

Factors Affecting Cancer Screening Participation
in Japan Classified by Working Status

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Abstract

Background: Cancer screening (CS) is a potential method that may reduce cancer mortality by early detection and treatment. In Japan, CS is organized to promote five types of CS (i.e., gastric, lung, colorectal, cervical and breast). However, overall CS participation rates are still low. In contrast, the number of workplace CS is on the rise. Few studies have distinguished organized CS and workplace CS, thus this study aimed to investigate the factors affecting CS participation classified by working status.

Method: Multivariable logistic regression analyses were conducted separately by five specific CS types and working status. A nationally representative cross-sectional data survey from 2013 was used. A total of 1,711 participants included females aged 20-74 years and males aged 40-74 years were enrolled in the study. **Findings:** Overall CS participation rates were 45-64% in workers and 37-50% in non-workers. Our study suggested that there are socioeconomic inequalities in CS participation both in workers and non-workers. Several modifiable factors that may improve CS participation included having a family doctor, communicative and critical health literacy and working hours for workers and smoking for non-workers. Different approaches may be needed between organized CS and workplace CS to improve overall CS participation in Japan.

Keywords: Cancer Screening, Employment, Health Literacy

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Introduction

Background

Cancer is the second leading cause of death worldwide (Fitzmaurice et al., 2018; World Health Organization, 2018). In Japan, it is the leading cause of death (Ministry of Health, Labour and Welfare, 2018). Approximately, half of Japanese people develop cancer, and one in three Japanese die due to the cancer; the three most common causes of cancer death (listed in descending order, age adjusted) are lung, gastric and colorectal for male; colorectal, breast and lung for female (Cancer Registry and Statistics, 2018). While this a significant concern, cancer screening (CS) is a potential method that may reduce cancer mortality by early detection and treatment in a cost-effective way (Pyenson, 2012). Although the effectiveness of CS is still controversial worldwide, the Japanese government concluded that the evidence of effectiveness is sufficient to support the five types of CS (i.e., gastric, lung, colorectal, cervical and breast) and to promote CSs with a legal basis by the Health Promotion Act Article 19-2 (Act No. 103, 2002) (Hamashima et al., 2016; Hamashima et al., 2018; Yoshida et al., 2010). However, CS participation rates are low in Japan compared with many other OECD countries (OECD, 2017). Overall CS participation rate was 40-50% for male (combining gastric, lung and colorectal) and 30-40% for female (combining gastric, lung, colorectal,

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cervical and breast) (Ministry of Health, Labour and Welfare, 2016). There is an urgent need to improve CS participation to reduce cancer mortality in Japan.

Other studies have concluded that factors contributing to the decrease in CS participation included female gender, younger age, lower income, lower level of education, ethnic minorities, not having a spouse, obesity, smoking and inadequate health literacy (Hama et al., 2016; Maruthur et al., 2009; Oldach et al., 2014; Schütte, 2018; Wools et al., 2016). However, those results are mainly obtained from Western countries and only a few from Japan. Compared with those countries, Japan may have a different distribution of socio-demographics and unique healthcare systems. Hence, the previous reports may not be useful to establish a Japanese policy. It is necessary to examine the factors that affect CS participation based on domestic evidence and situations.

Currently in Japan, CS is mainly promoted and carried out in two settings. One is organized CS, a population-based program that is managed and conducted by local governments to reduce mortality at a population level. Most of the time, this type of CS is equally available for all community residents who meet the age and gender requirements, in accordance with the national CS guideline (see Table 1) (Ministry of Health, Labour and Welfare, 2018). In contrast, opportunistic CS is distinguished from

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organized CS in terms of the purpose to prevent cancer deaths at an individual level or company level. Currently, the number of workplaces conducting opportunistic CS as a part of employee benefit is showing a tendency to increase (hereinafter, referred to as “workplace CS”). It is reported that 30-60% of people who participated in CS in Japan have undergone the examinations at workplaces (Ministry of Health, Labour and Welfare, 2016). Workers are often able to take workplace CS at the same time with the mandatory Specific Health Checkups (Act on Assurance of Medical Care for Elderly People Article 18, Act No. 80, 1982) by employer; thus it makes more convenient and accessible compared to organized CS. However, workplace CS is only limited to insured employees and their family. As might be expected, the national survey reported that workers had higher participation rates compared to non-workers in all five types of CS (Ministry of Health, Labour and Welfare, 2016). This suggests that different approaches between workers and non-workers may be needed to improve overall CS participation in Japan. It is necessary to distinguish these two different CS approaches to examine factors that affect CS participation, although few studies have taken these approaches into account using the data from the general Japanese population.

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Aims and Hypotheses

This study aimed to investigate the factors affecting CS participation in Japan classified by working status; workers who were available for workplace CS, and non-workers who were not. Furthermore, the study may contribute to the development of interventions to improve CS participation. Specifically, this study will seek to verify the following two hypotheses, which we formulated preliminarily by reviewing previous literature.

- Socio-demographics will remain as factors affecting CS participation even after classified by working status.
- Different modifiable factors affect CS participation between workers and non-workers.

Methods

Data Source

A cross-sectional data set from the *2013 Health Diary Study*, which surveyed health-related behaviors from a nationally quasi-representative sample were used for the

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selection of individuals who participated in CS (Fukui et al., 2017). A Japan *Health Diary Study* was first conducted in 2003 for the purpose of describing the ecology of medical care for the Japanese population (Fukui et al., 2005). It was conducted for the second time from October 1 to October 31, 2013 in the same way (Fukui et al., 2017). From a nationally representative panel comprised of 210,000 households belonging to the Japan Management Association Consultants Inc., a population-weighted random sample of 5,387 households, controlling for the size of cities, towns and villages were selected. Variations in terms of age, gender, and region were also examined. The sample size was adjusted to 5,000 participants for the survey to obtain a nationally representative sample and a self-reported questionnaire was sent to them. Respondents were asked to give informed consent during the survey period for their data to be used. Out of the 5,000 participants, 4548 participants (response rate 91.0%) completed the questionnaire. Of these, 2,183 were male and 2,365 were female. The respondents received, 4,000 yen after the response.

For our study, only anonymized information was collected through the Japan Management Association Consultants Inc. Ethical approval was obtained from the Research Ethics Committee of St. Luke's International Hospital, Tokyo, Japan.

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Inclusion and Exclusion Criteria

We evaluated the five specific cancers in accordance with the national CS guideline (Table 1); inclusion criteria of age and gender also varied depending on cancer types. For example, for the analysis of gastric CS, males and females aged 50-74 years were included; for cervical CS, females aged 20-74 years were included. Overall, out of 4,458 participants who completed the questionnaire in the *2013 Health Diary Study*, female participants aged 20-74 years and male participants aged 40-74 years were included in our study. Next, participants were classified by working status. We defined workers as those with an occupation of either company employee or public employee in order to include those who were possibly available for workplace CS. For non-workers, we defined as those who are jobless, unable to work or a part-time employee in order to include those who were possibly not available for workplace CS. In addition, those with low annual household income of below 4 million yen were also included in the study. This is because small companies tend not to be able to offer workplace CS. Finally, missing values were excluded.

