RESEARCH ARTICLE

Editorial Process: Submission:10/01/2025 Acceptance:05/01/2026 Published:05/19/2026

Knowledge of Colorectal Cancer Risk and Cancer Screening, with Colorectal Cancer Screening Attendance: A Nationwide Study in Japan (INFORM Study, 2020)

Otome Watanabe[1], Naoki Nakaya[2], Kumi Nakaya[1,2], Yuki Kaji[3], Aki Otsuki[4], Junko Saito[5], Akiko Yaguchi-Saito[3,6], Aya Kuchiba[5,7], Maiko Fujimori[8], Taichi Shimazu[3]*, Atsushi Hozawa[1,2]*

Abstract

Background: Despite the availability of colorectal cancer (CRC) screening, participation rates in Japan remain low. Although knowledge about CRC has been identified as a predictor of screening uptake, data specific to the Japanese population remain limited. We aimed to examine the associations between knowledge of CRC risk factors and knowledge of cancer screening, with CRC screening attendance in Japan. **Methods:** A nationwide cross-sectional survey was conducted among 1,966 Japanese adults aged 40–69 years. Associations between correct answers on CRC risk factors and cancer screening, and CRC screening attendance were analyzed using multiple logistic regression, adjusting for relevant covariates. **Results:** Seventy percent of participants had undergone CRC screening. A significant positive linear association was observed between knowledge of CRC risk factors and CRC screening attendance (P for trend < 0.01). Similarly, greater knowledge of cancer screening was significantly associated with higher attendance (P for trend < 0.01). **Conclusion:** Accurate knowledge of CRC risk factors and cancer screening was positively associated with CRC screening attendance. These findings show the importance of disseminating accurate information to the Japanese population; however, further prospective studies are needed to examine this association more thoroughly.

Keywords: Cancer screening attendance- Colorectal cancer- Cross-sectional survey- Knowledge- Nationwide

Asian Pac J Cancer Prev, **27 (5)**, 1835-1843

Introduction

Colorectal cancer (CRC) is highly prevalent in Japan and is expected to remain so in coming decades [1]. As of 2024, CRC was the leading cause of cancer-related deaths in women and the second in men [2]. Evidence indicates that cancer screening, particularly with the fecal occult blood test (FOBT), reduces CRC mortality [3]. In Japan, the Ministry of Health, Labour and Welfare recommends annual CRC screening for individuals aged ≥40 years [4]. A national target of 60% screening uptake was set for 2023 [5]; however, self-reported past-year CRC screening participation remained 46% in 2022 [6].

International reviews have identified knowledge as a crucial factor influencing CRC screening attendance [7, 8], consistent with the health belief model [8, 9]. However, in Japan, the relationship between knowledge and CRC screening participation remains unclear. Three studies have examined the associations between knowledge of CRC or cancer screening and actual screening attendance in the Japanese population [10-12]. However, the study populations and survey items had some limitations: participants were outpatients from specialties other than gastroenterology (n=388) [10] and parents of children (n=612) [11], and the focus was only on knowledge of cancer screening conducted by the municipality of residence among citizens of a single city [12]. Therefore, additional comprehensive investigations targeting a broader Japanese population were warranted.

We examined the associations between knowledge of CRC risk factors and knowledge of cancer screening and CRC screening attendance, using data from a nationwide

[1]*Division of Epidemiology, School of Public Health, Tohoku University Graduate School of Medicine, 2-1 Seiryo-machi, Aoba-ku, Sendai, Miyagi 980-8575 Japan.* [2]*Department of Preventive Medicine and Epidemiology, Tohoku Medical Megabank Organization, Tohoku University, 2-1 Seiryo-machi, Aoba-ku, Sendai, Miyagi 980-8573 Japan.* [3]*Division of Behavioral Sciences, National Cancer Center Institute for Cancer Control, National Cancer Center, Japan.* [4]*Division of Prevention, National Cancer Center Institute for Cancer Control, National Cancer Center, Japan.* [5]*Teikyo University Graduate School of Public Health, Japan.* [6]*Faculty of Human Sciences, Tokiwa University, Japan.* [7]*Division of Biostatistical Research, National Cancer Center Institute for Cancer Control, National Cancer Center, Japan* [8]*Division of Survivorship Research, National Cancer Center Institute for Cancer Control, National Cancer Center, Japan. *For Correspondence: tshimazu@ncc.go.jp, atsushi.hozawa.a6@tohoku.ac.jp*

survey of the Japanese population.

