International Journal of Clinical Oncology (2019) 24:313–322
https://doi.org/10.1007/s10147-018-1350-z

ORIGINAL ARTICLE

Factors related to cervical cancer screening among women of childrearing age: a cross-sectional study of a nationally representative sample in Japan

Misato Kaso[1,2] · **Yoshimitsu Takahashi**[1] · **Takeo Nakayama**[1]

Received: 30 August 2018 / Accepted: 27 September 2018 / Published online: 1 October 2018

Abstract

Background This study aimed to determine the factors related to undergoing cervical cancer screening among Japanese women of childrearing age by focusing on the presence or absence of children.

Methods This was a cross-sectional study of a nationally representative sample based on the Comprehensive Survey of Living Conditions in Japan. Data for women aged 20–39 were selected, and those whose number of children was unknown, whose youngest child was under 2 years or of unknown age, who were either hospitalized or institutionalized, and who were pregnant were excluded. To determine the factors related to undergoing cervical cancer screening, multivariable logistic regression analysis was performed on the following variables: status of cervical cancer screening, age, number of children, marital status, educational level, cohabitation with parents, employment status, subjective health awareness, hospital use, health check-ups, subjective symptoms of health, and interaction of women's age and number of children.

Results Of the 49,217 women in the analyses, 19,545 (39.7%) underwent cervical cancer screening within the last 2 years. Undergoing cervical cancer screening increased with advancing age. On comparing women with and without children in the same generation, screening rates among women with children were higher than those without children in their early 20s, the same in their late 20s, and lower in their 30s. Receiving health check-ups, higher education, subjective symptoms, and hospital use increased participation in cervical cancer screening.

Conclusions Although women of childrearing age tended to undergo cervical cancer screening with advancing age, the increase tended to be restrained among mothers.

Keywords Cervical cancer screening · Women's health · Childrearing

Introduction

Although the incidence of cervical cancer has declined because of the human papillomavirus vaccine and cervical cancer screening, it remains the fourth most common cancer among women globally [1, 2]. The morbidity rate of cervical cancer in Japan has been increasing in recent years [3] and the cervical cancer population is shifting towards a younger age group with women engaging in sexual intercourse at an earlier age [4]. There has been a rapid rise in cervical cancer among women in their 20s and the peak in seen in women in their early 40s in Japan [5, 6]. For women under 40, child-bearing age, the morbidity rate of cervical cancer (including carcinoma in situ) is the highest, and the mortality rate is the second highest after breast cancer [5, 7].

Detecting cervical cancer through cytological diagnosis before cancer cells develop is an easy process. The 5-year

✉ Misato Kaso
kaso.misato.32r@st.kyoto-u.ac.jp

Yoshimitsu Takahashi
y-takahashi@umin.ac.jp

Takeo Nakayama
nakayama.takeo.4a@kyoto-u.ac.jp

[1] Department of Health Informatics, Kyoto University School of Public Health, Kyoto University, Yoshida Konoe-cho, Sakyo-ku, Kyoto, Kyoto 606-8501, Japan

[2] Department of Nursing, Faculty of Health Sciences, Morinomiya University of Medical Sciences, 1-26-16 Nankou Kita, Suminoe-ku, Osaka, Osaka 559-8611, Japan

survival rate of cervical cancer is over 90% in Japan if it is contained within the organ; however, it decreases to under 20% if it invades and metastasizes to distant organs and lymph nodes [8]. Therefore, cervical cancer screening is recommended every 3 years for women aged 21–64 in the United States [9, 10], every 2 years for women aged 25–49 in the United Kingdom [11], and every 2 years for women aged 20 and above in Japan [12, 13]. Cervical cancer screening rates in western countries range from 70 to 80% [14]. While the cytological Papanicolaou smear test is one of the standard routine pregnancy tests in Japan [15], the 2-year cervical cancer screening rate is only 42% [16], one of the lowest among the Organisation for Economic Co-operation and Development countries [14].

Factors inhibiting undergoing cervical cancer screening are low socio-economic status [17–19], lack of knowledge and anxiety towards the screening test and cervical cancer, time and cost, reluctance towards examination of reproductive organs, aversion to obstetrics and gynecology, and insufficient screening environments [20–23]. Furthermore, it was demonstrated that the cervical cancer screening rate is higher among multipara than primipara [24–26]. However, no studies examining factors affecting cervical cancer screening among women of child rearing age have been conducted.

95% of all births in Japan are by mothers in their 20s and 30s [7], meaning that the common age for pregnancy, birth and childrearing is also the common age for cervical cancer. Therefore, it is important to women's health and family and social matters that women in their childrearing age undergo appropriate screening tests for early detection of cervical cancer. The purpose of this study was to determine the factors related to undergoing cervical cancer screening among Japanese women aged 20–39, in childrearing age, by focusing on the presence or absence of children.