Outcomes and Covariates

CS participation for each five specific cancers was evaluated by self-report as

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binary outcomes; whether the respondents had undergone the specific CS within a year (within two years for cervical and breast) or not. Covariates included socio-demographics such as gender, age, education level, annual household income, types of health insurance and marital status, which can possibly affect CS participation (Fukuda et al., 2005; Fukuda et al., 2007; Schütte, 2018; Wools, et al., 2016). In addition, prevalence of obesity and depression, and modifiable factors such as having a family doctor, smoking, working hours and health literacy were included in covariates as well, which were also chosen by reviewing previous studies (Hama et al., 2016; Maruthur et al., 2009; Oldach et al., 2014).

Annual household income was divided into three levels. Education level was classified within three categories: graduated from high school or lower, vocational college or junior college degree, and college degree or higher. Age was used as a continuous variable, ranged from 20-74 years old for female and 40-74 years old for male. Types of health insurance were classified into three categories: National Health Insurance (*Kokumin kenko hoken*), Japan Health Insurance Association (*Kyokai kenpo*) and either Society-Managed Health Insurance (*Kumiai kenpo*) or Mutual Aid Association (*Kyosai kumiai*). Marital status was classified into binary variables: not having a spouse including divorced and widowed or having a spouse. Smoking status

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was classified into binary categories: current smokers or non-smokers. For obesity, body mass index (BMI) was calculated by self-reported height and weight and was used to classify into binary variables: participants with BMI 25.0 or above were categorized as being obese according to the classification established by World Health Organization (World Health Organization, 2019). Depression was measured and classified into binary variables using Patient Health Questionnaire (PHQ-9) translated into Japanese (Huang et al., 2006). Average weekly working hours was obtained by self-report and split into three levels.

Health literacy is defined as “the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health” by the World Health Organization (Nutbeam, 1998, p. 10). In the *2013 Health Diary Study*, health literacy was measured using a scale/questionnaire that consists of 10 items established by Ishikawa et al. (Ishikawa, Nomura, Sato & Yano, 2008; Ishikawa, Takeuchi, & Yano, 2008). Item are presented in Appendix B with the summary of actual scores obtained from study participants. The first five items measure functional health literacy, the basic skills of reading and writing, and the last five items measure communicative and critical health literacy, the advanced skills that allow a person to access, critically analyze and use

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information. Each item of functional health literacy was rated on a 4-point scale, ranging from 1 (*never*) to 4 (*often*), whereas communicative and critical health literacy was rated on a 5-point scale for each item, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The scores were reversed for functional health literacy, thus higher scores indicated higher health literacy. Furthermore, the scores for the items in a scale were summed and divided by the number of items in the scale to give a scale score (functional health literacy, range 1-4; communicative and critical health literacy, range 1-5). Using the scale score, both functional health literacy and communicative and critical health literacy were classified into binary levels at the median score of each (functional health literacy, high ≥ 3 , low < 3 ; communicative and critical health literacy, high ≥ 4 , low < 4).

Statistical Analysis

The associations between CS participation and covariates were assessed via univariate analysis, using the Pearson's chi-squared test or Student's t-test. Covariates with a p-value (P) < 0.20 in the univariate analysis, were included in the multivariable logistic regression analysis to determine the adjusted odds ratio (AOR) and 95% confidence intervals (CI). A two-sided significance level of 0.05 was used in the

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multivariable logistic regression analysis. IBM SPSS Statistics software, version 24.0 (IBM, Tokyo, Japan) was used for all statistical analyses.

Results

Baseline Characteristic

Selection of participants is presented in Figure 1. Out of the 4,548 respondents of the *2013 Health Diary Study*, a total of 1,711 participants were enrolled after applying inclusion and exclusion criteria. There were 829 workers and 882 non-workers.

Table 2 shows CS participation rates for five specific cancers. Overall the rates ranged from 45 to 64% in workers and 37 to 50% in non-workers. Consistent with the results from the national survey, workers surpassed non-workers in all types of cancers (Ministry of Health, Labour and Welfare, 2016).

Table 3 presents the summary of baseline characteristics of workers and non-workers. The age of female participants ranged from 20 to 74 years and the age of male participants ranged from 40 to 74 years. Age ranges were different between male and female because cervical CS is applicable to wider age range for females of 20 years or older. In terms of gender prevalence, workers only had 35.6% of female whereas non-workers had 77.4% of female. For the educational level, 48.8% of workers

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graduated from college or higher whereas 46.6% of non-workers graduated high school education or lower. Related to health insurance, 60.3% of workers belonged to Society-Managed Health Insurance, which is known as the wealthiest health insurance program whereas 51.0% of non-workers belonged to National Health Insurance. Average weekly working hours were not included as covariates for non-workers.

Univariate comparison of baseline characteristics by CS participation

In order to select the variables retained in the final model, univariate comparisons of baseline characteristics between those who had participated in CS and those who did not were conducted separately for five cancer types and shown in Table 4 (workers) and Table 5 (non-workers). Among workers enrolled for CS were: 345 for gastric, 644 for lung, 648 for colorectal, 295 for cervical, and 114 for breast. Among non-workers enrolled for CS were, 481 for gastric, 675 for lung, 677 for colorectal, 295 for cervical, and 478 for breast.

Among workers, factors that showed significant difference by CS participation were age (in lung, colorectal and cervical), annual household income (in gastric, lung, colorectal and cervical), types of health insurance (in all cancer types), marital status (in lung, colorectal, cervical, breast), smoking status (in colorectal), not having a family

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doctor (in gastric, lung and colorectal), average weekly working hours (in gastric, lung and colorectal), functional health literacy (in cervical) and communicative and critical health literacy (in lung and colorectal). Among non-workers, factors that showed significant difference by CS participation were gender (in lung and colorectal), age (in lung, colorectal, cervical and breast), education level (in lung, colorectal, cervical and breast), annual household income (in lung, colorectal, cervical and breast), types of health insurance (in gastric, cervical and breast), marital status (in gastric, colorectal, cervical and breast), smoking status (in all cancer types), obesity (in cervical), not having a family doctor (in lung, colorectal and cervical), functional health literacy (in lung and colorectal) and communicative and critical health literacy (in lung and breast). No significant difference was observed in depression for all cancer types both in workers and non-workers, thus we eliminated it from the final model.

Factors affecting CS Participation in Workers

Table 6 shows the results of the multivariable logistic regression analysis for CS participation in workers. Participants with higher household income (above 8 million yen annually) were more likely to participate in gastric CS (AOR, 3.61; 95% CI, [1.52-8.55]), lung CS (AOR, 2.52; 95% CI, [1.43-4.45]) and colorectal CS (AOR, 2.29;

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95% CI, [1.29-4.06]) compared to those with lower household income (below 4 million yen annually); those with middle household income (4 million to 8 million yen annually) were also more likely to participate in lung CS (AOR, 1.81; 95% CI, [1.11-2.94]) and colorectal CS (AOR, 2.13; 95% CI, [1.30-3.49]) compared to those with lower household income. In terms of types of health insurance, those who belonged to the Society-Managed Health Insurance/Mutual Aid Association were more likely to participate in all types of CS compared to those with National Health Insurance with AOR ranged from 2 to 5 times. In terms of average weekly working hours, participants who worked longer (60 hours or above weekly) were likely not to participate in gastric CS (AOR, 0.24; 95% CI, [0.08-0.75]), lung CS (AOR, 0.53; 95% CI, [0.28-0.99]) and colorectal CS (AOR, 0.51; 95% CI, [0.27-0.96]) compared to those who work less hours (1 hour to 42 hours weekly). Participants who worked 43 hour to 59 hours weekly also had a lower prevalence of gastric CS (AOR, 0.45; 95% CI, [0.26-0.78]) compare to those who worked fewer hours. In relation to health literacy, participants with low levels of communicative and critical health literacy were not likely to participate in lung CS, (AOR, 0.64; 95% CI, 0.45-0.90) and colorectal CS (AOR, 0.55; 95% CI, 0.39-0.78) compare to those with high levels. In contrast, in cervical CS, participants with low levels of functional health literacy showed a reverse association (AOR, 2.89; 95% CI,

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[1.31-6.37]) compare to those with high levels. Among all covariates, no significant association was observed between CS participation and age, gender, education level, marital status, smoking status and obesity.