Materials and Methods

Study design and participants

We used data from a nationally representative cross-sectional survey on consumer access to health information in Japan in 2020 (INFORM Study 2020). The survey was conducted through mailed, self-administered questionnaires [13]. It assessed consumer behavior related to cancer prevention and screening, along with knowledge, attitudes, beliefs, and access to reliable cancer information. The questionnaire incorporated core items from the Health Information National Trends Survey (HINTS) conducted in the United States [14].

Participants were selected using two-stage stratified random sampling. In the first stage, 500 census areas were randomly selected with probability proportional to stratum size, stratified by nine regions and four municipality categories based on population size. In the second stage, 20 individuals aged ≥20 years were randomly selected from each census area. 10,000 individuals were invited by mail; 281 surveys were undeliverable. Of the remaining 9,719 individuals, 3,929 consented and returned questionnaires. After excluding incomplete responses, 3,605 were eligible for analysis (response rate = 37%) . The sampling strategy has been described previously [13]. For this analysis, 1,995 adults aged 40–69 years, eligible for CRC screening under national guidelines [4], were considered. We excluded 23 individuals with a history of CRC and six with missing CRC screening data, resulting in 1,966 participants (Figure 1). The study was approved by the Ethics Committee of Tohoku University Tohoku Medical Megabank Organization (project no. 2024-4-003) and the Research Ethics Committee of the National Cancer Center (project no. 2019-290).

Exposure variables

Knowledge of CRC risk factors

Participants were asked, “Do you think the following items cause cancer?” with response options of “yes,” “no,” or “I don’t know” [13]. Of the 15 items, five (tobacco smoking, alcohol consumption, insufficient intake of vegetables/fruits, lack of exercise, and obesity) were identified as CRC risk factors [15]. A total score was calculated by assigning 1 point for each correct answer (“yes”) and 0 points for each incorrect answer (“no” or “I don’t know”), yielding a possible score of 0–5.

Knowledge of cancer screening

Participants were asked, “As far as you know, do you think the following statements regarding cancer screening (fecal occult blood test, mammography, cervical cytology, etc.) are true or false?” [13]. Knowledge of cancer screening was assessed with three true/false items: 1) Cancer screening can definitively tell that a person has cancer (“false” is correct [16]); 2) Cancer screening can cause additional physical burden depending on further

