

RESEARCH ARTICLE

Factors Affecting Breast Cancer Screening Behavior in Japan - Assessment using the Health Belief Model and Conjoint Analysis

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Abstract

Background: Japanese women in their 40s or older have been encouraged to attend breast cancer screening. However, the breast cancer screening rate in Japan is not as high as in Europe and the United States. The aim of this study was to identify psychological and personal characteristics of women concerning their participation in breast cancer screening using the Health Belief Model (HBM). In addition, the attributes of screening more easily accepted by participants were analyzed by conjoint analysis. **Materials and Methods:** In this cross sectional study of 3,200 age 20-69 women, data were collected by an anonymous questionnaire. Questions were based on HBM and personal characteristics, and included attitudes on hypothetical screening attributes. Data of women aged 40-69 were analyzed by logistic regression and conjoint analysis to clarify the factors affecting their participation in breast cancer screening. **Results:** Among responses collected from 1,280 women of age 20-69, the replies of 993 women of age 40-69 were used in the analysis. Regarding the psychological characteristics based on HBM, the odds ratios were significantly higher in “importance of cancer screening” (95% CI: 1.21-2.47) and “benefits of cancer screening” (95% CI: 1.09-2.49), whereas the odds ratio was significantly lower in “barriers to participation before cancer screening” (95% CI: 0.27-0.51). Conjoint analysis revealed that the respondents, overall, preferred screening to be low cost and by female staff members. Furthermore, it was also clarified that attributes of screening dominant in decision-making were influenced by the employment status and the type of medical insurance of the women. **Conclusions:** In order to increase participation in breast cancer screening, it is necessary to disseminate accurate knowledge on cancer screening and to reduce barriers to participation. In addition, the attributes of screening more easily accepted were inexpensive, provided by female staff, executed in a hospital and finished in a short time.

Keywords: Breast cancer prevention - breast cancer screening - health belief model - conjoint analysis

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Introduction

In Japan, the annual numbers of new cancer cases and cancer deaths in women are approximately 340,000 and 144,000 (Matsuda et al., 2013; Ministry of Health, Labor and Welfare of Japan, 2013; <http://ganjoho.jp/professional/statistics/statistics.html>), respectively, with breast cancer being among the most common types (Curado et al., 2007; Saika and Sobue, 2009). Each year, approximately 65,000 women newly develop this cancer, and approximately 13,000 women die from it (Matsuda et al., 2013; Ministry of Health, Labor and Welfare of Japan, 2013). Since 2004, breast cancer screening has been recommended for women 40 years of age and older as one of the strategic screening programs in Japan. The Basic Plan to Promote Cancer Control Programs, developed in 2007, stated the aim of improving the cancer screening rate to 50% or more within 5 years (Ministry of Health, Labor and Welfare of Japan, 2007; <http://www.mhlw.go.jp/shingi/2007/06/>

[s0615-1.html](http://www.mhlw.go.jp/stf/houdou/2r9852000001igt0.html)). However, the breast cancer screening rate in Japan is still 31.4% (Ministry of Health, Labor and Welfare of Japan, 2010; <http://www.mhlw.go.jp/stf/houdou/2r9852000001igt0.html>), which is no so high as the rates in Europe and the United States (Saika and Sobue, 2011; Suzuki et al., 2012). Thus, an important issue for prevention of death from breast cancer is the development of strategies to increase breast cancer screening rates in Japan.

In order to increase participation in breast cancer screening, factors affecting participation of breast cancer screening need to be analyzed. In Europe and the United States, many studies aiming to improve cancer screening rates have been conducted using the theory of applied behavioral science (Champion, 1993; Doi, 2009; Ahmadian and Samah, 2013). Especially, the Health Belief Model (HBM) proposed by Rosenstok (1966) from the United States is a well-known theoretical model that explains the association between preventive health

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practices and psychological attitudes. According to the first HBM theory, specific preventive health practices are determined by interactions among the following 4 factors: perception of risk of contracting a particular disease (Perceived Susceptibility), perception of seriousness of the contracted disease (Perceived Seriousness), perception of benefits of practices to prevent such diseases (Perceived Benefit), and perception of barriers to the implementation of preventive practices (Perceived Barrier). In Japan, Hata et al. (2009) are proposing a revised HBM based on these basic concepts. In the past, studies on the association between breast cancer screening behaviors and psychological characteristic by the HBM have been conducted mainly in Europe and the United States (Stein et al., 1992; Hyman et al., 1994; Menon et al., 2007; Tavafian et al., 2009; Hajian et al., 2011; Yilmaz et al., 2013). In Japan, although there are reports on screening behaviors associated with population-based (Tohnai and Hata, 1994) and gastric cancer screenings (Tsubono et al., 1993), few have applied studies on breast cancer screening behaviors. Thus, a study based on this theory appears to be necessary for understanding the psychological characteristics of breast cancer screening behaviors.

Meanwhile, in order to establish a screening system which is likely to motivate residents to participate in screening, it is necessary to analyze attributes of screening more easily accepted by participants, such as the place, time, and cost of screening. In recent years in Europe and the United States, conjoint analysis, one of the stated preference techniques, is used for quantitative assessment of preferences for conditions allowing or promoting participation in cancer screening (Gyrd-Hansen and Sogaard, 2001; Marshall et al., 2007; Hawley et al., 2008; Hol et al., 2010; Ghanouni et al., 2013). In the past, it has been pointed out that the factors receiving emphasis are difficult to identify by reciprocal comparisons of multiple factors. However, conjoint analysis can be applied to determining the levels of importance of multiple factors (Ryan and Farrar, 2000).