Factors affecting with CS Participation in Non-workers

Table 7 shows the results of the multivariable logistic regression analysis for CS participation in non-workers. Female participants were not likely to participate in lung CS (AOR, 0.58; 95%CI, [0.38-0.89]) and colorectal CS (AOR, 0.64; 95%CI, [0.42-0.97]). Age was positively correlated with participation in lung CS (AOR, 1.02; 95%CI, [1.00-1.05]). Participants with higher household incomes (above 8 million yen annually) were more likely to participate in breast CS (AOR, 2.25; 95%CI, [1.16-4.38]) compared to those with lower household incomes (below 4 million yen annually); those with middle household income (4 million to 8 million yen annually) were also more likely to participate in lung CS (AOR, 1.69; 95%CI, [1.10-2.59]) compared to those with lower household incomes. In terms of types of health insurance, those who belonged to Society-Managed Health Insurance/Mutual Aid Association were more likely to participate in cervical CS (AOR, 2.24; 95%CI, [1.49-3.36]) and breast CS (AOR, 1.81; 95%CI, [1.08-3.02]). Current smokers were not likely to participate in

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colorectal CS (AOR, 0.36; 95%CI, [0.18-0.71]) and breast CS (AOR, 0.30; 95%CI, [0.11-0.80]) compared to non-smokers. Those who did not have a spouse were also not likely to participate in cervical CS (AOR, 0.64; 95%CI, [0.43-0.96]) compared to those who had a spouse. Among all covariates, no significant association was observed between CS participation and education level, prevalence of obesity, functional health literacy, and communicative and critical health literacy.

Discussion

We investigated the factors affecting CS participation in workers and non-workers by multivariable logistic regression analyses using a nationally quasi-representative cross-sectional data. Our study identified several findings.

Firstly, in terms of socio-demographics, our results indicated that socioeconomic status such as household income and types of health insurance were frequently affecting CS participation both in workers and non-workers. This is consistent with some previous studies from overseas and within Japan (Fukuda et al., 2005; Fukuda et al., 2007; Schütte et al., 2018; Wools, et al., 2016). Participants with lower household incomes tended not to participate in CS compared with higher and middle household income participants for several cancer types. This might be explained by the financial

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burden of CS as an obstacle, which could affect motivation to participate in CS. In terms of types of health insurance, participants with National Health Insurance were not as likely to participate in CS compared to the other health insurance programs. In contrast with wealthier health insurance programs that consisted of employees, National Health Insurance includes those with lower household income such as pensioners and unemployed people. Wealthier health insurance programs are also more able to independently coordinate health promotion strategies thus making them more ‘user friendly’. Thus the implementation of CS may be largely dependent on those background healthcare systems.

In contrast, compared with previous studies from the Western countries (Wools, et al., 2016; Schütte et al., 2018), no significant association was observed in education level, or obesity in either type of CS. This international difference may be explained by smaller disparities in education, or the low prevalence of obesity observed in Japan (OECD, 2017). These findings emphasized the importance of considering socioeconomic factors to promote CS in Japan, regardless of working status.

Secondly, related to modifiable factors that might improve CS participation, not having a family doctor was a factor affecting CS participation both in workers and non-workers. It may be that having a close family doctor might increase awareness

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about cancer and CS. Therefore the promotion of having a family doctor may be an effective strategy at a population level to increase CS, regardless of working status.

For workers, despite of having better access to CS compared to non-workers, long working hours, low level of communicative and critical health literacy were found to lead to low CS participation. A study from South Korea found that part-time workers had more difficulty participating in CS compared to full-time workers (Kim et al., 2016). However, little was known about the relationship between working hours and CS participation. Lack of time and awareness from excessive work-hours may have caused an inequality in self-care management and communicative and critical health literacy. Another study also pointed out that long-working hours may lead to various poor health outcomes (Bannai et al., 2013). Therefore, controlling excessive working hours and promoting health education on cancer should be actively considered for workers at a company level in order to receive appropriate CS.

For non-workers, consistent with previous studies, current smokers and not having a spouse were found to lead low participation in CS (Hama et al., 2016). Current smokers may have a tendency to have lower health awareness and an increased risk of developing cancers. In the present study, though workers showed larger prevalence of smoking than non-workers, there was a significant association between smoking status

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and CS participation, which was demonstrated only in workers. We only obtained the smoking experience by self-report without detailed information about the number of cigarettes smoked daily and the duration of smoking. Thus maybe non-workers had more excessive smoking habits which could have affected CS participation. Not having a spouse might not be included in modifiable factors, however, it could be considered in actual practices more in the context of social control. Therefore, enhancing tailored smoking cessation by a family doctor or a public health nurse, and involvement of key-people should be actively considered for non-workers at a community level in order to promote CS.

Strengths and limitation of this study

A major strength of our study was the use of a nationally representative data with a high response rate, which made the results more reliable. By contrast with most previous studies, we also classified the study participants by working status to take into consideration of the difference between organized CS and workplace CS. This division was to find key variables that could be used to tailor different approaches between organized CS and workplace CS to improve overall CS participation.

Some other limitations should also be acknowledged. Firstly, data we used to

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evaluate CS participation and other covariates were obtained by self-report, therefore responses on CS participation relied on respondents' memory and understanding about five types of CS. Detailed information about each types of CS was not offered to respondents during the survey period. Thus, we were not able to ascertain whether respondents took the corresponding procedures in accordance with the national CS guideline. This could be result in either an underestimate or an overestimate of the true association. Functional health literacy and communicative and critical health literacy were also measured based on a self-reported questionnaire in this study, which might have led to underestimation or overestimation. In the presents study, low functional health literacy showed a positive association CS participation in cervical CS among workers. The questionnaire of *2013 Health Diary Study* consisted of 100 items. Thus, respondents who completed the questionnaire may have had relatively high functional health literacy at baseline. In future studies, we should examine the association between health literacy and CS participation carefully considering the potential confounders or using other health literacy scale to see whether the results will be consistent with the present study or not.

Secondly, participants were classified based on working status and household income. This may have caused misclassification of participants who were available for

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workplace CS.

Finally, regional areas and cancer history in relatives were not analyzed as covariates. It should be noted that previous studies have suggested they are possibly associated with CS participation (Hama et al., 2016; Yokoe et al., 1997).

Conclusion

In conclusion, our study suggests that there are socioeconomic inequalities in CS participation both in workers and non-workers. There are also several modifiable factors that may improve CS participation including having a family doctor, working hours and communicative and critical health literacy for workers and smoking for non-workers. It must be emphasized that different approaches are needed between organized CS and workplace CS to improve overall participation rate in Japan.