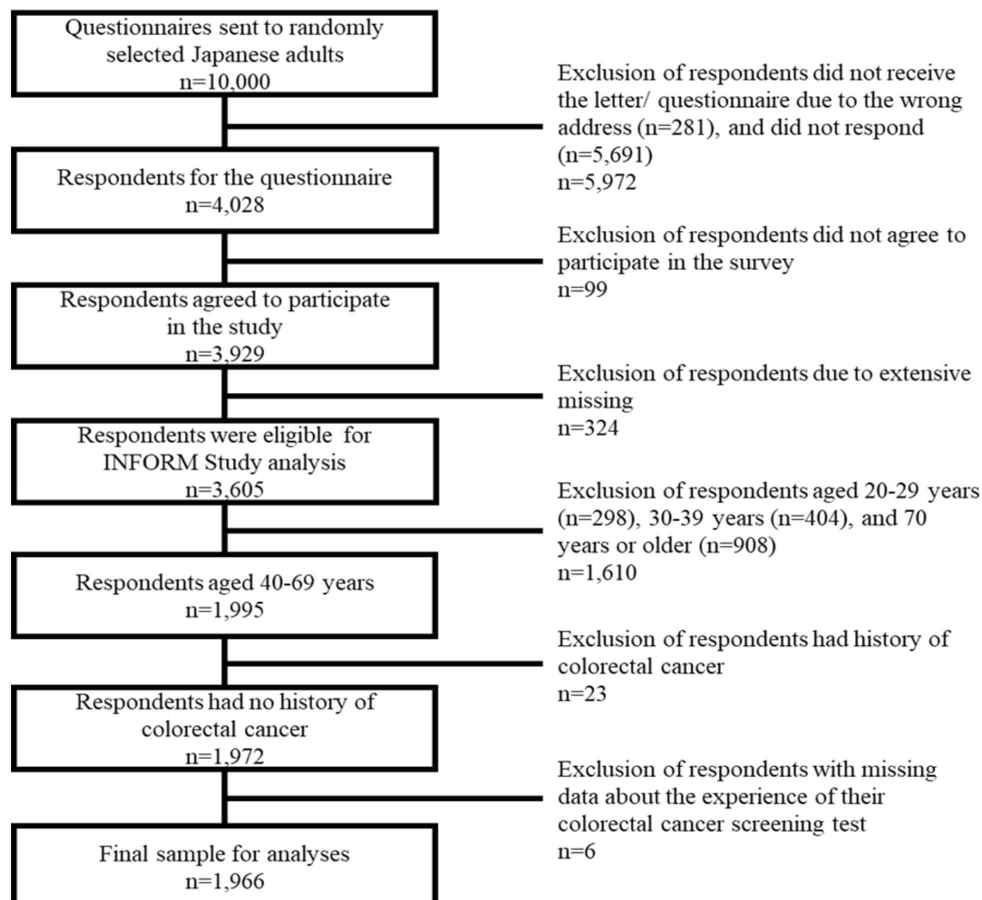

Figure 1. Participant Flowchart

testing (“true” is correct [17, 18]); and 3) Every “cancer” detected by cancer screening grows to a life-threatening extent (“false” is correct [17, 18]). Response options were “true,” “false,” or “I don’t know.” A total score was calculated by assigning 1 point for each correct answer and 0 points for each incorrect answer (including “I don’t know”), yielding a possible score of 0–3.

Outcome variable

CRC screening attendance was assessed with the question, “Have you ever had an FOBT to screen for colorectal cancer?” Response options were “yes,” “no,” or “I don’t know.” Participants who answered “yes” were categorized as attendees, and those who answered “no” or “I don’t know” were categorized as non-attendees.

Sociodemographic characteristics of study participants

Sociodemographic characteristics included sex, age, educational attainment, working status, equivalent household income, marital status, household composition, residential area, personal history of cancer other than CRC, family history of cancer, and history of cancer among friends or acquaintances [12, 19-27]. Educational attainment was categorized as “high” (vocational school, college, technical college, university, or graduate school) or “low” (high school or less). Equivalent household income was calculated by dividing annual household income by the square root of household size and categorized as “high” (>4.5 million JPY), “medium” (2.8–4.5 million JPY), and “low” (<2.8 million JPY).

Statistical analysis

We conducted a weighted analysis to account for the complex sampling design and nonresponse, ensuring accurate population parameter estimates for the Japanese general population. Each participant’s weight was calculated by multiplying the sampling weight and the nonresponse weight. Based on the survey’s sampling strategy, the sampling weight for each participant was the reciprocal of the probability of selection within the stratum. The nonresponse weight was estimated as the reciprocal of the response rate in “nonresponse adjustment cells,” assuming respondents in each cell represented a random sample of all sampled individuals in that cell [28]. We used a search algorithm [29] to create the nonresponse adjustment cells based on the variables of the sampling strata, sex, and age group, resulting in a total of 26 nonresponse adjustment cells [30]. Descriptive and inferential analyses were conducted using the weight consistently. Frequencies of participant characteristics were calculated according to the number of correct answers regarding CRC risk and cancer screening knowledge. Multiple logistic regression models were used to estimate odds ratios (ORs) for CRC screening attendance based on knowledge scores (0–5 for CRC risk factors; 0–3 for cancer screening), adjusting for age, educational attainment, marital status, personal history of cancer other than CRC, and family history of cancer. Knowledge scores were analyzed as both continuous and categorical variables. Participants with missing knowledge data were excluded from the regression analysis. Confidence intervals (CIs) were estimated using the Taylor series linearization method [31]. All analyses were performed using the svyset command in Stata (version 17.0), with 500 census areas as the primary sampling units and 35 sampling strata as the strata variable. All analyses were conducted at a significance level of $\alpha=0.05$ using two-tailed tests.