In order to increase participation in breast cancer screening, the aim of this study is to identify psychological and personal characteristics of women concerning their participation in breast cancer screening by the HBM. In addition, the attributes of screening more easily accepted by participants were analyzed by conjoint analysis.

Materials and Methods

Survey subjects

From among women 20-69 years of age (4,521 women) living in A Town (with a population of 9,300 women as of April 1, 2012) of Hiroshima Prefecture in Japan, 3,200 women were selected by stratified random sampling, and an anonymous questionnaire survey was conducted. The sampling was stratified by taking population ratios, by age group, into consideration.

Survey items and contents

Status of participation in breast cancer screening: we surveyed whether the subjects participated in breast cancer screening in the past 2 years and which types of screening

programs (population-based screening, workplace-based screening, complete physical examination, hospital visit based on individual decisions, and others) these women participated in. In the survey target region, arrangements have been made for residents with no opportunity to participate in screening at their workplaces so that they can participate in population-based screening. The unscreened women were surveyed to ascertain why they did not participate in screening (good health status, busy schedule, anxiety over results, bothersome, others).

Personal characteristics: based on preceding studies (Lemon et al., 2001; Coughlin et al., 2008; Seki et al., 2011; Murakami, 2012), the survey items on personal characteristics included the following items as factors that might be associated with participation in breast cancer screening: age, marital status, children, household composition (single, 2-person household, 2-generation family, 3-generation family, others), employment status (self-employment, regular employment, non-regular employment, housewife, unemployed), medical insurance (Japan Health Insurance Association administered health insurance, Association/union administered Health Insurance, National Health Insurance, Mutual aid association, others), subjective health status (good, relatively good, normal, relatively bad, and bad), body mass index (BMI) (lean, normal, and obese), and family history of cancer. In Japan, public health insurance programs are broadly divided into “employees’ insurance” and “regional insurance”. The employees’ insurance is mainly composed of “Japan Health Insurance Association administered health insurance (for employees of small and medium-sized businesses and their dependent family members)”, “Association/union administered Health Insurance (for employees of large businesses and their dependent family members)”, and “Mutual aid associations (for public servants and their dependent family members)”. The regional insurance includes “National Health Insurance (for people not eligible for employees’ insurance, such as self-employed or unemployed people)”.

Psychological characteristics based on the HBM: regarding psychological characteristics based on the HBM, the survey items were examined based on the preceding studies on cancer screening behaviors (Yarbrough and Braden, 2001; Gozum and Aydin, 2004; Medina-Shepherd and Kleier, 2010; Guvenc et al., 2011; Seki et al., 2011). The questionnaire survey was composed of 7 component based on the revised HBM by Hata et al. (2009) (Figure 1). Each item was answered on a 5-point scale (1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5 strongly agree). As higher scores on each of the items indicated that participation in screening was perceived as being more beneficial, the total scores were calculated for each factor. The Cronbach’s α coefficients, which are an index of internal consistency among the questions comprising each scale, were 0.869 for “susceptibility to cancer”, 0.813 for “seriousness of cancer”, 0.811 for “importance of cancer screening”, 0.797 for “benefits of cancer screening”, 0.640 for “barriers to participation before cancer screening”, 0.759 for “barriers to participation at the time of cancer screening”, and 0.806 for “cues to participation in screening”.

Subjective assessment of female cancer	1) Susceptibility to female cancer	I may develop female cancer in the future. I may develop female cancer within a few years. I am more likely to develop female cancer than other women.
	2) Seriousness of female cancer	If I develop female cancer, my activities of daily living will be limited. If I develop female cancer, my life will be changed. If I develop female cancer, my family will be made trouble. I am afraid of developing female cancer.
	3) Importance of female cancer screening	I do not need to participate in female cancer screening because I have no particular subjective symptoms. I do not need to participate in female cancer screening because I can visit a medical institution whenever there is any concern. Participate in female cancer screening is less important than other health issues.
Decision process		
Subjective assessment of female cancer screening	4) Benefits of female cancer screening	Participate in female cancer screening can lead to early detection of female cancer. Participate in female cancer screening can lead to reduction in mortality from female cancer. Participate in female cancer screening can lead to better management of my health.
	5) Barriers to participation before female cancer screening	I do not have time to participate in female cancer screening. Participation in female cancer screening is costly. I forget to regularly participate in female cancer screening.
	6) Barriers to participation at the time of female cancer screening	I am embarrassed about participating in female cancer screening because it includes examination of a delicate area. I do not want to participate in female cancer screening that is performed by male doctors/ staff members. Female cancer screening causes discomfort, even pain.
Behavioral process	Motivational factors for participation in screening	7) Cues to participation in screening
		My closest family members recommend that I participate in female cancer screening. My close friends/acquaintances recommend that I participate in female cancer screening. The doctors at the hospital which I regularly visit recommend that I participate in female cancer screening.

Figure 1. Component Items Base on the Health Belief Model (22 items). Female cancer: breast cancer and cervical cancer

Attitudes on hypothetical screening attributes: we presented hypothetical screening attributes (a total of 10 types) that had been derived by the conjoint analysis described below. The subjects assessed their preference for each course defined according to different combinations of each condition on a 5-point scale (1: completely undesirable, 2: undesirable, 3: neither desirable nor undesirable, 4: desirable, and 5: very desirable).