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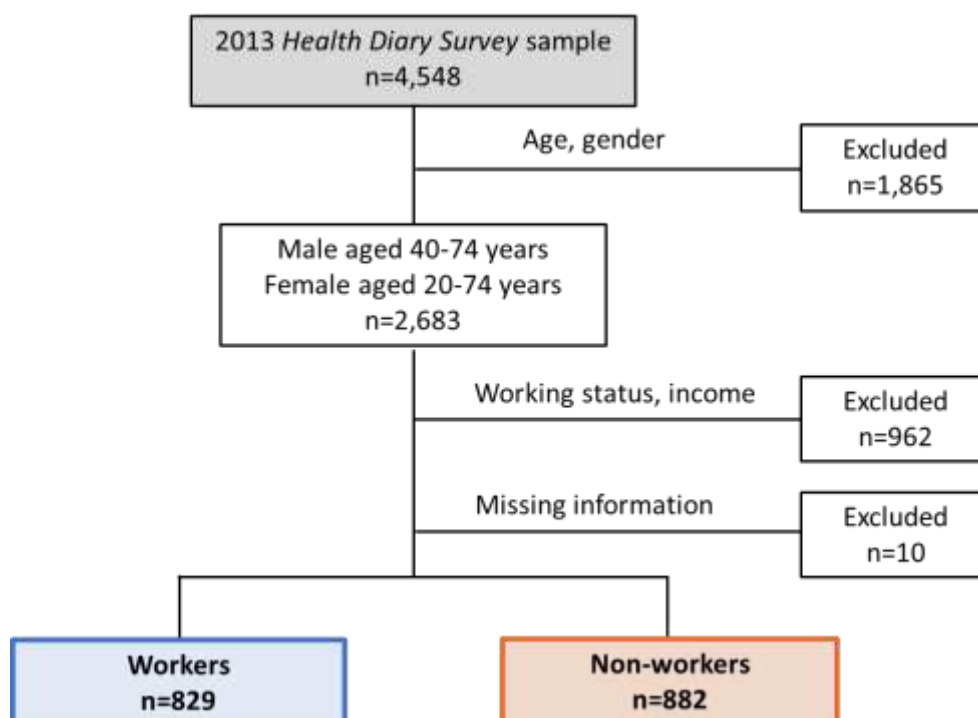
Table 1

Japanese cancer screening guideline

Type of cancer	Test or procedure	Sex	Age	Frequency
Gastric	Medical interview and either radiographic or endoscopic screenings	Male, Female	50 years or older	Annually
Lung	Medical interview, radiographic and sputum cytology	Male, Female	40 years or older	Annually
Colorectal	Medical interview and fecal occult blood test	Male, Female	40 years or older	Annually
Cervical	Medical interview, visual examination, cervical cytology and pelvic examination	Female	20 years or older	Once in 2 years
Breast	Medical interview and mammographic screening	Female	40 years or older	Once in 2 years

Source: Ministry of Health, Labour and Welfare. (2018). Types of cancer screening.

<https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000059490.html>



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Figure. Flow diagram of the study participants

Table 2

Cancer screening participation rates of study participants, n (%)

	Gastric CS	Lung CS	Colorectal CS	Cervical CS	Breast CS
Workers	205 (58.7)	336 (51.7)	359 (55.2)	135 (45.5)	73 (64.0)
Non-workers	184 (38.0)	253 (37.3)	268 (39.5)	306 (44.8)	241 (50.4)

Table 3

Baseline characteristics of study participants

Variables	Workers (n=829)	Non-workers (n=882)
Gender, female, n (%)	295 (35.6)	683 (77.4)
Age, mean (SD)		
Male, (range 40-74 years old)	51.0 (7.2)	61.4 (9.3)
Female, (range 20-74 years old)	37.7 (12.0)	48.5 (13.7)
Education level, n (%)		
High school education or lower	245 (29.8)	405 (46.6)
Vocational college or junior college degree	176 (21.4)	293 (33.7)
College degree or higher	401 (48.8)	171 (19.7)
Annual household income, n (%)		
<4 million yen	138 (16.7)	476 (54.0)
4 million to 8 million yen	433 (52.5)	297 (33.7)
>8 million yen	254 (30.8)	109 (12.4)
Types of health insurance, n (%)		
National Health Insurance (Kokumin kenko hoken)	77 (9.4)	441 (51.0)
Japan Health Insurance Association (Kyokai kenpo)	249 (30.3)	130 (15.0)
Society-Managed Health Insurance (Kumiai kenpo)/ Mutual Aid Association (Kyosai kumiai)	496 (60.3)	293 (33.9)
Marital status, not having a spouse, n (%)	255 (31.5)	271 (31.5)
Current smokers, n (%)	144 (17.4)	84 (9.5)
Obesity, n (%)	191 (23.0)	161 (18.3)
Depression, n (%)	214 (26.0)	278 (31.9)
Not having a family doctor, n (%)	520 (62.7)	449 (51.2)
Average weekly working hours, n (%)		
1 hour to 42 hours	396 (47.8)	-
43 hours to 59 hours	370 (44.7)	-
60 hours or above	62 (7.5)	-
Functional health literacy, low, n (%)	172 (20.7)	232 (26.3)
Communicative and critical health literacy, low, n (%)	381 (46.0)	481 (54.5)

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Table 4

Univariate comparison of baseline characteristics by cancer screening participation in workers

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Variables	Gastric CS participation (n=345)			Lung CS participation (n=644)			Colorectal CS participation (n=648)		
	Yes (n=205)	No (n=140)	P	Yes (n=336)	No (n=308)	P	Yes (n=359)	No (n=289)	P
Gender, female, n (%)	34 (16.6)	21 (15.0)	0.693	61 (18.2)	52 (16.9)	0.672	67 (18.7)	47 (16.3)	0.425
Age, mean (SD)	56.48 (4.82)	56.80 (4.49)	0.531	51.35 (6.97)	50.41 (7.58)	0.101	51.43 (7.04)	50.36 (7.50)	0.064
Education level, n (%)			0.300			0.262			0.434
High school education or lower	72 (35.6)	54 (38.6)		106 (31.8)	106 (34.6)		112 (31.4)	100 (35.0)	
Vocational college or junior college degree	20 (9.9)	20 (14.3)		55 (16.5)	61 (19.9)		62 (17.4)	54 (18.9)	
College degree or higher	110 (54.5)	66 (47.1)		172 (51.7)	139 (45.4)		183 (51.3)	132 (46.2)	
Annual household income, n (%)			<0.001			<0.001			<0.001
<4 million yen	29 (14.1)	33 (23.6)		43 (12.9)	71 (23.1)		45 (12.6)	69 (24.0)	
4 million to 8 million yen	102 (49.8)	82 (58.6)		186 (55.7)	174 (56.7)		206 (57.5)	156 (54.4)	
>8 million yen	74 (36.1)	25 (17.9)		105 (31.4)	62 (20.2)		107 (29.9)	62 (21.6)	
Types of health insurance, n (%)			<0.001			0.008			0.002
National Health Insurance (Kokumin kenko hoken)	12 (5.9)	21 (15.3)		21 (6.3)	32 (10.5)		24 (6.7)	29 (10.2)	
Japan Health Insurance Association (Kyokai kenpo)	55 (26.8)	55 (40.1)		92 (27.4)	105 (34.5)		94 (26.3)	104 (36.5)	
Society-Managed Health Insurance (Kumiai kenpo)/ Mutual Aid Association (Kyosai kumiai)	138 (67.3)	61 (44.5)		223 (66.4)	167 (54.9)		240 (67.0)	152 (53.3)	
Marital status, not having a spouse, n (%)	28 (14.0)	24 (17.9)	0.334	49 (14.8)	59 (19.7)	0.105	52 (14.7)	57 (20.3)	0.066
Smoking, current smokers, n (%)	41 (20.0)	32 (22.9)	0.523	71 (21.1)	61 (19.8)	0.677	65 (18.1)	67 (23.2)	0.111
Obesity, n (%)	58 (28.3)	36 (25.7)	0.597	98 (29.2)	79 (25.6)	0.318	99 (27.6)	77 (26.6)	0.791
Depression, n (%)	44 (21.6)	24 (17.4)	0.342	76 (22.7)	82 (26.9)	0.219	86 (24.1)	76 (26.5)	0.487
Not having a family doctor, n (%)	101 (49.3)	94 (67.1)	<0.001	187 (55.7)	207 (67.2)	0.003	201 (56.0)	195 (67.5)	0.003
Average weekly working hours, n (%)			0.035			0.218			0.234
1 hour to 42 hours	115 (56.1)	59 (42.1)		154 (45.8)	133 (43.3)		169 (47.1)	121 (42.0)	
43 hours to 59 hours	80 (39.0)	70 (50.0)		158 (47.0)	140 (45.6)		163 (45.4)	136 (47.2)	
60 hours or above	10 (4.9)	11 (7.9)		24 (7.1)	34 (11.1)		27 (7.5)	31 (10.8)	
Functional health literacy, low, n (%)	60 (29.3)	44 (31.4)	0.668	77 (22.9)	74 (24.0)	0.740	84 (23.4)	72 (24.9)	0.654
Communicative and critical health literacy, low, n (%)	90 (43.9)	70 (50.0)	0.265	132 (39.3)	152 (49.4)	0.010	138 (38.4)	151 (52.2)	<0.001