Results

Tables 1 and 2 present participant characteristics stratified by knowledge scores. Table 1 shows the distribution and weighted proportions of participants by knowledge of CRC risk factors, while Table 2 presents knowledge related to cancer screening. Overall, 70% of participants reported having undergone CRC screening. Among respondents, 36%, 33%, and 31% were aged 40–49, 50–59, and 60–69 years, respectively. Overall, 728 participants (37%) correctly identified all five CRC risk factors. Higher CRC risk knowledge scores were more common among female individuals, younger participants, and those with higher educational attainment and equivalent household income.

For cancer screening knowledge, 295 participants (15%) correctly answered all three questions related to cancer screening knowledge. Higher knowledge scores were more common among CRC screening attendance, those with higher educational attainment, working, greater equivalent household income, and being married.

Table 3 shows a significant positive association between the number of correct answers on CRC risk factors and CRC screening attendance (P for trend < 0.01). Participants who correctly identified specific risk factors, such as insufficient intake of vegetables/fruits (adjusted OR [aOR]: 1.41; 95% confidence interval [CI]: 1.14–1.76) and lack of exercise (aOR: 1.38; 95% CI: 1.13–1.68), had higher odds of CRC screening attendance.

Table 3 summarizes the association between cancer screening knowledge and CRC screening attendance. A significant positive trend was observed between the number of correct answers on cancer screening knowledge and CRC screening attendance (P for trend < 0.01). Participants who correctly answered the items “Cancer screening can definitively tell that a person has cancer” (aOR: 1.32; 95% CI: 1.05–1.66) and “Every ‘cancer’ detected by cancer screening grows to a life-threatening extent” (aOR: 1.28; 95% CI: 1.04–1.56) were more likely to attend CRC screening than those who answered incorrectly.

Discussion

We examined the associations between knowledge of CRC risk factors, knowledge of cancer screening, and CRC screening attendance using data from a nationwide survey of the Japanese population. Our findings revealed a positive association between knowledge of CRC risk factors and screening attendance. Among nine previous studies investigating this relationship [10, 11, 32-38], seven studies found no association [10, 11, 34-38]. These studies considered non-modifiable factors such as age

Table 1. Sociodemographic Characteristics of Study Participants According to the Knowledge Score Regarding CRC Risk (n=1,966)

Characteristic	Knowledge score regarding CRC risk															
	0 (n=24)		1 (n=180)		2 (n=316)		3 (n=369)		4 (n=325)		5 (n=728)		Missing (n=24)		Overall (n=1,966)	
	n	(Weighted %)	n	(Weighted %)	n	(Weighted %)	n	(Weighted %)	n	(Weighted %)	n	(Weighted %)	n	(Weighted %)	n	(Weighted %)
CRC screening attendance																
Non-attendance	10	44	61	34	109	35	98	28	103	32	186	25	11	45	578	30
Sex																
Male	18	77	99	60	171	60	172	53	135	47	292	45	7	35	894	51
Age in years																
40–49	5	27	43	26	88	32	117	36	119	40	263	40	6	28	641	36
50–59	7	26	67	38	109	35	114	31	109	34	230	31	8	35	644	33
60–69	12	47	70	35	119	33	138	33	97	26	235	29	10	37	681	31
Educational attainment																
Low	14	55	87	48	162	51	156	42	123	37	241	33	14	59	797	40
Working status																
Not working	6	24	39	20	76	21	98	24	66	18	160	20	6	23	451	21
Equivalent household income																
Low	13	50	60	32	113	36	132	35	120	36	198	27	9	36	645	32
Marital status																
Not married	8	35	34	19	58	19	78	21	76	23	162	22	12	49	428	22
Household composition																
None	5	24	19	11	20	6	32	9	32	10	68	9	6	27	182	9
Residential area																
21 major cities	5	20	45	24	81	25	98	26	101	31	238	32	7	31	575	29
History of cancer other than CRC																
No	21	89	163	91	299	95	338	92	305	94	667	92	20	85	1,813	93
Family history of cancer																
No	10	44	63	35	114	37	137	38	117	37	258	36	12	51	711	37
History of cancer among friends or acquaintances																
No	8	35	50	29	91	30	103	30	89	27	204	29	10	43	555	29

Analyses were restricted to participants aged 40–69 years from the INFORM Study 2020. Values are presented as prevalence estimates, expressed as percentages adjusted for survey weights. Percentages may not sum to 100 because of rounding.

