women; the factors identified in this study regarding occupational stress can thus be useful.

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Authors' contributions

Conceptualization, Y.N., Y.S.T., K.N., and T.Y.;

Methodology, Y.N., Y.S.T., and Y.T.; Formal Analysis, Y.N. and Y.S.T.; Investigation, Y.N.; Data Curation, Y.T., Y.N., and A.W.; Writing—Original Draft Preparation, Y.N.; Writing—Review & Editing, Y.T., A.W., M.K., M.Y., and T.Y.; Supervision, T.Y. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare that there are no conflicts of interest.

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