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Association between serious psychological distress and non-participation in cancer screening, and the modifying effect of socioeconomic status: analysis of anonymized data from a national cross-sectional survey in Japan

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Cancer screening and mental health

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All authors: study design, data interpretation, and writing of the manuscript. Masaki Fujiwara: literature review, data analysis, and writing of the initial draft.

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Precis for use in the Table of Contents:

- People with serious psychological distress, particularly those with lower levels of education, were less likely to participate in colorectal, gastric, and lung cancer screening. Individuals with serious psychological distress should be supported to access cancer screening.

Abstract:

Background: It is unclear whether people with serious psychological distress (SPD) are less likely to participate in screening tests for gastric, lung, and other types of cancer. Of the few studies examining the association between SPD and participation in cancer screening, none have reported modifying effects of educational, marital, and employment status.

Methods: We analyzed a national representative dataset from the 2010 Comprehensive Survey of Living Conditions of Japan. We included people under the age of 69 who met the national program criteria for each type of cancer screening (colorectal, gastric, and lung: n = 29,926; breast: n = 15,423; and cervical: n = 24,735). SPD was defined as a score of 13 or more on the Kessler 6. We conducted logistic regression analyses to examine the association between SPD and participation in cancer screening, and multivariate analyses stratified by socioeconomic status.

Results: SPD was significantly associated with lower odds ratios (ORs) for participation in colorectal (OR [confidence interval: CI]: .743 [.638–.866]), gastric (.823 [.717–.946]), and lung cancer screening (.691 [.592–.807]). Only educational status significantly modified the effect of SPD on participation in these three types of cancer screening ($p < .05$).

Conclusions: People with SPD, especially those with lower education levels, were less likely to participate in colorectal, gastric, and lung cancer screening. Individuals with SPD should be

encouraged and supported to participate in cancer screening tests.

Keywords:

Early Detection of Cancer, Cancer Screening, Mental Disorder, Psychological Distress, Healthcare Disparities

INTRODUCTION

Cancer screening programs are an important part of preventive health care. A number of studies have reported that people experiencing psychological distress (PD), such as depression or anxiety, are less likely to participate in cancer screening. According to our in-house preliminary systematic review, most population-based studies have been conducted in North America or Europe, examining the associations between PD and colorectal,[1-14] breast,[1-6, 10, 14-21] or cervical cancer screening.[1, 3, 10, 15, 17-19, 22-24] A meta-analysis reported a significant reduction in mammography screening rates among women with mood disorders.[25] However, subsequently published studies reported a non-significant association between PD and participation in mammography screening.[10, 14, 18-21] Findings for colorectal and cervical cancer screening have been controversial. Moreover, as the majority of previous studies were conducted in countries with relatively high cancer screening rates, their findings may not be applicable to countries with lower cancer screening rates, such as Japan.[26] Only a few studies have examined the association between PD and cancer screening behavior in Asia.[7, 27] We found only one study on gastric cancer screening, which is more important in Eastern Asia where the incidence and mortality rate of gastric cancer are relatively high.[27]

Low socioeconomic status (SES) is reported to be associated with both high PD[28] and non-participation in cancer screening.[29] However, only a few studies have considered the modifying

effect of SES on the relationship between PD and participation in cancer screening.[4, 8, 11 20]

The objectives of the present study were (1) to investigate the association between serious psychological distress (SPD) and participation in cancer screening in the general population and (2) to explore the modifying effect of SES on the association between SPD and participation in cancer screening.

METHODS

Setting

In Japan, all residents are required to join the public health insurance program, and individuals' medical expenses are kept below specified limits according to their income. People can access cancer screening provided by municipalities, or opportunistic screening that may be free or with a low copayment.