Subjects and methods of analysis

In Japan, strategic breast cancer screening programs are recommended for women 40 years of age or older. Accordingly, the age range of the subjects included in the analysis was set at 40-69 years for this study. According to breast cancer screening participation status in the past 2 years, the respondents were divided into the screened and unscreened groups. As exploratory analysis for multiple logistic regression analysis, the χ^2 test was performed to analyze the associations between personal characteristics and screening behaviors. Then, multiple logistic regression analysis was performed with factors significantly associated with screening behaviors based on χ^2 test of personal characteristics and the seven components by the HBM as independent variables and screening behaviors (screened and unscreened women) as dependent variables. The variables for age and the components by the HBM were included in the multiple logistic regression analysis, and the personal characteristics that were shown to be associated with screening behaviors were analyzed using the step-up procedure.

The hypothetical screening attributes were assessed using conjoint analysis. Conjoint analysis is a statistical analysis technique used to examine factors affecting decision-making on purchasing behavior, etc. This technique allows relative importance to be estimated, which indicates the influences of the factors on each other, and partial utility values, which indicate how influential

Table 1. Attributes and Associated Levels for Assessment of Breast Cancer Screening Preferences

Attributes	Levels
Place ^a	Hospitals or clinics (Individual screening)/ Screening car (Group screening)
Cost ^b	Low (500 yen)/High (9,000 Yen)
Time ^c	1 hour/3 hours
Staff ^d	male/female

^aPlace: "Screening car" indicates a screening program provided at local community centers, etc; ^bCost (copayment): The cost was determined based on the cost of the screening programs provided in the survey target region. "Low" indicates low cost of participating in population-based screening in A Town (500 yen). "High" indicates high cost of participating in screening at a medical institution (9,000yen); ^cTime: Time required for screening; and ^dStaff: Persons in charge of screening (i.e. doctor, radiation technologist and/or nurse)

the levels of each attributes are. In this study, the attributes shown in Table 1 and their levels were set based on the data obtained in preceding studies (Kawakami et al., 2007; Taguchi et al., 2010). If hypothetical screening attributes that the subjects evaluated for desirability were developed employing every possible combination of these 4 attributes, there would be a total of 16 possible courses. However, the number of combinations can be reduced by using ORTHOPLAN (orthogonal array) in consideration of the balance between attributes and their levels. In this study, 10 courses were selected, and each course was assessed for its desirability on a 5-point scale. The relative importance and the partial utility values were estimated.

PASW Statistics 18 (SPSS Japan Inc.) was used for statistical analysis. The significance level was set at 5%.

Ethical consideration

In this survey, the residents were asked to respond to an anonymous self-completed questionnaire survey. There was no return address on the envelopes for returning completed questionnaire forms. After the forms had been delivered, consideration was given to avoiding the retention of records of personal information on the

investigator side. This study was conducted after obtaining approval from the ethics committee at the Graduate School of Biomedical and Health Sciences, Hiroshima University.

Results

Out of 3,200 women to whom the questionnaire survey

Table 2. Subject Characteristics

Characteristics		n	%
Age	40-49	182	19.1
	50-59	317	33.2
	60-69	456	47.7
Household composition	Single	51	5.5
	2-person household	299	32.1
	2-generation family	359	38.5
	3-generation family	143	15.3
	Others	80	8.6
Marital Status	Married	798	83.7
	Single, Divorced, Widowed	155	16.3
Children	Yes	845	93.3
	No	61	6.7
Work status	Self-employed	118	12.8
	Regular employment	256	27.8
	Non-regular employment	205	22.2
	Housewife	293	31.8
	Unemployed	50	5.4
Medical insurance	Japan Health Insurance Association	297	32.2
	Association/union	58	6.3
	National health insurance	418	45.3
	Mutual aid association	112	12.1
	Others	31	3.4
	Unknown	6	0.7
Family history of cancer	Yes	423	45.9
	No	483	52.4

*For each attribute, the number of respondents who did not provide an answer is not shown

Table 3. Status of Participation in Breast Cancer Screening

Characteristic		Population-based		Workplace-based		Individual complete physical examination/hospital visit		Others		Total	
		n	%	n	%	n	%	n	%	n	%
Age	40-49	36	32.4	44	39.6	26	23.4	5	4.5	111	100.0
	50-59	83	39.9	72	34.6	50	24.0	3	1.4	208	100.0
	60-69	204	78.2	17	6.5	38	14.6	2	0.8	261	100.0
Work status	Self-employed	49	64.5	8	10.5	18	23.7	1	1.3	76	100.0
	Regular employment	36	20.9	96	55.8	37	21.5	3	1.7	172	100.0
	Non-regular employment	66	59.5	19	17.1	23	20.7	3	2.7	111	100.0
	Housewife	143	81.3	3	1.7	28	15.9	2	1.1	176	100.0
	Unemployed	18	69.2	1	3.8	7	26.9	0	0.0	26	100.0

*For each attribute, the number of respondents who did not provide an answer is not shown