Materials and methods

Design and data sources

We conducted a cross-sectional study using data from the Comprehensive Survey of Living Conditions 2013 [16]. This survey is implemented by Japan's Ministry of Health, Labor and Welfare every 3 years, and consists of self-administered questionnaires about the household, health, nursing care, income, and savings. The target population based on household and health factors in 2013 was extracted from a stratified random sampling of all households (295,000 households) and household members (740,000 household members).

Study subjects

Data for women aged 20–39 years were selected for analysis because this generation has the highest proportion of women who are rearing infants and young children in Japan [7]. Data for women were excluded when the presence or absence of children was unknown, the age of the youngest child was unavailable, and the status of cervical cancer screening was not available due to the women being either hospitalized or institutionalized (including those with missing information). In addition, pregnant women and women whose youngest child was under 2 years old were also excluded because cervical cancer screening is included in routine pregnancy tests in Japan [15] and the objective variable was whether or not a woman underwent a test within the last 2 years.

Statistical analysis

The main outcome was whether or not a woman underwent cervical cancer screening within the last 2 years. The following variables were used in the analyses: age of the women, marital status, educational level, status of cohabitation with parents, employment status, subjective symptoms of health, status of hospital use (visiting a hospital when sick or injured), subjective health awareness, and status of health check-ups (completing a comprehensive medical examination (Ningen Dock) or regular health check-up in the past year). Moreover, in the case that the women had children, the age and number of children were also used.

The age and educational level variables were divided into four categories each. Women's age was divided into categories of 20–24 years old, 25–29 years old, 30–34 years old and 35–39 years old, and educational level was divided into categories of 'elementary, junior high school or high school', 'vocational school, junior college or technical college', 'university or graduate school' and 'dummy' for missing data. Other variables were divided into three categories as follows: marital status (single, divorced or widowed, married); mean working hours per day (less than 8 h, 8 h, more than 8 h); and subjective health awareness ('good, slightly good', 'normal', 'slightly poor, poor'). The other variables were divided into two categories depending on the presence or absence of children, employment, cohabitation with parents, mental and physical subjective symptoms, status of hospital use, and status of health check-ups.

After each item was summarized using descriptive statistics, univariable logistic regression analysis was used to investigate the relationship with cervical cancer screening.

After checking the multicollinearity, forced-entry multivariable logistic regression analysis was performed. Analyses without interaction consisting of women's age and number of children were treated as model 1, and analyses including interaction were treated as model 2. In addition, analyses to calculate odds ratios (ORs) and 95% confidence intervals (CIs) for cervical cancer screening by women's age and number of children were treated as model 3. Missing data were excluded from analysis, with the exception of missing data for educational level, which was treated as a single dummy variable. The significance level was set at 5%. SPSS Version 23 was used for all analyses.

Ethical considerations

Under the provision of Article 33 of the Statistics Act [27], unlinkable anonymized data were obtained. This protocol was approved by the Kyoto University Graduate School and Faculty of Medicine Ethics Committee (no. 1077-1) and the Kansai University of Health Sciences Ethics Committee (approval no. 14–39).

Results

Process of selecting subjects

We obtained data from 234,383 households and 603,211 individuals (Fig. 1). According to the eligibility criteria, 62,260 women between the ages of 20 and 39 years old were selected. We excluded data for women if we could not confirm whether they had children or not from their family status information. Furthermore, women who were hospitalized or institutionalized, women with a youngest child of unknown age or under 2 years old, and pregnant women were also excluded. Finally, 49,217 women were selected for analysis.

Subject attributes

A total of 19,545 women (39.7%) had undergone cervical cancer screening within the last 2 years (Table 1). The mean age of the women was 30.8 years [standard deviation (SD) 5.9]. A total of 36.9% of the women had children and 63.6% of them had children under 6 years old. 43.5% were married and 51.5% were single. As for educational background, high school (33.7%) was the most common