Table 2. Sociodemographic Characteristics of Study Participants According to the Knowledge Score Regarding Cancer Screening (n=1,966)

Characteristic	Knowledge score regarding cancer screening											
	0 (n=435)		1 (n=645)		2 (n=576)		3 (n=295)		Missing (n=15)		Overall (n=1,966)	
	n	(Weighted %)	n	(Weighted %)	n	(Weighted %)	n	(Weighted %)	n	(Weighted %)	n	(Weighted %)
CRC screening attendance												
Non-attendance	152	35	191	30	163	29	67	24	5	29	578	30
Sex												
Male	210	54	292	51	248	49	137	53	7	53	894	51
Age in years												
40–49	116	30	205	36	188	36	129	48	3	22	641	36
50–59	132	31	211	33	206	35	90	30	5	36	644	33
60–69	187	38	229	31	182	28	76	22	7	42	681	31
Educational attainment												
Low	227	52	297	46	200	34	66	22	7	48	797	40
Working status												
Not working	129	27	138	20	132	21	48	15	4	25	451	21
Equivalent household income												
Low	177	40	221	34	169	29	72	24	6	36	645	32
Marital status												
Not married	99	23	142	22	129	22	56	19	2	12	428	22
Household composition												
None	41	9	63	10	55	9	22	8	1	6	182	9
Residential area												
21 major cities	115	26	169	26	193	33	92	29	6	41	575	29
History of cancer other than CRC												
No	397	92	600	94	529	93	275	93	12	83	1,813	93
Family history of cancer												
No	143	34	240	38	209	37	112	39	7	48	711	37
History of cancer among friends or acquaintances												
No	130	31	167	27	162	29	91	32	5	35	555	29

Analyses were restricted to participants aged 40–69 years from the INFORM Study 2020. Values are presented as prevalence estimates, expressed as percentages adjusted for survey weights. Percentages may not sum to 100 because of rounding.

Table 3. Association between the Knowledge Score and CRC Screening Attendance: Logistic Regression Results (n=1,966)

	Non attendance (n=578)		Attendance (n=1,388)		OR	(95% CI)	P value	AOR **	(95% CI)	Pvalue
	n	(Weighted %)*	n	(Weighted %)*						
Knowledge score regarding CRC risk										
0	10	44	14	56	1	(Ref.)		1	(Ref.)	
1	61	34	119	66	1.5	(0.63–3.59)	0.36	1.31	(0.53–3.20)	0.56
2	109	35	207	65	1.46	(0.64–3.37)	0.37	1.35	(0.57–3.22)	0.5
3	98	28	271	72	2.05	(0.88–4.76)	0.1	1.89	(0.80–4.48)	0.15
4	103	32	222	68	1.68	(0.72–3.94)	0.23	1.59	(0.66–3.82)	0.3
5	186	25	542	75	2.31	(0.99–5.37)	0.052	2.15	(0.90–5.13)	0.09
Knowledge score regarding cancer screening										
0	152	35	283	65	1	(Ref.)		1	(Ref.)	
1	191	30	454	70	1.27	(0.98–1.64)	0.07	1.35	(1.05–1.75)	0.02
2	163	29	413	71	1.3	(1.004–1.69)	0.047	1.3	(0.99–1.70)	0.06
3	67	24	228	76	1.73	(1.23–2.42)	<0.01	1.76	(1.24–2.49)	<0.01
					OR when knowledge score was treated as a continuous variable ***		P for linear trend	AOR when knowledge score was treated as a continuous variable ***		P for linear trend
Knowledge score regarding CRC risk					1.12	(1.05–1.21)	<0.01	1.13	(1.05–1.22)	<0.01
Knowledge score regarding cancer screening					1.17	(1.06–1.29)	<0.01	1.16	(1.05–1.29)	<0.01

OR, odds ratio; CI, confidence interval; AOR, adjusted odds ratio; Missing values of knowledge score regarding CRC risk (n=24) and knowledge score regarding cancer screening (n=15) were excluded from the analysis; *Values are presented as prevalence estimates, expressed as percentages adjusted for survey weights. Percentages may not sum to 100 because of rounding; ** Adjusted for age, educational attainment, marital status, personal history of cancer other than CRC, and family history of cancer; *** P values for linear trends were calculated by treating knowledge scores as continuous variables.

and family history of CRC, which may be less effective in promoting behavior change compared with modifiable risk factors. Such discrepancies highlight the potential role of awareness of modifiable risks in encouraging screening participation.