Table 4. Reasons for Not Participating in Breast Cancer Screening

Characteristic		Good health status		Busy schedule		Anxiety over results		Bothersome		Others		Total	
		n	%	n	%	n	%	n	%	n	%	n	%
Age	40-49	6	11.8	18	35.3	7	13.7	7	13.7	13	25.5	51	100.0
	50-59	12	16.4	28	38.4	9	12.3	15	20.5	9	12.3	73	100.0
	60-69	44	31.7	30	21.6	17	12.2	17	12.2	31	22.3	139	100.0
Work status	Self-employed	7	21.2	8	24.2	5	15.2	5	15.2	8	24.2	33	100.0
	Regular employment	11	18.3	26	43.3	5	8.3	11	18.3	7	11.7	60	100.0
	Non-regular employment	13	20.3	26	40.6	2	3.1	12	18.8	11	17.2	64	100.0
	Housewife	24	28.9	12	14.5	14	16.9	10	12.0	23	27.7	83	100.0
	Unemployed	5	38.5	2	15.4	1	7.7	1	7.7	4	30.8	13	100.0
Medical insurance	Japan Health Insurance Association	18	18.2	35	35.4	10	10.1	18	18.2	18	18.2	99	100.0
	Association/union	1	6.7	7	46.7	2	13.3	1	6.7	4	26.7	15	100.0
	National health insurance	38	33.9	24	21.4	13	11.6	14	12.5	23	20.5	112	100.0
	Mutual aid association	3	25.0	5	41.7	1	8.3	2	16.7	1	8.3	12	100.0
	Others	2	20.0	2	20.0	2	20.0	2	20.0	2	20.0	10	100.0
	Unknown	0	0.0	0	0.0	0	0.0	1	33.3	2	66.7	3	100.0

*For each attribute, the number of respondents who did not provide an answer is not shown

forms had been delivered, responses were collected from 1,280 women 20-69 years of age (40.0%). Among them, 993 women 40-69 years of age were included in the analysis.

Subjects characteristic

The basic attributes of the subjects included in the analysis are shown in Table 2. The mean age was 57.40 (standard deviation: ±7.98) years. The most common employment status was housewife (293 women; 31.8%). The most common type of medical insurance was the national health insurance in 418 women (45.3%), followed by government-managed health insurance in 297 women (32.2%). Women with a family history of cancer accounted for 45.9%.

Status of participation in breast cancer screening

The number of women who had participated in breast cancer screening was 595 (63.5%), and the screening rates were in the order of 67.9% (212 women) in those in their 50s, 63.5% (115) in those in their 40s, and 60.4% (268) in those in their 60s. The status of participation in breast cancer screening is shown according to each attribute in Table 3. While more women in their 40s and 50s participated in workplace-based screening, there were more women in their 60s participating in population-based screening. Among the self-employed women, housewives, and the unemployed, more women were participating in population-based screening. In the women with regular employment, more were participating in workplace-based screening. In the women with non-regular employment, more were participating in population-based screening or

visiting a hospital based on their individual preferences.

The number of women who had not participated in screening was 342 (36.5%). The common reasons for not participating in screening were busy schedule and that it was bothersome in the women in their 40s and 50s and good health status in those in their 60s. According to employment status, the common reasons were busy schedule and that it was bothersome in women with regular or non-regular employment and good health status among the housewives and the unemployed women. Among the women other than those with national health insurance, the common reasons were busy schedule and that it was bothersome (Table 4). Other reasons included "I can consult a doctor whenever there is any concern" and "I do not have any particularly worrying symptoms".

Table 5. Associations between Breast Cancer Screening Behaviors and Personal Characteristics

Characteristic	Screened		Unscreened		Total n (100%)	p value ^a
	n	%	n	%		
Age						
40-49	115	63.5	66	36.5	181	0.103
50-59	212	67.9	100	32.1	312	
60-69	268	60.4	176	39.6	444	
Household composition						
Single	22	44.9	27	55.1	49	0.009**
2-person household	187	63.0	110	37.0	297	
2-generation family	228	64.8	124	35.2	352	
3-generation family	101	72.1	39	27.9	140	
Others	44	57.1	33	42.9	77	
Marital Status						
Married	519	66.2	265	33.8	784	0.000**
Single, Divorced, Widowed	76	50.3	75	49.7	151	
Children						
Yes	530	63.8	301	36.2	831	0.270
No	34	56.7	26	43.3	60	
Work status						
Self-employed	77	67.0	38	33.0	115	0.050
Regular employment	176	69.8	76	30.2	252	
Non-regular employment	116	57.1	87	42.9	203	
Housewife	177	61.7	110	38.3	287	
Unemployed	28	59.6	19	40.4	47	
Payroll number						
Independent business or 5-	84	62.2	51	37.8	135	0.256
5-	171	67.1	84	32.9	255	
100-	48	66.7	24	33.3	72	
300-	26	60.5	17	39.5	43	
Public office	15	88.2	2	11.8	17	
Medical insurance						
Japan Health Insurance Association						
Association/union	168	57.3	125	42.7	293	0.000**
National health insurance	269	65.3	143	34.7	412	
Mutual aid association	92	82.9	19	17.1	111	
Others	15	48.4	16	51.6	31	
Unknown	2	33.3	4	66.7	6	
Health status						
Good	123	59.7	83	40.3	206	0.025*
Slightly good	168	66.9	83	33.1	251	
Normal	224	67.1	110	32.9	334	
Slightly bad	67	57.3	50	42.7	117	
Bad	8	40.0	12	60.0	20	
BMI						
Lean	36	48.0	39	52.0	75	0.003**
Normal	464	66.5	234	33.5	698	
Obese	85	58.6	60	41.4	145	
Family history of cancer						
Yes	302	71.4	121	28.6	423	0.000**
No	275	56.9	208	43.1	483	

*p<0.05; **p<0.01; ^aχ² test; BMI, Body mass indexes were divided into 3 grades: lean (BMI<18.5), normal (18.5≤BMI<25), and obese (BMI≥25)

Factors affecting participation of breast cancer screening

After the association between the personal characteristics and screening behaviors had been assessed using the χ² test, significant associations were observed with household composition, marital status, employment status, medical insurance, current health status, BMI, and family history of cancer (Table 5).