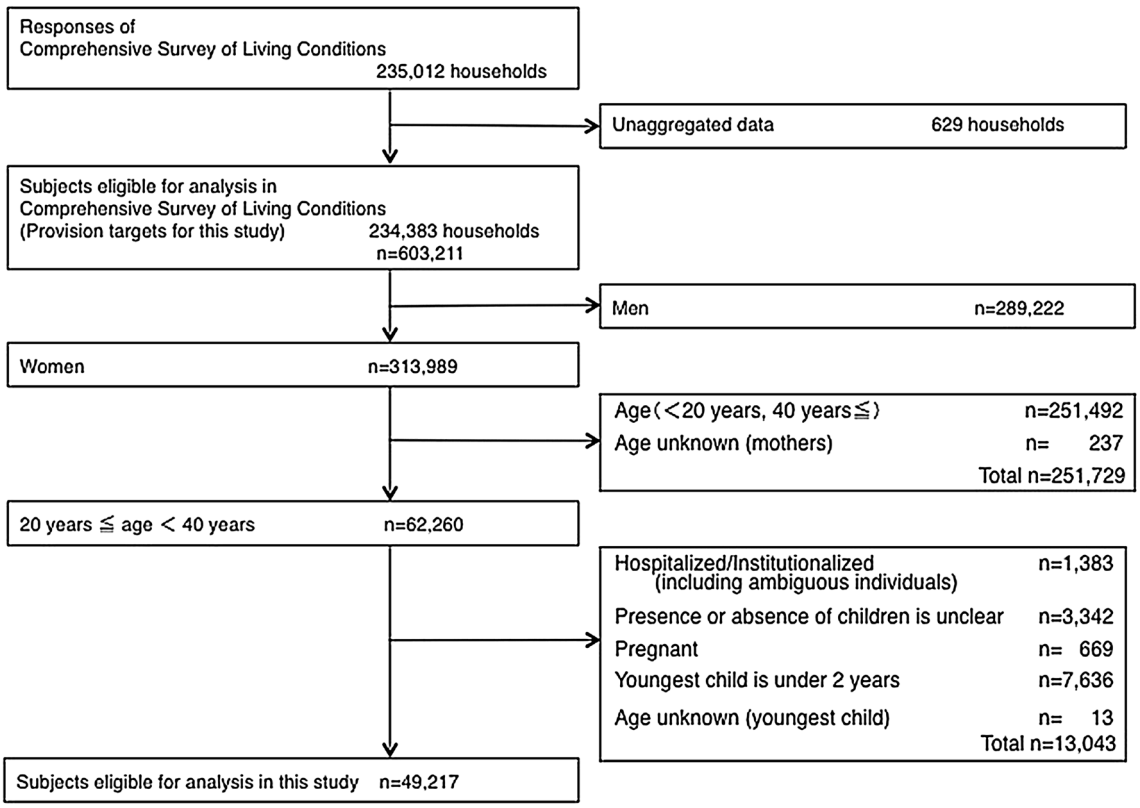

Fig. 1 Process for selecting study subjects

Table 1 Subject attributes

	n	%	Average (SD)
Cervical cancer screening within the last 2 years	49,217		
No	29,672	60.3	
Yes	19,545	39.7	
Age of women (years)	49,217		30.8 (5.9)
20–24	10,000	20.3	
25–29	10,128	20.6	
30–34	12,012	24.4	
35–39	17,077	34.7	
No. of children	49,217		0.7 (1.0)
0	31,062	63.1	
1	6118	12.4	
2	8907	18.1	
More than 2	3130	6.4	
Age of youngest child	18,155		5.9 (3.5)
2–6 years	11,542	63.6	
7–12 years	5603	30.9	
More than 12 years	1010	5.6	
Marital status	49,217		
Single	25,350	51.5	
Married	21,402	43.5	
Divorced	2365	4.8	
Widowed	100	0.2	
Student or graduate	45,977		
Student	3081	6.7	
Graduate	42,872	93.2	
Not yet entered school	24	0.1	
Educational level[a]	44,834		
Elementary school, junior high school	1675	3.7	
High school	15,104	33.7	
Vocational school	7884	17.6	
Junior college, technical college	7690	17.2	
University	11,756	26.2	
Graduate school	725	1.6	
Cohabitation with parents	49,217		
No	24,151	49.1	
Yes	25,066	50.9	
Employment status	48,628		
Employed	36,423	74.9	
Housework	7881	16.2	
Attending school	2176	4.5	
Other	2148	4.4	
Type of employment	36,179		
Full-time employee	18,120	50.1	
Part-time employee	11,076	30.6	
Temporary employee	3794	10.5	
Other employee	368	1.0	
Executive level	441	1.2	
Self-employment, work at home	1947	5.4	
Other	433	1.2	
Mean working hours per day	34,729		
Under 8 h	13,726	39.5	

Table 1 (continued)

	n	%	Average (SD)
8 h	11,306	32.6	
More than 8 h	9697	27.9	
Mental and physical subjective symptoms	48,885		
No	35,138	71.9	
Yes	13,747	28.1	
Status of hospital use	48,959		
No	38,818	79.3	
Yes	10,141	20.7	
Subjective health awareness	48,919		
Good	11,295	23.1	
Slightly good	9737	19.9	
Normal	23,320	47.7	
Slightly poor	4145	8.5	
Poor	422	0.9	
Status of health check-ups	48,825		
No	20,210	41.4	
Yes	28,615	58.6	

SD standard deviation

[a]Educational level consisted of both students and graduates

educational institution. 71.9% had no mental or physical subjective symptoms and 79.3% were not receiving care at a hospital. The most common subjective health awareness was 'normal' at 47.7% and 'good' combined with 'slightly good' accounted for 90.7%. A total of 58.6% of the women had health check-ups.

Variables related to cervical cancer screening in univariable logistic regression analysis

The variables that indicated statistical significance with cervical cancer screening within the last 2 years were: age of the women, number of children, marital status, educational level, employment status, cohabitation with parents, mental and physical subjective symptoms, status of hospital use, and status of health check-ups (Table 2).