Data source

We used an anonymized dataset from the 2010 Comprehensive Survey of Living Conditions (CSLC) conducted by the Ministry of Health, Labour, and Welfare (MHLW) of Japan,[26] which is a national cross-sectional survey. The 2010 Household and Health questionnaire covered

289,363 households (comprising approximately 750,000 people) in Japan who were randomly sampled from 5,510 districts included in the National Census in 2005. The response rate for the 2010 Household and Health questionnaire was 79.1% (228,864 responses). We used an anonymized subset of the data comprising 93,730 responses, resampled by the MHLW while maintaining representativeness.[30] Because our analysis of the anonymized dataset was conducted independently, our statistical data may differ from those published by the MHLW.

Participants

We included (a) people aged 40–69 years for analyses of colorectal, gastric, and lung cancer screening, (b) females aged 40–69 years for analyses of breast cancer screening, and (c) females aged 20–69 years for analyses of cervical cancer screening. We excluded participants based on the following criteria: (1) unknown age, (2) in hospital or in social welfare facilities at the survey date, or this information was unknown, (3) currently attending outpatient clinics for malignant neoplasm, pregnancy or postpartum care, and (4) not independently mobile.

Variables

Cancer screening

The main outcome variables were participation in colorectal, gastric, and lung cancer

screening within 1 year and breast and cervical cancer screening within 2 years. The MHLW recommended the following types of cancer screening at the time of the survey: fecal occult blood testing for colorectal cancer screening, upper gastrointestinal X-ray for gastric cancer screening, chest X-ray for lung cancer screening for people aged 40 or older every year, mammography for breast cancer screening for women aged 40 or older every 2 years, and Pap smear testing for cervical cancer screening for women aged 20 or older every 2 years. The 2010 CSLC questionnaire asked whether respondents had received these recommended screening tests, as well as upper endoscopy test for gastric cancer screening and breast ultrasound for breast cancer screening, which were not included on the MHLW's list of recommended tests in 2010.

Psychological distress

The Kessler 6 (K6) scale was used to measure PD in the CSLC. The K6 was developed as a brief screening scale for nonspecific psychological distress in adults.[31,32] The K6 consists of six questions that ask about the symptoms of PD in the previous month. We classified individuals with scores of 13 or more as having SPD.[31]

Covariates

The categorical variables age, sex, educational status, employment status, marital status,

type of health insurance, smoking status, the presence or absence of current visits to outpatient clinics for physical illness, and independence of daily living, were included as potentially confounding variables.

Statistical analysis

All of the analyses were conducted with SPSS Version 22 (IBM, Tokyo, Japan). The characteristics of the three groups are described in Table 1. We conducted multivariate logistic regression analyses to assess the associations between SPD and participation in each type of cancer screening. In Model 1, we calculated the partially adjusted odds ratio (OR) and 95% CI of SPD for participation in cancer screening with adjustment for age and sex. In Model 2, we calculated the fully adjusted OR of SPD with adjustment for all covariates. In addition, we calculated the fully adjusted OR of PD divided into four categories (no psychological distress: 0–4; mild: 5–9; moderate: 10–12; and severe: 13 or more)[33] to explore potential associations in more detail (for example, the possible association between moderate levels of anxiety and higher likelihood of participating in cancer screening, compared with people with milder or more severe levels of anxiety).

We performed multivariate analyses (Model 2) stratified by each SES category to test for the possible modifying effect of SES on the associations between SPD and participation in each type of cancer screening. Marital and employment status were re-classified into two categories to simplify

the models *a priori*: married and non-married; and employed (regardless of type of employment) and unemployed. In the analysis stratified by employment status, we used the subsample of respondents below the general compulsory retirement age of 65.

RESULTS

Figures 1a–1c show the sampling flowchart. Table 1 shows the sample characteristics of the three groups. The cancer screening rates of the samples were 29% for colorectal, 36% for gastric, 28% for lung, 42% for breast, and 41% for cervical cancer screening.

Table 2 shows the ORs for participation in each type of cancer screening for SPD. SPD was significantly associated with non-participation in colorectal, gastric, and lung cancer screening. The association between SPD and participation in breast cancer screening was not significant in Model 2. SPD was not significantly associated with cervical cancer screening in either model. In the additional analyses using PD divided into four categories, for the reference group ("no psychological distress"), we did not find that ORs for other PD categories were greater than 1.0 for any type of cancer screening (data not shown).