Table 6 shows the results of the psychological characteristics of the screened group based on the HBM, the odds ratios were significantly higher for "importance of cancer screening" [95% confidence interval (CI): 1.21-2.47] and "benefits of cancer screening" (95%CI: 1.09-2.49), whereas the odds ratio was significantly lower for "barriers to participation before cancer screening" (95%CI: 0.27-0.51). Among the personal characteristics, the BMI (95%CI: 0.18-1.0) and family history of cancer (95%CI: 0.42-0.93) were significantly associated with screening behaviors.

Attitudes on hypothetical screening attributes

The results on preferences of the respondents for the hypothetical screening attributes are shown in Figure 2. The response rates were 84.3% (805 women) at the highest and 76.5% (731 women) at the lowest. Among the 10 courses, the most desirable was Screening Course 7 (with a combination of screening car, low cost, 1-hour duration, and female staff), which was selected by 61.6% (496 women) of the respondents. Meanwhile, the most undesirable was Screening Course 9 (with a combination of screening car, high cost, 3-hour duration, and male staff), which was not selected by 76.4% (559 women) of the respondents. Then, based on these results, the relative importance of each attributes was determined to identify which had the greatest influence on cancer screening behaviors, and the following items were separately examined: all respondents, status of participation in breast cancer screening, employment status, and medical insurance (Figure 3).

Overall, the important of each attribute were cost

Table 6. Psychological and Personal Characteristics Affecting Participation of Breast Cancer Screening

Variables	Odds ratio (95% CI) ^a	p value
HBM		
Susceptibility of cancer	1.18 (0.87-1.61)	0.280
Seriousness of cancer	0.98 (0.70-1.36)	0.894
Importance of screening	1.73 (1.21-2.47)	0.003**
Benefits of screening	1.65 (1.09-2.49)	0.019*
Barriers before screening	0.37 (0.27-0.51)	0.000**
Barriers at screening	1.01 (0.78-1.31)	0.927
Cues to screening	0.87 (0.69-1.11)	0.259
Age		
40-49	1.47 (0.84-2.57)	0.174
50-59	1.59 (1.00-2.54)	0.052
60-69	Reference	
BMI		
Lean	0.43 (0.18-1.00)	0.049*
Normal	1.13 (0.64-1.97)	0.675
Obese	Reference	
Family history of cancer		
No	0.62 (0.42-0.93)	0.021*
Yes	Reference	

*p<0.05; **p<0.01; Multiple logistic regression analysis was performed. Dependent variables: screening behaviors (0: unscreened women, 1: screened women); Independent variables: factors significantly associated with screening behaviors based on χ² test of personal characteristics (household composition, marital status, employment status, medical insurance, current health status, BMI, and family history of cancer), and the HBM scales (continuous variable); ^a95% confidence interval [CI]; HBM, Health Belief Model