The crude ORs increased with age. The ORs of women aged 25–29, 30–34, and 35–39 compared to women aged 20–24 were 2.71 (95% CI 2.54–2.90), 3.92 (95% CI 3.68–4.18), and 4.83 (95% CI 4.55–5.13), respectively. In terms of marital status, the ORs for 'divorced or widowed' and 'married' women were higher than those for 'single' women. As for educational level, the ORs for 'vocational school, junior college or technical college' and 'university or graduate school' were higher than those for 'elementary, junior high school or high school'. The ORs of women who had mental and physical subjective symptoms, women who visited a hospital when sick or injured, and women who received health check-ups were higher than those who did not. As for employment status, the ORs among women who were employed were higher than those among women who were not working. However, there was no statistical significance in terms of mean daily working hours.

Variables related to cervical cancer screening in multivariable logistic regression analysis

The adjusted OR without interaction of women's age and number of children (model 1) was 0.90 (95% CI 0.85–0.96) for childrearing women compared with women without children (Table 3). This OR direction differed from that obtained in the univariable logistic regression analysis, which was 2.08 (95% CI 2.00–2.16). However, considering the interaction of women's age and number of children (model 2), the OR of childrearing women compared with women without children was 1.62 (95% CI 1.16–2.26). The ORs with or without interaction were very different in only number of children.

In terms of the interaction in model 2, the ORs decreased with the age of the women. The ORs for 'childrearing women aged 25–29 years old', 'childrearing women aged 30–34 years old', and 'childrearing women aged 35–39 years old' were lower than those for 'women without children', or 'childrearing women aged 20–24 years old' at 0.61 (95% CI 0.43–0.87), 0.56 (95% CI 0.40–0.79), and 0.54 (95% CI 0.38–0.75), respectively.

The ORs for cervical cancer screening were calculated by women's age and number of children in model 3 (Fig. 2). Comparing women with and without children in the same generation, the OR for women with children was higher

Table 2 Variables related to cervical cancer screening in univariable logistic regression analysis

	Total	Screening (−)		Screening (+)		OR (95% CI)
	n	*n*	%	*n*	%	
Age of women (*n* = 49,217)						
20–24 years	10,000	8251	82.5	1749	17.5	1.00 (reference)
25–29 years	10,128	6429	63.5	3699	36.5	2.71 (2.54–2.90)
30–34 years	12,012	6558	54.6	5454	45.4	3.92 (3.68–4.18)
35–39 years	17,077	8434	49.4	8643	50.6	4.83 (4.55–5.13)
No. of children (*n* = 49,217)						
0	31,062	20,744	66.8	10,318	33.2	1.00 (reference)
1 or more	18,155	8928	49.2	9227	50.8	2.08 (2.00–2.16)
Marital status (*n* = 49,217)						
Single	25,350	18,253	72.0	7097	28.0	1.00 (reference)
Divorced, widowed	2465	1363	55.3	1102	44.7	2.08 (1.91–2.26)
Married	21,402	10,056	47.0	11,346	53.0	2.90 (2.79–3.02)
Educational level[a] (*n* = 49,217)						
Elementary school, junior high school, high school	16,779	10,665	63.6	6114	36.4	1.00 (reference)
Vocational school, junior college, technical college	15,574	8765	56.3	6809	43.7	1.36 (1.30–1.42)
University, graduate school	12,481	7534	60.4	4947	39.6	1.15 (1.09–1.20)
Dummy (missing data)	4383	2708	61.8	1675	38.2	1.08 (1.01–1.16)
Employment status (*n* = 48,628)						
No	12,205	7725	63.3	4480	36.7	1.00 (reference)
Yes	36,423	21,532	59.1	14,891	40.9	1.19 (1.14–1.24)
Mean working hours per day (*n* = 34,729)						
Under 8 h	13,726	8122	59.2	5604	40.8	1.00 (reference)
8 h	11,306	6686	59.1	4620	40.9	1.00 (0.95–1.05)
More than 8 h	9697	5702	58.8	3995	41.2	1.02 (0.96–1.07)
Cohabitation with parents (*n* = 49,217)						
No	24,151	12,238	50.7	11,913	49.3	1.00 (reference)
Yes	25,066	17,434	69.6	7632	30.4	0.45 (0.43–0.47)
Mental and physical subjective symptoms (*n* = 48,885)						
No	35,138	21,690	61.7	13,448	38.3	1.00 (reference)
Yes	13,747	7763	56.5	5984	43.5	1.24 (1.20–1.29)
Status of hospital use (*n* = 48,959)						
No	38,818	24,089	62.1	14,729	37.9	1.00 (reference)
Yes	10,141	5402	53.3	4739	46.7	1.44 (1.37–1.50)
Subjective health awareness (*n* = 48,919)						
Good, slightly good	21,032	12,417	59.0	8615	41.0	1.00 (reference)
Normal	23,320	14,386	61.7	8934	38.3	0.90 (0.86–0.93)
Slightly poor, poor	4567	2635	57.7	1932	42.3	1.06 (0.99–1.13)
Status of health check-ups (*n* = 48,825)						
No	20,210	14,938	73.9	5272	26.1	1.00 (reference)
Yes	28,615	14,372	50.2	14,243	49.8	2.81 (2.70–2.92)

OR odds ratio, *CI* confidence interval

[a]Educational level consisted of both students and graduates

than that for women without children in their early 20s [OR of childrearing women, 1.62 (95% CI 1.16–2.26); OR of women without children, 1.00, reference)]. However, screening rates were the same for women with or without children in their late 20s [OR of women with children, 2.15 (95% CI 1.88–2.46); OR of women without children, 2.16 (95% CI 2.01–2.33)]. Furthermore, the OR for women with children was lower than that for women without children in their 30s [OR of women with children, 2.60 (95% CI 2.37–2.84); OR of women without children, 2.99 (95% CI 2.76–3.25)].