As shown in Table 3, among respondents with a high school level of education or lower and those with a junior college/vocational college level of education, those with SPD were

significantly less likely to participate in colorectal, gastric, and lung cancer screening than those without SPD. In contrast, SPD was not significantly associated with cancer screening among those with a college or higher level of education. We conducted *post-hoc* multivariate logistic regression analyses to test the potential modifying effect of educational status on the relationship between SPD and participation in cancer screening (including the interaction term of SPD × dichotomous educational status [“college or higher” versus “other lower education group”] in Model 2). The interaction term was significant for all three types of screening (colorectal: p = .003; gastric: p = .004; lung: p = .041). For breast and cervical cancer screening, the point estimates of ORs were lower in the “other lower education” group than in the “college or higher” group, although the interactions were not significant in the *post-hoc* analyses (breast: p = .055, cervical: p = .473). For the analyses stratified by marital status, similar ORs were obtained in the “married” and “non-married” groups for all cancer sites, and the interactions were also non-significant in the *post-hoc* analysis (data not shown). Similarly, for all cancer sites, employment status (“employed” versus “unemployed”) did not significantly modify the relationship between SPD and participation in screening (data not shown).

DISCUSSION

This nationally representative survey demonstrated an association between SPD and participation in colorectal, gastric, and lung cancer screening, but not breast and cervical cancer screening. The results were confirmed by additional analysis using a variable of PD divided into four categories. The current findings provide new knowledge relevant to Asia and other countries with low cancer screening rates. In addition, educational status modified the effect of SPD on participation in colorectal, gastric, and lung cancer screening.

Three previous U.S. population-based studies using the K6 showed a non-significant association between PD and participation in colorectal cancer screening.[1, 10, 12] This inconsistency might be due to differences in cancer screening systems, medical systems, or cultures. Further studies in other countries are needed to clarify the association. We found a significant association between SPD and non-participation in gastric cancer screening. This finding is inconsistent with the results of a Korean study reporting a non-significant association between depression, assessed by a single question, and participation in gastric cancer screening.[27] Korea has higher cancer screening rates than Japan, perhaps caused by differences in its national healthcare systems such as a call-recall system and large financial incentives.[34] The inconsistent findings might also be related to the use of different PD measures (K6 versus a single question). Meanwhile, the association between SPD and lung cancer screening in the present study is a novel finding. No previous studies have reported such as association, possibly because very few countries have lung cancer screening programs.

The current study did not reveal a significant association between SPD and non-participation in breast screening in the fully adjusted model. However, three of four previous population-based studies reported a significant association using the K6[10,17,18] and the other reported a non-significant association,[1] while a meta-analysis showed a significant association between mood disorders and non-participation in mammography.[25] Meanwhile, our *post-hoc* analysis of the association between SPD and participation in breast cancer screening within 1 year showed an OR that was nearly significant in the fully adjusted model (OR = .834; 95% CI: .693-.1.003; p = .054). Thus, one-point assessment by the K6 cannot measure 2-year PD, and the association may be diluted.

Our study did not show a significant association between SPD and non-participation in cervical screening in either model. Of four previous population-based studies using the K6, two studies showed a significant association[10,18] and two showed a non-significant association.[1,17] Our *post-hoc* analysis was also non-significant. Overall, therefore, the association seems to be non-significant. Meanwhile, although previous studies reported that the relationship differed by age group,[17,22] our *post-hoc* analysis showed no significant difference in ORs between the 20–39 and 40–69 age groups (data not shown). Compared with other cancers, cervical cancer is characterized by relatively young age of onset and screening, which might lead to differences in people's attitudes toward screening or in the effectiveness of public activities to increase the cervical cancer screening

rate.