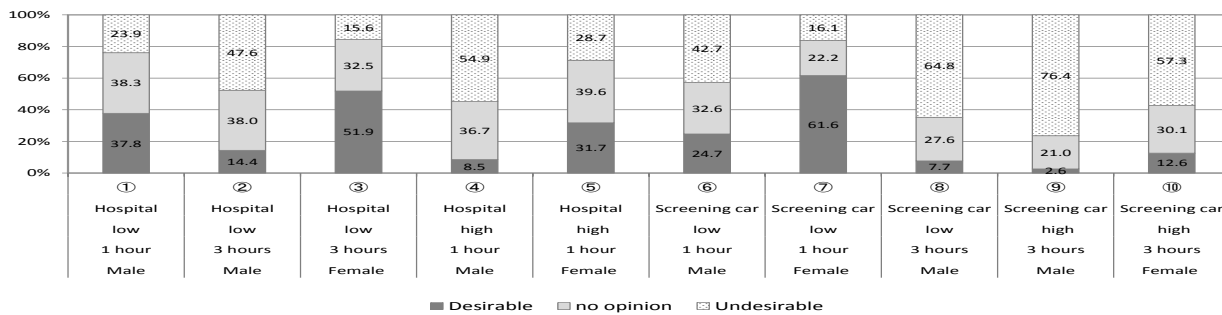


Figure 2. Preferences for Hypothetical Screening Attributes

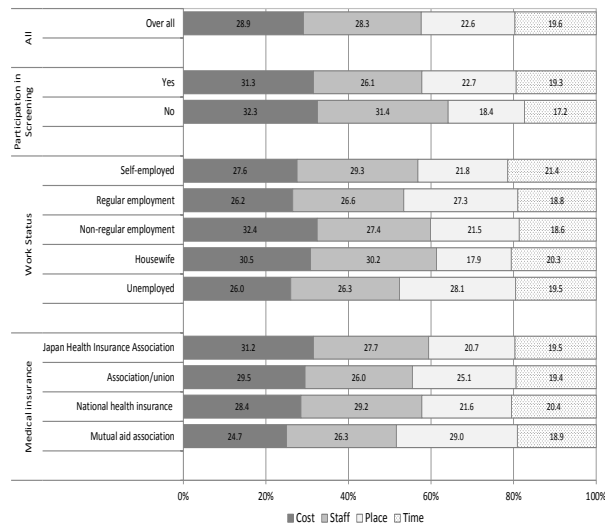


Figure 3. Relative Importance of Each Attribute Derived from Conjoint Analysis

(28.9%), staff (28.3%), place (22.6%), and duration time (19.6%). Next, the unscreened group especially emphasized cost and staff. The women with non-regular employment and those with Japan Health Insurance Association administered health insurance placed the most emphasis on cost. Those with aid association insurance most emphasized the place of screening, and their preference differed from that of the other women.

The partial utility values were negative coefficients for either cost (high cost: -1.45, low cost: -0.72) or duration (1 hour: -0.36, 3 hours: -0.73). Cost and duration were inhibitory factors for participation in screening, regardless of the levels of other factors. Next, the partial values were place (screening car: -0.11, hospital: 0.11) and staff (male: -0.38, female: 0.38). It was revealed that a hospital setting was preferred to a screening car, and that female staff members were preferred to male staff members. For the other attributes, desirability was the same.

Discussion

Based on analysis of associations between breast cancer screening behaviors and psychological characteristics based on the HBM, women were found to participate in screening when they perceived the importance and benefits of cancer screening and there were fewer barriers to participation in such screening program. Finding in our study are consistent with previous studies (Tsubono et al., 1993; Tohnai and Hata, 1994). Thus, in order to motivate women to participate in screening, it seemed to

be necessary to disseminate accurate knowledge on cancer screening and to enlighten women accordingly, as well as to reduce barriers to participation in screening.

Unlike a visit to a medical institution for a consultation, cancer screening is for people without symptoms. Nevertheless, this survey revealed that the non-participating group had not participated in screening for the following reasons: “I am healthy”, “I can consult a doctor whenever there is any concern” and “I do not have any particularly worrying symptoms”. Based on this, some unscreened women might be confusing cancer screening with a visit to a medical institution motivated by illness. Thus, dissemination of accurate information regarding the purpose and meaning of cancer screening, such as the importance of participation in cancer screening before the appearance of symptoms, was suggested to be important.

In this survey, the most common reasons for not participating in screening were busy schedule and that it was bothersome, responses which were frequently given especially by women in their 40s with a high risk of breast cancer (Shin et al., 2010a; 2010b). Because the employment rate in women in this age group is high, it can be speculated that these women are likely to put off management of their own health to balance the requirements of their jobs, household chores, child rearing, etc. However, the 40s is an important decade when the risk of developing breast cancer increases rapidly. Thus, while information on breast cancer, such as morbidity, should be provided to women in this age group to help them understand the importance of starting participation in cancer screening at an appropriate age, an important issue is to improve the screening environment in order to reduce barriers to participation in screening for busy women.

According to the comparison by employment status, the screening rate was lowest in women with non-regular employment, and many of them were participating in population-based screening rather than workplace-based screening. Thus, it was assumed that women with non-regular employment have few opportunities to participate in screening at the workplace. If women are not willing to actively collect information on cancer from places other than the workplace, it seems unlikely that busy women will increase their knowledge of cancer and become willing to participate in screening. Thus, it is also necessary to investigate opportunities that can be used to disseminate knowledge on cancer to working women lacking opportunities to participate in workplace screening, to inform them, and to provide all information needed for them to participate in screening.

According to the preceding studies on analysis of

personal characteristics associated with cancer screening behaviors, it has been shown that people with a family history of cancer tend to participate in screening (Kaneto et al., 2010). This survey yielded similar results, suggesting that people with a family history of cancer may be more aware of the risk of developing cancer and thus be motivated to participate in screening because their close family members have suffered from cancer. Moreover, BMI, particularly in those with obesity, was also associated with screening behaviors. It was observed that lean women were more unlikely to participate in screening than obese women. This was consistent with the results of preceding studies (Kaneto et al., 2010). In general, obese people are considered to be at high risk of developing diseases. Because of this, it was assumed that lean women might be less aware of the risk of developing diseases than obese women and not take actions to prevent cancer. In recent years, obesity, which is increasing due to the westernized diet, has also been pointed out as a risk for developing breast cancer (Tajima, 2012). Thus, it was also assumed that obese women perceive the importance of participation in breast cancer screening and actually participate in it.

Conjoint analysis was performed to evaluate attributes of screening emphasized for participation in screening. Overall, cost and staff members were most emphasized by the respondents. The unscreened women, especially, preferred female staff members. It was assumed that a sense of embarrassment regarding the screening procedure is affecting the decision as to whether or not to participate in screening (Sugawara and Matsuda, 2013). Based on this, it might be necessary to consider measures to make the screening environment privacy-conscious in the case of unscreened women. For example, having female staff members perform screening should perhaps be implemented.