Table 3 Variables related to cervical cancer screening in multivariable logistic regression analysis ($n=47,697$)

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Age of women			
0: 20–24 years	1.00 (reference)	1.00 (reference)	
1: 25–29 years	2.16 (2.01–2.32)	2.16 (2.01–2.33)	
2: 30–34 years	2.64 (2.46–2.84)	2.69 (2.49–2.91)	
3: 35–39 years	2.85 (2.65–3.06)	2.99 (2.76–3.25)	
No. of children			
0: 0	1.00 (reference)	1.00 (reference)	
1: 1 or more	0.90 (0.85–0.96)	1.62 (1.16–2.26)	
Marital status			
Single	1.00 (reference)	1.00 (reference)	1.00 (reference)
Divorced, widowed	1.72 (1.54–1.92)	1.70 (1.52–1.89)	1.70 (1.52–1.89)
Married	2.40 (2.24–2.58)	2.38 (2.22–2.56)	2.38 (2.22–2.56)
Educational level[a]			
Elementary school, junior high school, high school	1.00 (reference)	1.00 (reference)	1.00 (reference)
Vocational school, junior college, technical college	1.23 (1.17–1.30)	1.24 (1.18–1.30)	1.24 (1.18–1.30)
University, graduate school	1.27 (1.20–1.34)	1.28 (1.21–1.35)	1.28 (1.21–1.35)
Dummy (missing data)	1.07 (0.98–1.15)	1.07 (0.99–1.16)	1.07 (0.99–1.16)
Employment status			
No	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	0.96 (0.91–1.01)	0.96 (0.91–1.01)	0.96 (0.91–1.01)
Cohabitation with parents			
No	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	0.82 (0.78–0.86)	0.82 (0.78–0.86)	0.82 (0.78–0.86)
Mental and physical subjective symptoms			
No	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	1.11 (1.05–1.16)	1.11 (1.05–1.16)	1.11 (1.05–1.16)
Status of hospital use			
No	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	1.40 (1.33–1.48)	1.40 (1.33–1.48)	1.40 (1.33–1.48)
Subjective health awareness			
Good, slightly good	1.00 (reference)	1.00 (reference)	1.00 (reference)
Normal	0.88 (0.84–0.92)	0.88 (0.84–0.92)	0.88 (0.84–0.92)
Slightly poor, poor	0.89 (0.82–0.97)	0.89 (0.82–0.97)	0.89 (0.82–0.97)
Status of health check-ups			
No	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	3.29 (3.15–3.44)	3.30 (3.16–3.45)	3.30 (3.16–3.45)
Interaction (women's age × no. of children)			
(0–3) × 0: women without children		1.00 (reference)	
0 × 1: childrearing women aged 20–24		1.00 (reference)	
1 × 1: childrearing women aged 25–29		0.61 (0.43–0.87)	
2 × 1: childrearing women aged 30–34		0.56 (0.40–0.79)	
3 × 1: childrearing women aged 35–39		0.54 (0.38–0.75)	
Women's age and no. of children			
Women without children aged 20–24			1.00 (reference)
Women without children aged 25–29			2.16 (2.01–2.33)
Women without children aged 30–34			2.69 (2.49–2.91)
Women without children aged 35–39			2.99 (2.76–3.25)
Childrearing women aged 20–24			1.62 (1.16–2.26)
Childrearing women aged 25–29			2.15 (1.88–2.46)
Childrearing women aged 30–34			2.45 (2.21–2.71)
Childrearing women aged 35–39			2.60 (2.37–2.84)

Table 3 (continued)

OR odds ratio, *CI* confidence interval

[a]Educational level consisted of both students and graduates

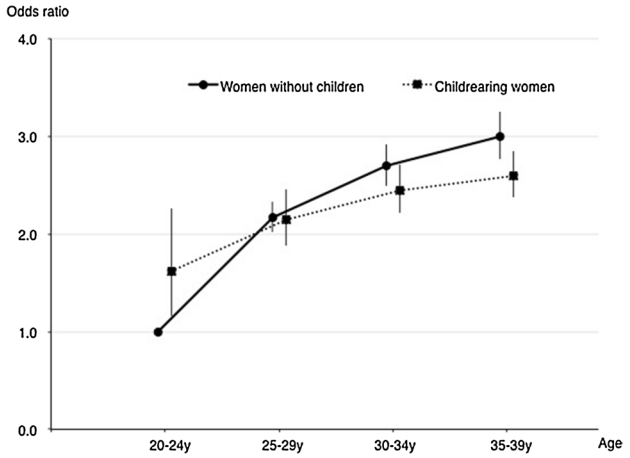

Fig. 2 Odds ratios of cervical cancer screening by women's age and number of children

Employment, which was significant in the univariable analysis, was not statistically significant in the multivariable analysis. On the contrary, 'slightly poor, poor' subjective health awareness, which was not significant in the univariable analysis, was statistically significant in the multivariable analysis [OR 0.89 (95% CI 0.82–0.97)].