Educational status modified the association between SPD and participation in colorectal, gastric, and lung cancer screening. To our knowledge, only one study has reported an interaction between PD and educational status on receiving cancer screening.[8] None of the reported interactions between depression and covariates, including educational level, were significantly associated with participation in colorectal cancer screening with colonoscopy.[8] In contrast, we examined the interaction with a different colorectal cancer screening method, fecal occult blood testing, which may have contributed to the inconsistency. In the highly educated group (university and above), cancer screening rates did not differ between individuals with and without SPD. High health literacy, reflected by higher education,[35] may attenuate the influence of SPD. Thus, less-educated individuals with SPD might be at high risk of non-participation in colorectal, gastric, and lung cancer screening.

Our findings have significant implications for public policy makers. Individuals with SPD, especially those with less education, might not benefit equitably from public activities to promote cancer screening. Therefore, an effective public awareness campaign specifically targeted to this population is needed. An individual approach for people with SPD could also be worth considering. Given that almost half of those with serious mental health disorders receive treatment,[36] primary care and psychiatric clinics may be an ideal setting in which to approach individuals with SPD, particularly people with chronic mental illness, to encourage and support them to undergo cancer

screening. It may be also useful to increase health literacy using an educational approach in community mental health centers and clinical settings. Further studies are needed to develop and examine the effects of such interventions.

The current study involved several limitations that should be considered. First, the self-report data could have overestimated the level of participation in cancer screening. Second, the presence of SPD was self-reported using K6, which is just a screening tool for psychiatric disorders. Therefore, it is unknown that what kind of psychological distress or what type of psychiatric disorder most strongly affected cancer screening behavior. Third, there was a timing gap between answering the K6 and participation in cancer screening, which may have been as much as 1 year for colorectal, gastric, and lung cancer screening, and 2 years for breast and cervical cancer screening. Fourth, there may have been a selection bias. Individuals with more serious psychological conditions might have declined to participate in the survey or to answer the K6 item, which might have led to underestimation of the effect of SPD on cancer screening participation. Fifth, we did not adjust for all potential confounding factors, such as personality traits, household income, and residential area, which were not included in our anonymized dataset. Sixth, the applicability of our findings to countries with different health care systems is unknown. Finally, the true medical end point is the influence of SPD on cancer mortality, which was not clarified by the current study.

CONCLUSION

This large-scale cross-sectional study of nationally representative data revealed that people with SPD were less likely to participate in colorectal, gastric and lung cancer screening. This association was stronger for individuals with lower levels of education. Therefore, policy makers and healthcare providers should address disparities in the rates of cancer screening among this population.

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FIGURE LEGEND

Figure 1. Sampling flow charts.

1a) Colorectal, gastric, and lung cancer screening samples.

1b) Breast cancer screening sample.

1c) Cervical cancer screening sample.

TABLE 1. Characteristics of participants recommended for each type of cancer screening.

	Colorectal, lung, gastric				Breast				Cervical			
	K6 < 13		K6 ≥ 13		K6 < 13		K6 ≥ 13		K6 < 13		K6 ≥ 13	
Characteristics	n	%	n	%	n	%	n	%	n	%	n	%
All	28,814		1,112		14,813		610		23,556		1,179	
Sex												
Women	14,715	51.1	611	54.9	14,813	100	610	100	23,556	100	1,179	100
Age group												
20–29	—		—		—		—		3,597	15.3	240	20.4
30–39	—		—		—		—		5,146	21.8	329	27.9
40–49	9,738	33.8	492	44.2	5,076	34.3	273	44.8	5,076	21.5	273	23.2
50–59	9,731	33.8	384	34.5	5,045	34.1	202	33.1	5,045	21.4	202	17.1
60–69	9,345	32.4	236	21.2	4,692	31.7	135	22.1	4,692	19.9	135	11.5
Education level												
≤ High school	15,576	54.1	591	53.1	8,287	55.9	342	56.1	11,138	47.3	562	47.7
> High school but ≤ junior college or vocational college	4,855	16.8	197	17.7	3,658	24.7	133	21.8	6,688	28.4	316	26.8
≥ University or college	5,819	20.2	190	17.1	1,508	10.2	58	9.5	3,718	15.8	191	16.2
Unknown	2,564	8.9	134	12.1	1,360	9.2	77	12.6	2,012	8.5	110	9.3
Employment status												
Employed	20,606	71.5	703	63.2	8,911	60.2	329	53.9	14,922	63.3	699	59.3
Unemployed - homemaker	5,344	18.5	219	19.7	5,170	34.9	209	34.3	7,232	30.7	321	27.2
Unemployed - student	24	.1	2	.2	15	.1	1	.2	324	1.4	23	2.0
Unemployed - others	2,532	8.8	168	15.1	633	4.3	62	10.2	973	4.1	125	10.6
Unknown	308	1.1	20	1.8	84	.6	9	1.5	105	.4	11	.9
Marital status												
Married	23,438	81.3	783	70.4	11,876	80.2	433	71.0	16,338	69.4	662	56.1
Never married	2,615	9.1	149	13.4	999	6.7	56	9.2	4,914	20.9	347	29.4
Bereaved	1,120	3.9	51	4.6	891	6.0	39	6.4	906	3.8	40	3.4
Divorced	1,641	5.7	129	11.6	1,047	7.1	82	13.4	1,398	5.9	130	11.0