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

Table 4

Univariate comparison of baseline characteristics by cancer screening participation in workers (cont.)

Variables	Cervical CS participation (n=295)			Breast CS participation (n=114)		
	Yes (n=135)	No (n=160)	P	Yes (n=73)	No (n=41)	P
Gender, female, n (%)	-	-	-	-	-	-
Age, mean (SD)	40.24 (11.35)	35.54 (12.23)	<0.001	50.56 (7.41)	51.05 (7.62)	0.740
Education level, n (%)			0.440			0.803
High school education or lower	34 (25.2)	39 (24.7)		26 (35.6)	14 (34.1)	
Vocational college or junior college degree	52 (38.5)	51 (32.3)		26 (35.6)	17 (41.5)	
College degree or higher	49 (36.3)	68 (43.0)		21 (28.8)	10 (24.4)	
Annual household income, n (%)			0.121			0.803
<4 million yen	31 (23.0)	24 (15.2)		21 (28.8)	10 (25.0)	
4 million to 8 million yen	48 (35.6)	72 (45.6)		30 (41.1)	19 (47.5)	
>8 million yen	56 (41.5)	62 (39.2)		22 (30.1)	11 (27.5)	
Types of health insurance, n (%)			0.009			0.030
National Health Insurance (Kokumin kenko hoken)	9 (6.8)	30 (19.0)		5 (7.0)	10 (24.4)	
Japan Health Insurance Association (Kyokai kenpo)	47 (35.3)	47 (29.7)		28 (39.4)	15 (36.6)	
Society-Managed Health Insurance (Kumiai kenpo)/ Mutual Aid Association (Kyosai kumiai)	77 (57.9)	81 (51.3)		38 (53.5)	16 (39.0)	
Marital status, not having a spouse, n (%)	81 (62.8)	115 (72.3)	0.084	36 (50.7)	14 (34.1)	0.089
Smoking, current smokers, n (%)	12 (8.9)	9 (5.6)	0.277	7 (9.6)	2 (4.9)	0.371
Obesity, n (%)	13 (9.6)	22 (13.8)	0.276	13 (17.8)	7 (17.1)	0.921
Depression, n (%)	42 (31.1)	46 (29.1)	0.710	24 (32.9)	12 (30.0)	0.754
Not having a family doctor, n (%)	81 (60.0)	105 (65.6)	0.319	41 (56.2)	21 (51.2)	0.611
Average weekly working hours, n (%)			0.908			0.963
1 hour to 42 hours	83 (61.5)	102 (63.8)		51 (69.9)	28 (68.3)	
43 hours to 59 hours	47 (34.8)	53 (33.1)		18 (24.7)	11 (26.8)	
60 hours or above	5 (3.7)	5 (3.1)		4 (5.5)	2 (4.9)	
Functional health literacy, low, n (%)	31 (23.0)	15 (9.4)	<0.001	22 (30.1)	8 (19.5)	0.216
Communicative and critical health literacy, low, n (%)	65 (48.1)	81 (50.6)	0.672	36 (49.3)	18 (43.9)	0.579

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

Table 5

Univariate comparison of baseline characteristics by cancer screening participation in non-workers

Variables	Gastric CS participation (n=481)			Lung CS participation (n=675)			Colorectal CS participation (n=677)		
	Yes (n=184)	No (n=297)	P	Yes (n=253)	No (n=422)	P	Yes (n=268)	No (n=409)	P
Gender, female, n (%)	117 (63.6)	196 (66.0)	0.591	169 (66.8)	307 (72.7)	0.101	181 (67.5)	297 (72.6)	0.156
Age, mean (SD)	62.53 (6.53)	62.06 (6.83)	0.456	58.37 (9.21)	56.45 (10.33)	0.013	58.47 (9.79)	56.32 (10.04)	0.006
Education level, n (%)			0.464			0.157			0.101
High school education or lower	83 (46.6)	154 (52.4)		108 (43.7)	211 (50.6)		113 (43.3)	206 (50.9)	
Vocational college or junior college degree	52 (29.2)	79 (26.9)		82 (33.2)	131 (31.4)		87 (33.3)	127 (31.4)	
College degree or higher	43 (24.2)	61 (20.7)		57 (23.1)	75 (18.0)		61 (23.4)	72 (17.8)	
Annual household income, n (%)			0.381			0.072			0.351
<4 million yen	112 (60.9)	192 (64.6)		136 (53.8)	264 (62.6)		150 (56.0)	251 (61.4)	
4 million to 8 million yen	48 (26.1)	78 (26.3)		81 (32.0)	113 (26.8)		82 (30.6)	113 (27.6)	
>8 million yen	24 (13.0)	27 (9.1)		36 (14.2)	45 (10.7)		36 (13.4)	45 (11.0)	
Types of health insurance, n (%)			0.189			0.690			0.863
National Health Insurance (Kokumin kenko hoken)	110 (60.4)	190 (65.7)		135 (54.2)	230 (55.8)		145 (55.1)	221 (55.3)	
Japan Health Insurance Association (Kyokai kenpo)	21 (11.5)	39 (13.5)		34 (13.7)	62 (15.0)		36 (13.7)	60 (15.0)	
Society-Managed Health Insurance (Kumiai kenpo)/ Mutual Aid Association (Kiyosai kumiai)	51 (28.0)	60 (20.8)		80 (32.1)	120 (29.1)		82 (31.2)	119 (29.8)	
Marital status, not having a spouse, n (%)	35 (19.6)	72 (24.8)	0.186	53 (21.5)	104 (25.4)	0.267	54 (20.7)	105 (26.4)	0.091
Smoking, current smokers, n (%)	10 (5.4)	30 (10.1)	0.072	18 (7.1)	45 (10.7)	0.125	13 (4.9)	51 (12.5)	<0.001
Obesity, n (%)	32 (17.4)	65 (21.9)	0.233	47 (18.6)	81 (19.2)	0.843	50 (18.7)	79 (19.3)	0.831
Depression, n (%)	46 (25.3)	76 (25.9)	0.872	65 (26.0)	126 (30.1)	0.251	71 (26.7)	123 (30.4)	0.304
Not having a family doctor, n (%)	71 (39.2)	130 (44.1)	0.299	105 (41.8)	211 (50.5)	0.030	105 (39.6)	211 (52.0)	0.002
Functional health literacy, low, n (%)	62 (33.7)	86 (29.0)	0.274	61 (24.1)	132 (31.3)	0.046	67 (25.0)	128 (31.3)	0.077
Communicative and critical health literacy, low, n (%)	92 (50.0)	163 (54.9)	0.297	120 (47.4)	239 (56.6)	0.020	137 (51.1)	224 (54.8)	0.352

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

Table 5

Univariate comparison of baseline characteristics by cancer screening participation in non-workers (cont.)