As for the other items, ORs became higher with advancing age, marital status other than being single, educational level other than 'elementary, junior high school and high school', mental and physical subjective symptoms, hospital use and receiving health check-ups. On the contrary, ORs became smaller among those cohabiting with their parents.

Discussion

We found that approximately 40% women aged 20–39 in Japan underwent cervical cancer screening within the last 2 years. The rates increased with the women's advancing age; however, this increase tended to be restrained among childrearing women. In other words, screening among childrearing women was higher than women without children among women in their early 20s, but the rate was the same among women in their late 20s, and became lower among women in their 30s. In addition, receiving health check-ups, higher education, subjective symptoms, and hospital use increased participation in screening.

Since the status of participation in cervical cancer screenings is currently managed by implementing bodies such as municipalities and insurers, it is difficult to gain perspective on the participants' attributes, the number of participants and data acquisition methods. Therefore, it is difficult to determine the relationship between the attributes of potential screening participants and the actual status of screening participation. On the other hand, the Comprehensive Survey of Living Conditions collects information pertaining to households, the state of health, and the status of cervical cancer screenings in a large target population. These official statistics were suitable to meet our research purpose.

Previous studies in Japan reported that multipara were more likely to undergo cervical cancer screening than primipara [24–26] and the present results were consistent with this among women in their early 20s. However, our results differed from the previous results among women aged 25 years and upward. This difference might be due to limitations in the previous studies such as unadjusted interaction, unaccounted routine screenings during pregnancy, and dispersion of subjects' age. Therefore, this study adjusted for the interaction of women's age and number of children, and for variables that showed significance in the univariable analysis and were important either clinically or as reported by previous studies. Moreover, the target age group was set to women aged 20–39 to focus on the presence or absence of children, and cervical cancer screenings during pregnancy were also taken into consideration in the analyses.

The present results showed that the increase in screening rate with age tended to be restrained among childrearing women. Khan et al. reported that childrearing mothers are reluctant to visit a doctor for their own health problems [28]. Furthermore, mothers with children under 3 years of age in Japan tend to put their own needs on hold even when experiencing subjective symptoms because of childrearing-related factors such as reluctance to visit a doctor's office with their child and hesitation to ask relatives to look after their child [29]. While cervical cancer screening is not a test that one seeks when there is some kind of physical subjective symptom, it could be influenced by factors related to childrearing.

As for educational level, women with higher education were more likely to participate in screenings. A previous study in Japan showed that people with lower education were likely to have poorer health literacy [30]. Health literacy is related to many health outcomes [31, 32], including participation in cervical cancer screening [20]. As for marital status, divorced or widowed women tended to participate in screening less than married women. Considering that 85% of fatherless families suffer from a lack of money [16], economical background could be related to participation in cervical cancer screening. Cervical cancer screening implemented by

local municipalities and workplaces costs between 0 and 20 dollars in Japan, and that from other sources costs between 20 and 100 dollars. While it has not yet been determined whether reducing out-of-pocket patient costs is effective in increasing cervical cancer screening [33–35], it has been indicated that undergoing cervical cancer screening was related to high total household income [36].

In addition, burdens such as time are referred to as factors in participation in cervical cancer screening [23]. Hence, one variable that tends to be restricted by time, 'employment status', was added in the present analysis. However, there was no statistical significance. While working people are restricted by time, the Industrial Safety and Health Act mandates workplace health check-ups periodically [37] and there are workplaces that offer cervical cancer screening as part of the workplace health check-up. Also, this may alleviate cost as an inhibiting factor.

In terms of encouraging women to undergo cervical cancer screening, it is reported that the healthcare provider reminder and recall systems increase the rate of cervical cancer screening [33–35]. However, the participation rate is very low in Japan [16] even though almost 80% of municipalities provide reminders to target women [38]. As a possible reason for this, a previous study reported that Japanese women, many of whom are raising infants and young children, might have a child-centric lifestyle and put their needs on hold [29]. The present results coincide with these previous results. To encourage cervical cancer screening, we need to take measures not only to provide reminders, but also to reduce barriers by improving the environment for women, such as providing daycare.