TABLE 1. (continued)

	Colorectal, lung, gastric				Breast				Cervical			
	K6 < 13		K6 ≥ 13		K6 < 13		K6 ≥ 13		K6 < 13		K6 ≥ 13	
Characteristics	n	%	n	%	n	%	n	%	n	%	n	%
Health Insurance												
NHI municipalities	9,486	32.9	421	37.9	5,078	34.3	226	37.0	6,540	27.8	360	30.5
NHI associations	528	1.8	13	1.2	241	1.6	9	1.5	397	1.7	18	1.5
EHI - insured	12,918	44.8	424	38.1	4,175	28.2	167	27.4	8,153	34.6	391	33.2
EHI - dependent	5,222	18.1	188	16.9	5,023	33.9	178	29.2	7,992	33.9	359	30.4
Long life medical care system												
	30	.1	2	.2	17	.1	1	.2	17	.1	1	.1
Others	382	1.3	47	4.2	149	1.0	19	3.1	246	1.0	35	3.0
Unknown	248	.9	17	1.5	130	.9	10	1.6	211	.9	15	1.3
Smoking status												
Non-smoker	20,143	69.9	700	62.9	12,739	86.0	460	75.4	19,761	83.9	852	72.3
Past smoker	1,041	3.6	39	3.5	205	1.4	16	2.6	487	2.1	38	3.2
Smoker - ≤ 20 cigarettes/day												
	5,360	18.6	223	20.1	1,502	10.1	94	15.4	2,773	11.8	225	19.1
Smoker - ≥ 21 cigarettes/day												
	1,770	6.1	113	10.2	167	1.1	24	3.9	260	1.1	40	3.4
Smoker - number per day uncertain												
	9	.0	1	.1	3	.0	0	.0	9	.0	0	.0
Unknown	491	1.7	36	3.2	197	1.3	16	2.6	266	1.1	24	2.0
Current outpatient visit												
No	16,373	56.8	500	45.0	8,331	56.2	252	41.3	15,226	64.6	561	47.6
Yes	12,096	42.0	600	54.0	6,305	42.6	350	57.4	7,978	33.9	595	50.5
Unknown	345	1.2	12	1.1	177	1.2	8	1.3	352	1.5	23	2.0
Independence of daily living												
Independent	28,618	99.3	1,084	97.5	14,728	99.4	594	97.4	23,444	99.5	1,154	97.9
Almost independent												
	158	.5	22	2.0	67	.5	13	2.1	93	.4	21	1.8
Unknown	38	.1	6	.5	18	.1	3	.5	19	.1	4	.3

Abbreviations: NHI, national health insurance; EHI, Employees' Health Insurance.