Variables	Cervical CS participation (n=295)			Breast CS participation (n=478)		
	Yes (n=135)	No (n=160)	P	Yes (n=241)	No (n=237)	P
Gender, female, n (%)	-	-	-	-	-	-
Age, mean (SD)	47.51 (11.66)	49.24 (15.06)	0.092	54.41 (9.27)	56.45 (10.10)	0.022
Education level, n (%)			0.022			0.011
High school education or lower	122 (40.4)	190 (51.1)		97 (41.1)	129 (54.9)	
Vocational college or junior college degree	135 (44.7)	135 (36.3)		109 (46.2)	82 (34.9)	
College degree or higher	45 (14.9)	47 (12.6)		30 (12.7)	24 (10.2)	
Annual household income, n (%)			<0.001			<0.001
<4 million yen	106 (34.6)	205 (54.4)		94 (39.0)	142 (59.9)	
4 million to 8 million yen	142 (46.4)	125 (33.2)		95 (39.4)	70 (29.5)	
>8 million yen	58 (19.0)	47 (12.5)		52 (21.6)	25 (10.5)	
Types of health insurance, n (%)			<0.001			<0.001
National Health Insurance (Kokumin kenko hoken)	94 (31.1)	202 (54.7)		82 (34.6)	139 (59.7)	
Japan Health Insurance Association (Kyokai kenpo)	54 (17.9)	52 (14.1)		48 (20.3)	24 (10.3)	
Society-Managed Health Insurance (Kumiai kenpo)/ Mutual Aid Association (Kynosai kumiai)	154 (51.0)	115 (31.2)		107 (45.1)	70 (30.0)	
Marital status, not having a spouse, n (%)	73 (24.6)	146 (39.5)	<0.001	43 (18.5)	63 (27.0)	0.029
Smoking, current smokers, n (%)	16 (5.2)	34 (9.0)	0.059	7 (2.9)	23 (9.7)	0.002
Obesity, n (%)	41 (13.4)	77 (20.4)	0.016	39 (16.2)	47 (19.8)	0.299
Depression, n (%)	104 (34.3)	113 (30.3)	0.265	66 (27.5)	67 (28.6)	0.784
Not having a family doctor, n (%)	149 (49.0)	212 (56.7)	0.046	108 (45.6)	118 (50.2)	0.313
Functional health literacy, low, n (%)	82 (26.8)	91 (24.1)	0.427	71 (29.5)	66 (27.8)	0.697
Communicative and critical health literacy, low, n (%)	162 (52.9)	214 (56.8)	0.318	121 (50.2)	135 (57.0)	0.139

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

Table 6

Factors affecting cancer screening participation in workers

Variable/Model	Gastric CS participation		Lung CS participation		Colorectal CS participation	
	AOR (95% CI)	P	AOR (95% CI)	P	AOR (95% CI)	P
Gender, female	1.34 (0.62-2.87)	0.458	1.34 (0.82-2.19)	0.249	1.43 (0.87-2.37)	0.159
Age (in years)	0.98 (0.93-1.04)	0.561	1.02 (0.99-1.04)	0.194	1.02 (1.00-1.05)	0.084
Education level						
High school education or lower	ref.		ref.		ref.	
Vocational college or junior college degree	0.65 (0.28-1.50)	0.314	0.82 (0.49-1.35)	0.433	0.86 (0.52-1.43)	0.568
College degree or higher	1.01 (0.57-1.80)	0.969	1.01 (0.68-1.50)	0.962	0.99 (0.66-1.48)	0.950
Annual household income						
<4 million yen	ref.		ref.		ref.	
4 million to 8 million yen	1.57 (0.76-3.26)	0.223	1.81 (1.11-2.94)	0.017	2.13 (1.30-3.49)	0.003
>8 million yen	3.61 (1.52-8.55)	0.004	2.52 (1.43-4.45)	0.001	2.29 (1.29-4.06)	0.004
Types of health insurance						
National Health Insurance (Kokumin kenko hoken)	ref.		ref.		ref.	
Japan Health Insurance Association (Kyokai kenpo)	2.31 (0.96-5.57)	0.062	1.43 (0.74-2.76)	0.288	1.15 (0.60-2.22)	0.674
Society-Managed Health Insurance (Kumiai kenpo)/ Mutual Aid Association (Kyoasai kumiai)	4.77 (1.97-11.51)	<0.001	2.15 (1.14-4.07)	0.019	2.17 (1.15-4.12)	0.017
Marital status, not having a spouse	0.99 (0.46-2.14)	0.977	0.88 (0.54-1.44)	0.619	0.83 (0.51-1.35)	0.441
Smoking, current smokers	1.16 (0.62-2.17)	0.649	1.20 (0.79-1.81)	0.394	0.79 (0.52-1.19)	0.257
Obesity	1.10 (0.63-1.93)	0.736	1.27 (0.87-1.86)	0.213	1.12 (0.76-1.65)	0.559
Not having a family doctor	0.43 (0.26-0.72)	0.001	0.64 (0.45-0.90)	0.010	0.60 (0.42-0.85)	0.004
Average weekly working hours						
1 hour to 42 hours	ref.		ref.		ref.	
43 hours to 59 hours	0.44 (0.25-0.76)	0.003	0.99 (0.68 - 1.43)	0.958	0.77 (0.53-1.11)	0.163
60 hours or above	0.23 (0.08-0.71)	0.011	0.53 (0.28 - 0.99)	0.047	0.51 (0.27-0.96)	0.037
Functional health literacy, low	1.16 (0.65-2.07)	0.612	1.12 (0.74 - 1.71)	0.583	1.13 (0.74-1.72)	0.571
Communicative and critical health literacy, low	0.79 (0.47-1.34)	0.386	0.64 (0.45 - 0.90)	0.011	0.55 (0.39-0.78)	<0.001

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

Table 6

Factors affecting cancer screening participation in workers (cont.)