Knowledge of cancer screening covering certainty about screening, potential disadvantages, and cancer prognosis was positively associated with CRC screening participation. This finding is consistent with the health belief model, suggesting that knowledge of cancer screening may be linked to higher perceived benefits and greater participation [8, 9]. However, accurate knowledge of potential disadvantages (e.g., "Cancer screening can cause additional physical burden depending on further testing") was not associated with screening attendance. Respondents who endorsed this item may have been considering the discomfort of diagnostic colonoscopy or potential complications (e.g., perforation), although this interpretation remains speculative. Previous research indicates that individuals without prior colonoscopy experience may overestimate the risks of complications [39]. Public education on CRC should therefore focus not only on disseminating information, but also on providing effective risk–benefit communication.

The primary strength of this study is its novelty, being the first population-based survey in Japan to examine the relationships between knowledge of CRC risk factors, knowledge of cancer screening, and screening attendance. However, several limitations should be noted. First, the cross-sectional design precludes causal inference. Using lifetime CRC screening as the outcome limits temporal interpretation, and reverse causation, cannot be excluded, as individuals who underwent screening may have subsequently acquired knowledge of CRC risk and screening. Nonetheless, intervention studies indicate that educational programs can increase screening uptake [40]. Second, data collection occurred during the corona virus disease 2019 pandemic, which may have influenced screening behaviors and levels of knowledge. National data indicated a 13% decline in CRC screening rates in fiscal year (FY) 2020 compared with FY2017–2019 [41]. As a result, screening attendance observed in this study may not represent usual patterns, and the direction and magnitude of the pandemic's influence on both knowledge and screening behavior cannot be determined. Therefore, the findings should be interpreted with caution due to potential temporal confounding. Third, the response rate was relatively low (37%), which may have led to participation being skewed toward more health-conscious individuals, potentially resulting in overestimation of both knowledge levels and screening participation. Although we conducted a sensitivity analysis excluding healthcare workers (n = 123), a group presumed to be more health-conscious and knowledgeable, selection bias related to unmeasured factors cannot be fully ruled out. In our results, association between knowledge levels and screening participation may be affected by this bias, although the degree of its impact is unknown. Further studies with higher response rate are desirable.

Our findings underscore the importance of disseminating accurate information about CRC risk and screening to support informed decision-making [42]. Future initiatives should prioritize targeted educational programs that equip healthcare providers to guide individuals in weighing the risks and benefits of screening.

In conclusion, this nationwide Japanese survey identified positive associations between knowledge of CRC risk factors, knowledge of cancer screening, and CRC screening attendance. These findings highlight the importance of disseminating accurate information to the Japanese population, although further prospective studies are needed to further examine the relevance.

Author Contribution Statement

OW, NN, KN, TS, AH: Conceptualization, study planning, methodology, data curation; OW, NN, KN, TS, AK: Formal analysis; OW, NN, KN, YK, AO, JS, AY-S, AK, MF, TS, AH: Drafting and revising the manuscript; TS, AH: Supervision.

Acknowledgements

The items of the questionnaire in this survey were selected and developed by the INFORM Study group: Maiko Fujimori, Masayo Hayakawa, Satoyo Hosono, Manami Inoue, Yuki Kaji, Kota Katanoda, Aya Kuchiba, Tomohiro Matsuda, Yutaka J. Matsuoka, Miyuki Odawara, Aki Otsuki, Junko Saito, Hirokazu Takahashi, Miyako Takahashi, Yosuke Uchitomi, Jun Umezawa, Otome Watanabe, Akiko Yaguchi-Saito, Itsuro Yoshimi & Taichi Shimazu (National Cancer Center); Gary L. Kreps (George Mason University); Naomi Sakurai (Cancer Solutions Co., Ltd.); Takumi Momosaka (Hitotsubashi University); Miki Akiyama (Keio University); Rina Miyawaki (Meiji University); Ryo Okubo (National Center of Neurology and Psychiatry); Rie Akamatsu, Yui Kawasaki (Ochanomizu University); Kahori Fujisaki (Sagami Women's University); Hirono Ishikawa, Runa Ogawa & Yoshiharu Fukuda (Teikyo University); Haruhiko Imamura (Toho University); Kumi Nakaya & Naoki Nakaya (Tohoku University); and Seigo Mitsutake & Hiroyuki Sasai (Tokyo Metropolitan Institute for Geriatrics and Gerontology).