This study had two limitations. First, in the process of selecting subjects, only women with definitive data on whether they had children or not were included and 5.4% of women with unclear data were excluded from the analyses. This may have caused selection bias; however, according to the 2010 census [39], the proportions of students and women aged 20–39 years who had not yet entered school (excluding those with missing information) were 7.0% and 0.1%, respectively. These proportions were very close to our target population's values of 6.7% and 0.1%, respectively. Therefore, the study subjects in the present study were thought to be representative of the general population in Japan. Second, data were missing for 10.6% of the total study population and excluding them from the analyses may have introduced bias. In this study, missing data for educational level were entered into the analyses as a dummy variable because there were major missing data for this variable (8.9% overall). The other missing data were excluded from the analyses because the amount of missing data was minor (employment status, 1.2%; mental and physical subjective symptoms, 0.1%; status of hospital use, 0.1%; subjective health awareness, 0.7% and status of health check-ups, 0.1%). Furthermore, missing data did not occur in either this study's objective variable 'participation or non-participation in cervical cancer screenings,' or the important predictor 'presence or absence of children'. Therefore, the risk of a large bias was thought to be low.

Conclusions

Approximately 40% women aged 20–39 in Japan underwent cervical cancer screening within the last 2 years, and the rate of participation increased with advancing age. However, the increase in rate tended to be restrained among childrearing women. Measures to promote screening for childrearing women are necessary.

Acknowledgements This work was supported by KAKENHI 25862214.

Compliance with ethical standards

Conflict of interest All authors have no competing financial interests to declare.

References

1. Ferlay J, Soerjomataram I, Dikshit R et al (2015) Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer 136:E359–E386
2. National of Institutes of Health (2010) FACT SHEET—cervical cancer. National of Institutes of Health, Maryland. https://report.nih.gov/nihfactsheets/Pdfs/CervicalCancer(NCI).pdf. Accessed Jan 2018
3. Itou Y (2016) Uterine cancer (in Japanese). In: Katanoda K, Sofue T, Tanaka H et al (eds) JACR Monograph Supplement No. 2. Japanese Association of Cancer Registries, Tokyo, pp 85–97. http://www.jacr.info/publicication/Pub/m_supp_02/m_supp2_all.pdf. Accessed Jan 2018
4. Hara J, Katase K (2012) Seisyounen no seikoudou zenkoku tyousa no gaiyou (Summary of nationwide sexual behavior survey in younger generation) 2011. Mon J Sex Educ Today 17:1–8
5. Cancer Information Service, National Cancer Center. Cancer Registry and Statistics (in Japanese). Cancer Information Service, National Cancer Center, Tokyo. https://ganjoho.jp/reg_stat/statistics/dl/index.html. Accessed Jan 2018
6. Hori M, Matsuda T, Shibata A et al (2015) Cancer incidence and incidence rates in Japan in 2009: a study of 32 population-based cancer registries for the Monitoring of Cancer Incidence in Japan (MCIJ) project. Jpn J Clin Oncol 45:884–891
7. Ministry of Health, Labour and Welfare (2017) Vital Statistics Japan 2016 (in Japanese). Ministry of Health, Labour and Welfare, Tokyo. http://www.mhlw.go.jp/toukei/saikin/hw/jinkou/kakutei16/index.html. Accessed Jan 2018
8. National Cancer Center, Center for Cancer Control and Information Services (2016) Monitoring of cancer incidence in Japan—survival 2006–2008 report (in Japanese). National Cancer Center, Tokyo. https://ganjoho.jp/data/reg_stat/statistics/brochure/mcij2006-2008_report.pdf. Accessed Jan 2018