Variable/Model	Cervical CS participation		Breast CS participation	
	AOR (95% CI)	<i>P</i>	AOR (95% CI)	<i>P</i>
Gender, female	-	-	-	-
Age (in years)	1.02 (1.00-1.05)	0.077	0.99 (0.92 - 1.05)	0.647
Education level				
High school education or lower	ref.		ref.	
Vocational college or junior college degree	1.55 (0.75-3.17)	0.233	0.60 (0.19 - 1.93)	0.394
College degree or higher	1.23 (0.58-2.61)	0.590	1.20 (0.32 - 4.53)	0.787
Annual household income				
<4 million yen	ref.		ref.	
4 million to 8 million yen	0.43 (0.20-0.92)	0.031	0.90 (0.28 - 2.93)	0.861
>8 million yen	0.73 (0.33-1.59)	0.423	1.65 (0.42 - 6.50)	0.473
Types of health insurance				
National Health Insurance (Kokumin kenko hoken)	ref.		ref.	
Japan Health Insurance Association (Kyokai kenpo)	3.32 (1.34-8.24)	0.010	3.64 (0.89 - 14.92)	0.073
Society-Managed Health Insurance (Kumiai kenpo)/ Mutual Aid Association (Kysai kumiai)	3.91 (1.66-9.23)	0.002	5.76 (1.45 - 22.78)	0.013
Marital status, not having a spouse	0.68 (0.35-1.29)	0.237	2.80 (0.95 - 8.26)	0.062
Smoking, current smokers	1.58 (0.58-4.29)	0.371	2.51 (0.39 - 16.31)	0.336
Obesity	0.52 (0.23-1.21)	0.130	1.07 (0.33 - 3.47)	0.906
Not having a family doctor	0.94 (0.54-1.61)	0.809	1.52 (0.60 - 3.85)	0.375
Average weekly working hours				
1 hour to 42 hours	ref.		ref.	
43 hours to 59 hours	1.24 (0.71-2.17)	0.449	0.65 (0.22 - 1.95)	0.439
60 hours or above	1.49 (0.37-6.05)	0.580	0.91 (0.12 - 6.97)	0.929
Functional health literacy, low	2.89 (1.31-6.37)	0.008	1.85 (0.61 - 5.63)	0.276
Communicative and critical health literacy, low	0.80 (0.47-1.38)	0.431	0.97 (0.36 - 2.63)	0.952

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

Table 7

Factors affecting cancer screening participation in non-workers

Variable/Model	Gastric CS participation		Lung CS participation		Colorectal CS participation	
	AOR (95% CI)	P	AOR (95% CI)	P	AOR (95% CI)	P
Gender, female	0.76 (0.47-1.23)	0.261	0.58 (0.38-0.89)	0.013	0.64 (0.42-0.97)	0.037
Age (in years)	1.01 (0.98-1.05)	0.446	1.02 (1.00-1.04)	0.042	1.02 (1.00-1.04)	0.071
Education level						
High school education or lower	ref.		ref.		ref.	
Vocational college or junior college degree	1.15 (0.71-1.86)	0.576	1.26 (0.85-1.87)	0.254	1.33 (0.90-1.98)	0.152
College degree or higher	1.20 (0.70-2.05)	0.511	1.21 (0.76-1.91)	0.419	1.37 (0.87-2.16)	0.173
Annual household income						
<4 million yen	ref.		ref.		ref.	
4 million to 8 million yen	1.07 (0.66-1.75)	0.784	1.69 (1.10-2.59)	0.016	1.29 (0.84-1.97)	0.246
>8 million yen	1.38 (0.68-2.80)	0.365	1.77 (0.98 - 3.20)	0.059	1.34 (0.74-2.41)	0.335
Types of health insurance						
National Health Insurance (Kokumin kenko hoken)	ref.		ref.		ref.	
Japan Health Insurance Association (Kyokai kenpo)	1.08 (0.56-2.07)	0.819	1.11 (0.66-1.87)	0.700	1.11 (0.66-1.87)	0.681
Society-Managed Health Insurance (Kumiai kenpo)/ Mutual Aid Association (Kyosai kumiai)	1.47 (0.86-2.49)	0.157	1.18 (0.75-1.85)	0.482	1.16 (0.74-1.81)	0.524
Marital status, not having a spouse	0.78 (0.48-1.28)	0.328	1.03 (0.67-1.57)	0.896	0.85 (0.56-1.29)	0.453
Smoking, current smokers	0.52 (0.24-1.12)	0.096	0.71 (0.38-1.33)	0.286	0.36 (0.18-0.71)	0.003
Obesity	0.86 (0.52-1.42)	0.561	1.13 (0.74-1.74)	0.571	1.05 (0.69-1.62)	0.813
Not having a family doctor	0.80 (0.53-1.21)	0.288	0.76 (0.54-1.07)	0.110	0.62 (0.44-0.87)	0.005
Functional health literacy, low	1.34 (0.87-2.08)	0.189	0.74 (0.50-1.08)	0.120	0.73 (0.50-1.07)	0.109
Communicative and critical health literacy, low	0.72 (0.48-1.08)	0.111	0.72 (0.51-1.01)	0.058	0.89 (0.63-1.25)	0.500

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

Table 7

Factors affecting cancer screening participation in non-workers (cont.)

Variable/Model	Cervical CS participation		Breast CS participation	
	AOR (95% CI)	P	AOR (95% CI)	P
Gender, female	-	-	-	-
Age (in years)	0.99 (0.98-1.00)	0.174	1.00 (0.97-1.02)	0.703
Education level				
High school education or lower	ref.		ref.	
Vocational college or junior college degree	1.26 (0.88 - 1.81)	0.208	1.47 (0.95-2.26)	0.084
College degree or higher	1.25 (0.75 - 2.08)	0.393	1.24 (0.64-2.37)	0.526
Annual household income				
<4 million yen	ref.		ref.	
4 million to 8 million yen	1.42 (0.95 - 2.12)	0.085	1.55 (0.95-2.53)	0.078
>8 million yen	1.37 (0.80 - 2.34)	0.248	2.25 (1.16-4.38)	0.017
Types of health insurance				
National Health Insurance (Kokumin kenko hoken)	ref.		ref.	
Japan Health Insurance Association (Kyokai kenpo)	1.97 (1.21 - 3.22)	0.006	2.86 (1.54-5.30)	<0.001
Society-Managed Health Insurance (Kumiai kenpo)/ Mutual Aid Association (Kyoasai kumiai)	2.24 (1.49 - 3.36)	<0.001	1.81 (1.08-3.02)	0.025
Marital status, not having a spouse	0.64 (0.43 - 0.96)	0.029	0.90 (0.54-1.49)	0.679
Smoking, current smokers	0.65 (0.33 - 1.30)	0.226	0.30 (0.11-0.80)	0.017
Obesity	0.72 (0.45 - 1.13)	0.149	0.99 (0.59-1.69)	0.983
Not having a family doctor	0.59 (0.42 - 0.84)	0.003	0.72 (0.48-1.08)	0.112
Functional health literacy, low	1.37 (0.93 - 2.03)	0.110	1.36 (0.87-2.12)	0.184
Communicative and critical health literacy, low	0.92 (0.66 - 1.29)	0.629	0.71 (0.47-1.07)	0.102

References

- Bannai, A., & Tamakoshi, A. (2013). The association between long working hours and health: A systematic review of epidemiological evidence. *Scandinavian Journal of Work, Environment & Health*, 40(1), 5-18. doi:10.5271/sjweh.3388
- Cancer Registry and Statistics. Cancer Information Service, National Cancer Center, Japan. (2018). *Cancer mortality 1958-2017* [Available in Japanese]. Retrieved from [https://ganjoho.jp/data/reg_stat/statistics/dl/cancer_mortality\(1958-2017\).xls](https://ganjoho.jp/data/reg_stat/statistics/dl/cancer_mortality(1958-2017).xls)
- Fitzmaurice, C. (2018). Global, regional, and national cancer incidence, mortality, years of life lost, years lived with disability, and disability-adjusted life-years for 29 cancer groups, 2006 to 2016: A systematic analysis for the Global Burden of Disease study. *Journal of Clinical Oncology*, 36(15_suppl), 1568-1568. doi:10.1200/jco.2018.36.15_suppl.1568
- Fujiwara, M., Inagaki, M., Nakaya, N., Fujimori, M., Higuchi, Y., Kakeda, K., & Yamada, N. (2017). Association between serious psychological distress and nonparticipation in cancer screening and the modifying effect of socioeconomic