Meanwhile, it revealed the attributes of screening that were dominant in decision were influenced by the employment status and the type of medical insurance of the women. The women with non-regular employment and those with government-managed health insurance (for small and medium-sized businesses) placed the most emphasis on cost. As for the current situation of workplace-based screening in Japan, more businesses with 30 or fewer employees do not provide cancer screening programs, compared to those with 100 employees or more (Ministry of Health, Labor and Welfare of Japan, 2009: <http://www.mhlw.go.jp/toukei/itiran/roudou/saigai/anzen/kenkou07/>). It has been reported that, even though women wish to participate in screening, an environment in which they can participate in screening at the workplace is not always provided at present. In this situation, the cost for screening can be expected to be high if these women do not participate in population-based screening, instead individually visiting a hospital for a health check-up. It was assumed that these women might have shown a tendency to most emphasize cost due to this current situation. Meanwhile, women with aid association insurance (for public offices) most emphasized the place of screening (hospital), showing a different trend from those with the other attributes. As for cancer screening, screening rates are higher in people with aid association insurance, as compared to those with other

types of medical insurance. A great disparity in cancer screening rates has been reported to exist among people with different types of medical insurance (Tabuchi et al., 2012). Thus, consideration of screening systems that fully take the living conditions of women into consideration would appear to be an important point when endeavoring to improve screening rates in the future.

Study limitations and future issues. The limitations of this study and future issues are described in this section. First, this study was conducted in a town with an adult female population of approximately 10,000 in Japan. However, because the methods and contents of breast cancer screening programs vary among municipalities, there are limitations in generalizing the results of this study to those of women 40-69 years of age.

Secondly, there is a problem with the theoretical validity of the HBM, which was used in this study. In order to understand breast cancer screening behaviors, the background factors of the subjects and psychological characteristics based on the HBM examined in this study may not be sufficient. In the future, it is necessary to closely examine factors associated with breast cancer screening by conducting studies with consideration of these associations with knowledge of breast cancer and psychological characteristics other than the HBM.

Thirdly, in the theory of the HBM, the direct determining factors for preventive health practices are psychological characteristics/attitudes called health beliefs, while background factors and personal characteristics are considered to be indirect modifying factors that are associated with behaviors through psychological attitudes. However, this study examined only the main effects of each psychological factor, not examining any of the potential interactions between these psychological factors. In the future, the correlation of screening behaviors with background factors and psychological characteristics by HBM need to be analyzed in more detail.

Finally, although 4 factors were specified for conjoint analysis, the respondents were asked to deal with the other factors as if they were under the same conditions. Thus, the responses may not reflect behaviors under actual screening conditions. Moreover, the non-response rates to the questions on the 10 the hypothetical screening attributes were 23.5% at the highest and 15.7% even at the lowest. The possibility that these high non-response rates might have affected the results cannot be ruled out.

In conclusion, we examined psychological and personal characteristics affecting participation of breast cancer screening by the HBM. In addition, the attributes of screening more easily accepted by participants were analyzed by conjoint analysis. The results revealed that the psychological characteristics affecting participation of breast cancer screening are perception of the importance and benefits of cancer screening and fewer barriers to participation in screening. Then, conjoint analysis revealed that the respondents, overall, preferred low cost and female staff members. Meanwhile, it also revealed the attributes of screening that were dominant in decision were influenced by the employment status and the type of medical insurance of the women. In order to increase participation in breast cancer screening, it is necessary to disseminate

accurate knowledge on cancer screening and to reduce barriers to participation in cancer screening. Additionally, the attributes of screening more easily accepted were inexpensive, provided by female staff, executed in hospital and finished in a short time.