9. Sawaya GF, Kulasingam S, Denberg TD et al (2015) Cervical cancer screening in average-risk women: best practice advice from the Clinical Guidelines Committee of the American College of Physicians. Ann Intern Med 162:851–859
10. U.S. Preventive Services Task Force (2016) Final recommendation statement: cervical cancer: screening. U.S. Preventive Services Task Force, Rockville. https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/cervical-cancer-screening. Accessed Jan 2018
11. NHS Choice (2018) Cervical screening. NHS, London. https://www.nhs.uk/conditions/cervical-screening/when-its-offered/. Accessed Jan 2018
12. Health Promotion Act (2002) Pub. L. No. 103 of 2002 (in Japanese). http://elaws.e-gov.go.jp/search/elawsSearch/elaws_search/lsg0500/detail?lawId=414AC0000000103. Accessed Jan 2018
13. Ministry of Health, Labour and Welfare (2008) Cancer guideline principle for screening and health education (in Japanese). Ministry of Health, Labour and Welfare, Tokyo. http://www.mhlw.go.jp/file/06-Seisakujouhou-10900000-Kenkoukyoku/0000111662.pdf. Accessed Jan 2018
14. OECD (2015) Health at a glance 2015: OECD indicators. OECD, Paris. https://doi.org/10.1787/health_glance-2015-en. Accessed Jan 2018
15. Ministry of Health, Labour and Welfare (2009) Implementation of the health checkups for pregnant women (in Japanese). Ministry of Health, Labour and Welfare, Tokyo. http://www.mhlw.go.jp/stf/houdou/2r98520000006wwl-img/2r98520000006wyx.pdf. Accessed Jan 2018
16. Ministry of Health, Labour and Welfare (2014) Comprehensive survey of living conditions 2013 (in Japanese). Ministry of Health, Labour and Welfare, Tokyo. http://www.mhlw.go.jp/toukei/saikin/hw/k-tyosa/k-tyosa13/dl/04.pdf. Accessed Jan 2018
17. Wee LE, Koh GC, Chin RT et al (2012) Socioeconomic factors affecting colorectal, breast and cervical cancer screening in an Asian urban low-income setting at baseline and post-intervention. Prev Med 55:61–67
18. Moser K, Patnick J, Beral V (2009) Inequalities in reported use of breast and cervical screening in Great Britain: analysis of cross sectional survey data. BMJ 338:b2025
19. Selvin E, Brett KM (2003) Breast and cervical cancer screening: sociodemographic predictors among White, Black, and Hispanic women. Am J Public Health 93:613–623
20. Kim K, Han HR (2016) Potential links between health literacy and cervical cancer screening behaviors: a systematic review. Psychooncology 25:122–130
21. Seow A, Wong ML, Smith WC et al (1995) Beliefs and attitudes as determinants of cervical cancer screening: a community-based study in Singapore. Prev Med 24:134–141
22. Nakamura K, Watanabe K (2015) The factors associated with cervical cancer screening behavior and an approach to improve screening rate: a literature review (in Japanese). J Hum Nurs Stud 3:51–57
23. Cabinet Office, Government of Japan (2015) Public Opinion Survey on Countermeasure for Cancer 2014 (in Japanese). Cabinet Office, Government of Japan, Tokyo. https://survey.gov-online.go.jp/h26/h26-gantaisaku/index.html. Accessed Jan 2018
24. Kimura Y, Usui K (2004) Jyosei kenkoushindansya niokeru shikyukeigan kenshin no hijyusinyouin nituiteno kentou (Consideration about factors of non cervical cancer screening among women in health check-up) (in Japanese). Nihon Kangogakkai Ronbun Syu: Chiiki Kango 3:85–87
25. Matuo I, Nishizawa Y, Matsuo T et al (2014) Cervical cancer screening behavior and factors associated with screening behavior (in Japanese). Hirosaki Med J 64:103–118
26. Kawai H, Takayama S, Imai M (2010) Shikyuugan kenshin no jyushin koudou ni kakawaru inshi no kentou (Consideration of factor related to cervical cancer screening behavior) (in Japanese). Ishikawa J Nurs 7:59–69
27. Statistics Act (2007) Pub. L. No. 53 of 2007 (in English and Japanese). http://www.japaneselawtranslation.go.jp/law/detail/?id=148. Accessed Jan 2018
28. Kahn RS, Wise PH, Finkelstein JA et al (1999) The scope of unmet maternal health needs in pediatric settings. Pediatrics 103:576–581
29. Kaso M, Miyazaki K, Nakayama T (2018) A qualitative study on coping behaviors and influencing factors among mothers in Japan raising children under three years old while experiencing physical and mental subjective symptoms. BMC Womens Health 18:14
30. Furuya Y, Kondo N, Yamagata Z et al (2015) Health literacy, socioeconomic status and self-rated health in Japan. Health Promot Int 30:505–513
31. Berkman ND, Sheridan SL, Donahue KE et al (2011) Low health literacy and health outcomes: an updated systematic review. Ann Intern Med 155:97–107
32. Nutbeam D (2000) Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. Health Promot Int 15:259–267
33. Baron RC, Rimer BK, Coates RJ et al (2008) Client-directed interventions to increase community access to breast, cervical, and colorectal cancer screening a systematic review. Am J Prev Med 35:S56–S66
34. Community Preventive Services Task Force (2012) Updated recommendations for client- and provider-oriented interventions to increase breast, cervical, and colorectal cancer screening. Am J Prev Med 43:92–96
35. Sabatino SA, Lawrence B, Elder R et al (2012) Effectiveness of interventions to increase screening for breast, cervical, and colorectal cancers: nine updated systematic reviews for the guide to community preventive services. Am J Prev Med 43:97–118
36. Chang HK, Myong JP, Byun SW et al (2017) Factors associated with participation in cervical cancer screening among young Koreans: a nationwide cross-sectional study. BMJ Open 7:e013868
37. Industrial Safety and Health Act (1972) Pub. L. No. 57 of 1972 (in Japanese). http://www.japaneselawtranslation.go.jp/law/detail/?id=1926. Accessed April 2018
38. Ministry of Health, Labour and Welfare (2016) Survey for Cancer Screening in Municipalities 2016 (in Japanese). Ministry of Health, Labour and Welfare, Tokyo. http://www.mhlw.go.jp/file/05-Shingikai-10901000-Kenkoukyoku-Soumuka/0000137850.pdf. Accessed Jan 2018
39. Statistic Bureau, Ministry of Internal Affairs and Communications (2011) Census 2010 (in Japanese). Statistic Bureau, Ministry of Internal Affairs and Communications, Tokyo. http://www.stat.go.jp/data/kokusei/2010/index.htm. Accessed Jan 2018