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

status: Analysis of anonymized data from a national cross-sectional survey in Japan. *Cancer*, 124(3), 555-562. doi:10.1002/cncr.31086

Fukuda, Y., Nakamura, K., & Takano, T. (2005). Reduced likelihood of cancer screening among women in urban areas and with low socio-economic status: A multilevel analysis in Japan. *Public Health*, 119(10), 875-884.
doi:10.1016/j.puhe.2005.03.013

Fukuda, Y., Nakamura, K., Takano, T., Nakao, H., & Imai, H. (2007). Socioeconomic status and cancer screening in Japanese males: Large inequality in middle-aged and urban residents. *Environmental Health and Preventive Medicine*, 12(2), 90-96.
doi:10.1007/bf02898155

Fukui, T., Rhaman, M., Takahashi, O., Saito, M., Shimbo, T., Endo, H., & Hinohara, S. (2005). The ecology of medical care in Japan. *Japan Medical Association Journal*, 48(4), 163-167.

Fukui, T., Rahman, M., Ohde, S., Hoshino, E., Kimura, T., Urayama, K. Y., . . .

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

Takahashi, O. (2017). Reassessing the ecology of medical care in Japan. *Journal of Community Health, 42*(5), 935-941. doi:10.1007/s10900-017-0337-4

Hama, H., Tabuchi, T., Ito, Y., Fukushima, W., Matsunaga, I., Miyashiro, I., &

Nakayama, T. (2016). Smoking behavior and participation in screening for lung, gastric, and colorectal cancers [Available only in Japanese]. *Nihon Koshu Eisei Zasshi. 2016;63*(3):126-34. doi:10.11236/jph.63.3_126.

Hamashima, C., Hattori, M., Honjo, S., Kasahara, Y., Katayama, T., Nakai, . . . Suto, A.

(2016). The Japanese guidelines for breast cancer screening. *Japanese Journal of Clinical Oncology, 46*(5), 482-492. doi:10.1093/jjco/hyw008

Hamashima, C. (2018). Update version of the Japanese Guidelines for gastric cancer

screening. *Japanese Journal of Clinical Oncology. 48*(7), 673-683.

doi:10.1093/jjco/hyy077

Huang, F. Y., Chung, H., Kroenke, K., Delucchi, K. L., & Spitzer, R. L. (2006). Using

the Patient Health Questionnaire-9 to measure depression among racially and

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

ethnically diverse primary care patients. *Journal General Internal Medicine*, 21(6), 547-552.

Ishikawa, H., Nomura, K., Sato, M. & Yano, E. (2008). Developing a measure of communicative and critical health literacy: A pilot study of Japanese office workers. *Health Promotion International*, 23(3), 269-274.
doi:10.1093/heapro/dan017

Ishikawa, H., Takeuchi, T. & Yano, E. (2008). Measuring functional, communicative, and critical health literacy among diabetic patients. *Diabetes Care*, 31(5).
doi:10.2337/dc07-1932

Kaneko, N. (2018). Factors associated with cervical cancer screening among young unmarried Japanese women: Results from an internet-based survey. *BMC Women's Health*, 18(1). doi:10.1186/s12905-018-0623-z

Kawata S, Hatashita H. (2015). Correlation of health literacy and life events to cervical cancer screening behaviors of Japanese female workers in their 20s. *Japanese*

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

Journal of Public Health Nursing. 4(1),41-47 doi:10.15078/jjphn.4.1_41

Kim, S. J., Han, K., & Park, E. (2016). Impact of job status on accessibility of cancer screening. *Cancer Research and Treatment*, 48(2), 825-833.

doi:10.4143/crt.2015.040

Maruthur, N. M., Bolen, S. D., Brancati, F. L., & Clark, J. M. (2009). The Association of Obesity and Cervical Cancer Screening: A systematic review and meta-analysis.

Obesity, 17(2), 375-381. doi:10.1038/oby.2008.480

Ministry of Health, Labour and Welfare. (2016). *Summary report of comprehensive survey of living conditions 2016*. Retrieved from

https://www.mhlw.go.jp/english/database/db-hss/dl/report_gaikyo_2016.pdf

Ministry of Health, Labour and Welfare. (2017). Survey on *economic conditions in health care 2015 (survey on insurers)*. Retrieved from

<https://www.e-stat.go.jp/stat-search/file-download?statInfId=000031641050&file>

Kind=0

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

Ministry of Health, Labour and Welfare. (2018). *Vital statistics in Japan: Trends up to 2016*. Retrieved from <https://www.mhlw.go.jp/english/database/db-hw/dl/81-1a2en.pdf>

Ministry of Health, Labour and Welfare. (2018). *Types of cancer screening* [Available in Japanese]. Retrieved from <https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000059490.html>

Nutbeam, D. (1998). Health promotion glossary. *Health Promotion International*, 13, 349–364. Retrieved from <https://www.who.int/healthpromotion/about/HPR%20Glossary%201998.pdf>

Nutbeam, D. (2000). Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st century. *Health Promotion International*, 15, 259–267.

OECD. (2017). *Health at a glance 2017*. Retrieved from

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

doi:https://dx.doi.org/10.1787/health_glance-2017-en.

OECD. (2017). *OECD obesity update 2017*. Retrieved from

<https://www.oecd.org/els/health-systems/Obesity-Update-2017.pdf>

Oldach, B. R., & Katz, M. L. (2014). Health literacy and cancer screening: A systematic review. *Patient Education and Counseling*, *94*(2), 149-157.

doi:10.1016/j.pec.2013.10.001

Pyenson, B. S., Sander, M. S., Jiang, Y., Kahn, H., & Mulshine, J. L. (2012). An actuarial analysis shows that offering lung cancer screening as an insurance benefit would save lives at relatively low cost. *Health Affairs*, *31*(4), 770-779.

doi:10.1377/hlthaff.2011.0814

Schütte, S., Dietrich, D., Montet, X., & Flahault, A. (2018). Participation in lung cancer screening programs: Are there gender and social differences? A systematic review.

Public Health Reviews, *39*(1). doi:10.1186/s40985-018-0100-0

FACTORS AFFECTING CANCER SCREENING PARTICIPATION

Wools, A., Dapper, E., & Leeuw, J. D. (2015). Colorectal cancer screening participation:

A systematic review. *The European Journal of Public Health*, 26(1), 158-168.

doi:10.1093/eurpub/ckv148

World Health Organization. (2018). *Cancer, key facts*. Retrieved from

<http://www.who.int/news-room/fact-sheets/detail/cancer>

World Health Organization. (2019). *Body mass index – BMI*. Retrieved from

<http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi>

Yokoe, T., Takei, H., Horiguchi, J., Koibuchi, Y., Maemura, M., Ohwada, S., . . .

Morishita, Y. (1997). Family history in participants of breast cancer screening.

Oncology Reports. doi:10.3892/or.4.5.973

Yoshida, M., Kondo, K., & Tada, T. (2010). The relation between the cancer screening

rate and the cancer mortality rate in Japan. *The Journal of Medical Investigation*,

57(3,4), 251-259. doi:10.2152/jmi.57.251