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References

- Ahmadian M, Samah AA (2013). Application of health behavior theories to breast cancer screening among asian women. *Asian Pac J Cancer Prev*, **14**, 4005-13.
- Champion VL (1993). Instrument refinement for breast cancer screening behaviors. *Nurs Res*, **42**, 139-43.
- Coughlin SS, Leadbetter S, Richards T, et al (2008). Contextual analysis of breast and cervical cancer screening and factors associated with health care access among United States women, 2002. *Soc Sci*, **66**, 260-75.
- Curado MP, Edwards B, Shin HR, et al (2007). Cancer Incidence in Five Continents.
- Doi Y (2009). Behavioral science research in Japan, from theory to practice. *J Natl Inst Public Health*, **58**, 2-10.
- Ghanouni A, Smith SG, Halligan S (2013). Public preferences for colorectal cancer screening tests: a review of conjoint analysis studies. *Expert Rev Med Devices*, **10**, 489-99.
- Gozum S, Aydin I (2004). Validation evidence for Turkish adaptation of champion's health belief model scales. *Cancer Nurs*, **27**, 491-8.
- Guvenc G, Akyuz A, Acikel CH (2011). Health belief model scale for cervical cancer and Pap smear test: psychometric testing. *J Adv Nurs*, **67**, 428-37.
- Gyrd-Hansen D, Sogaard J (2001). Analysing public preferences for cancer screening programmes. *Health Econ*, **10**, 617-34.
- Hajian S, Vakilian K, Najabadi KM, et al (2011). Effects of education based on the health belief model on screening behavior in high risk women for breast cancer, Tehran, Iran. *Asian Pac J Cancer Prev*, **12**, 49-54.
- Hata E (2009). Health belief model. In 'Behavioral Science - Theory and Application for Health Promotion', Eds Hata E and Doi Y. Nankodo, Japan pp 37-56
- Hawley ST, Volk RJ, Krishnamurthy P, et al (2008). Preferences for colorectal cancer screening among racially/ethnically diverse primary care patients. *Med Care*, **46**, 10-6.
- Hol L, de Bekker-Grob EW, van Dam L, et al (2010). Preferences for colorectal cancer screening strategies: a discrete choice experiment. *Br J Cancer*, **102**, 972-80.
- Hyman RB, Baker S, Ephraim R, et al (1994). Health Belief Model variables as predictors of screening mammography utilization. *J Behav Med*, **17**, 391-406.
- Kaneto C, Toyokawa T, Mitoshi Y (2010). The factors influential to cervical cancer screening behaviors among Japanese female workers: MY Health Up Study. *J Health and Welfare Statistics*, **57**, 1-7.
- Kawakami C, Okamoto N, Ohshige K, et al (2007). The survey of citizens' ideas on cancer screening behaviors. *J Health and Welfare Statistics*, **58**, 83-94.
- Lemon S, Zapka J, Puleo E, et al (2001). Colorectal cancer screening participation: comparisons with mammography and prostate-specific antigen screening. *Am J Public Health*, **91**, 1264-72.
- Matsuda A, Matsuda T, Shibata A, et al (2013). Cancer incidence and incidence rates in Japan in 2007: a study of 21 population-based cancer registries for the monitoring of cancer incidence in Japan (MCIJ) project. *Jap J Clin Oncol*, **43**, 328-36.
- Marshall DA, Johnson FR, Phillips KA, et al (2007). Measuring patient preferences for colorectal cancer screening using a choice-format survey. *Value Health*, **5**, 415-30.
- Medina-Shepherd R, Kleier JA (2010). Spanish translation and adaptation of Victoria Champion's Health Belief Model Scales for breast cancer screening--mammography. *Cancer Nurs*, **33**, 93-101.
- Menon U, Champion V, Monahan PO, et al (2007). Health belief model variables as predictors of progression in stage of mammography adoption. *Am J Health Promot*, **21**, 55-61.
- Murakami S (2012). Risk factors of breast cancer--life style and environmental factors. *Nihon Rinsho*, **70**, 50-4.
- Ryan M, Farrar S (2000). Using conjoint analysis to elicit preferences for health care. *BMJ*, **320**, 1530-3.
- Rosenstock IM (1966). Why people use health services. *Milbank Mem Fund Q*, **44**, 94-127.
- Saika K, Sobue T (2009). Epidemiology of Breast Cancer in Japan and the US. *JMAJ*, **52**, 39-44.
- Saika K, Sobue T (2011). Time trends in breast cancer screening rates in the OECD countries. *Jpn J Clin Oncol*, **41**, 591-2.
- Sugawara S, Matsuda T (2013). Effectiveness of the measures to non-participants in cancer screening among Japanese workers. *Nihon Koshu Eisei Zasshi*, **60**, 396-402.
- Seki A, Hirai K, Nagatsuka M et al (2011). Measurement of the attitude regarding breast cancer screening. *J Health and Welfare Statistics*, **58**, 14-20.
- Shin HR, Joubert C, Boniol M (2010a). Recent trends and patterns in breast cancer incidence among Eastern and Southeastern Asian women. *Cancer Causes Control*, **21**, 777-85.
- Shin HR, Boniol M, Joubert C (2010b). Secular trends in breast cancer mortality in five East Asian populations: Hong Kong, Japan, Korea, Singapore and Taiwan. *Cancer Sci*, **101**, 1241-6.
- Stein JA, Fox SA, Murata PJ, et al (1992). Mammography usage and the health belief model. *Health Educ Q*, **19**, 447-62.
- Suzuki A, Ishida T, Ohuchi N (2012). Current status and problems of breast cancer screening in Japan. *Nihon Rinsho*, **70**, 780-4.
- Tabuchi T, Nakayama T, Tsukuma H (2012). Disparity in cancer screening rates in Japan: Impact of the type of medical insurance. *Nihon Iji Shinpōsha*, **4605**, 84-8.
- Taguchi R, Yamazaki Y, Nakayama K (2010). Eliciting preferences for mammography: using a discrete choice experiment approach. *Nihon Koshu Eisei Zasshi*, **57**, 83-94.
- Tajima K (2012). Epidemiological features of breast cancer with special reference of global pattern. *Nihon Rinsho*, **70**, 42-9.
- Tavafian SS, Hasani L, Aghamolaei T, et al (2009). Prediction of breast self-examination in a sample of Iranian women: an application of the Health Belief Model. *BMC Womens Health*, **9**, 37.
- Tohna S, Hata E (1994). Factors affecting health behavior of the people aged forties-a test of the health belief model. *Nihon Koshu Eisei Zasshi*, **41**, 362-9.
- Tsubono Y, Fukao A, Hisamichi S, et al (1993). Health belief model and attendance at screenings for gastric cancer in a population in Miyagi, Japan. *Nihon Koshu Eisei Zasshi*, **40**, 255-64.
- Yarbrough SS, Braden CJ (2001). Utility of health belief model as a guide for explaining or predicting breast cancer screening behaviours. *J Adv Nurs*, **33**, 677-88.
- Yilmaz D, Bebis H, Ortabag T, et al (2013). Determining the awareness of and compliance with breast cancer screening among Turkish residential women. *Asian Pac J Cancer Prev*, **14**, 3281-8.