TABLE 2. Adjusted ORs of SPD for participation in cancer screening (reference: K6 < 13)

	Colorectal (n = 29,926)				**Gastric** (n = 29,926)			
	OR	95% CI		p	OR	95% CI		p
Model 1[a]	.671	.579	.779	<.001	.727	.636	.830	<.001
Model 2[b]	.743	.638	.866	<.001	.823	.717	.946	.006

	Lung (n = 29,926)				**Breast** (n = 15,423)			
	OR	95% CI		p	OR	95% CI		p
Model 1	.625	.537	.728	<.001	.829	.702	.979	.027
Model 2	.691	.592	.807	<.001	.922	.775	1.096	.356

	Cervical (n = 24,735)			
	OR	95% CI		p
Model 1	.906	.802	1.025	.116
Model 2	.980	.862	1.113	.751

Abbreviations: OR, odds ratio; SPD, serious psychological distress; CI, confidence interval.

[a]Adjusted for age and sex.

[b]Adjusted for age, sex, educational level, employment status, marital status, types of health insurance, smoking status, the presence or absence of current visits to outpatient clinics for physical illness, and independence of daily living.

Crude ORs (95% CIs) of colorectal, gastric, lung, breast, and cervical cancer screenings were .639 (.551–.741), .710 (.622–.810), .612 (.526–.713), .866 (.734–1.022), and .920 (.816–1.037), respectively.

TABLE 3. Adjusted ORs of SPD for participation in cancer screenings in stratified analysis (Model 2[a]) by SES (reference: K6 < 13)

a) Stratified by educational status

	≤ High school				**> High school but ≤ junior college or vocational college**				**≥ University or college**			
	OR	95% CI		p	OR	95% CI		p	OR	95% CI		p
	(n = 16,167)				(n = 5,052)				(n = 6,009)			
Colorectal	.628	.501	.787	<.001	.633	.436	.919	.016	1.063	.781	1.447	.697
Gastric	.718	.587	.877	.001	.691	.491	.972	.034	1.156	.854	1.565	.348
Lung	.709	.570	.882	.002	.509	.344	.753	.001	.945	.694	1.288	.721
	(n = 8,629)				(n = 3,791)				(n = 1,566)			
Breast	.810	.640	1.026	.081	.876	.610	1.259	.475	1.395	.780	2.497	.262
	(n = 11,700)				(n = 7,004)				(n = 3,909)			
Cervical	.955	.794	1.148	.622	.935	.733	1.192	.587	1.130	.811	1.573	.470

b) Stratified by marital status

	Married				**Not married**			
	OR	95% CI		p	OR	95% CI		p
	(n = 24,221)				(n = 5,705)			
Colorectal	.734	.617	.872	<.001	.807	.584	1.115	.193
Gastric	.809	.690	.950	.009	.897	.676	1.190	.451
Lung	.671	.563	.801	<.001	.764	.551	1.058	.105
	(n = 12,309)				(n = 3,114)			
Breast	.934	.765	1.140	.502	.910	.640	1.292	.597
	(n = 17,000)				(n = 7,735)			
Cervical	.972	.827	1.141	.727	1.011	.820	1.246	.919

TABLE 3. (Continued)

c) Stratified by employment status

	Employed				Unemployed			
	OR	95% CI		p	OR	95% CI		p
		(n = 19,722)				(n = 5,894)		
Colorectal	.765	.633	.925	.006	.695	.504	.959	.027
Gastric	.820	.690	.975	.025	.867	.650	1.156	.331
Lung	.670	.553	.813	<.001	.699	.505	.968	.031
		(n = 8,654)				(n = 4,680)		
Breast	1.009	.797	1.278	.938	.827	.618	1.106	.200
		(n = 15,035)				(n = 7,588)		
Cervical	1.077	.913	1.270	.379	.927	.744	1.155	.500

Abbreviations: SPD, serious psychological distress; OR, odds ratio; CI, confidence interval.

[a]Adjusted for age, sex, educational level, employment status, marital status, types of health insurance, smoking status, the presence or absence of current visits to outpatient clinics for physical illness, and independence degree of daily living, excluding the variable used to stratify.