Funding

Supported by the National Cancer Center Research and Development Fund (30-A-18; 2021-A-19; 2024-A-17).

Approval

This work forms part of the author's doctoral dissertation.

Ethical Declarations

The study protocol was approved by the Ethics Committee of Tohoku University Tohoku Medical Megabank Organization (2024-4-003) and the Research Ethics Committee of National Cancer Center (2019-290). This study employed a self-administered postal questionnaire survey. The mailing envelope contained a written document describing the study's aims, procedures,

and ethical considerations, along with the questionnaire. The questionnaire included a statement requesting consent to participate in the study. Participation was entirely voluntary, and informed consent was obtained by asking respondents to indicate their consent by checking a designated box on the questionnaire and returning it anonymously by mail.

Data Availability

Data are not publicly available; anonymized data may be shared upon approval by the INFORM study group and the institutional review board. Proposals should be submitted to the corresponding author, Atsushi Hozawa, Taichi Shimazu.

Study Registration

This study was not subject to clinical trial or systematic review registration requirements.

Conflict of Interest

The authors declare no conflicts of interest.

References

1. Nguyen PT, Hori M, Matsuda T, Katanoda K. Cancer prevalence projections in Japan and decomposition analysis of changes in cancer burden, 2020-2050: A statistical modeling study. Cancer Epidemiol Biomarkers Prev. 2023 Dec 1;32(12):1756–70. doi:10.1158/1055-9965.
2. Cancer Information Service. CANCER STATISTICS IN JAPAN 2025; Figures and Tables; 1. Projection of Cancer Mortality and Incidence in 2024 [Internet]. Japan: National Cancer Center; 2025 [cited 2025 May 9]. Available from: https://ganjoho.jp/public/qa_links/report/statistics/2025_en.html.
3. US Preventive Services Task Force, Davidson KW, Barry MJ, Mangione CM, Cabana M, Caughey AB, et al. Screening for colorectal cancer: US Preventive Services Task Force recommendation statement: US preventive services task force recommendation statement. JAMA. 2021 May 1;325(19):1965–77. doi:10.1001/jama.2021.6238.
4. Ministry of Health, Labour and Welfare. [Cancer Screening; Guidelines for Implementation of Cancer Prevention focused health education and cancer screening (Partially amended on July 1, 2025) (in Japanese)] [Internet]. Japan: Ministry of Health, Labour and Welfare; c2025. [cited 2025 July 1]. Available from: https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000059490.html.
5. Ministry of Health, Labor and Welfare. [Basic Plan to Promote Cancer Control Programs; The 4th-term Basic Plan to Promote Cancer Control Programs (Cabinet decision on March 28, 2023) (in Japanese)] [Internet]. Japan: Ministry of Health, Labour and Welfare; c2023. [cited 2023 Mar 28]. Available from: https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000183313.html.
6. Ministry of Health, Labour and Welfare. [Comprehensive survey of living conditions 2022: Overview; III Health Status of Household Members (in Japanese)] [Internet]. Japan: Ministry of Health, Labour and Welfare; c2022. [cited 2022]. Available from: https://www.mhlw.go.jp/toukei/saikin/hw/k-tyosa/k-tyosa22/index.html.
7. Honein-AbouHaidar GN, Kastner M, Vuong V, Perrier L, Daly C, Rabeneck L, et al. Systematic Review and Meta-study Synthesis of Qualitative Studies Evaluating Facilitators and Barriers to Participation in Colorectal Cancer Screening. Cancer Epidemiol Biomarkers Prev. 2016 June;25(6):907–17. doi:10.1158/1055-9965.
8. Beydoun HA, Beydoun MA. Predictors of colorectal cancer screening behaviors among average-risk older adults in the United States. Cancer Causes Control. 2008 May;19(4):339–59. doi:10.1007/s10552-007-9100-y.
9. Becker MH. The Health Belief Model and Sick Role Behavior. Health Educ Monogr. 1974 Dec 1;2(4):409–19. doi:10.1177/109019817400200407.
10. Koo JH, You MY, Liu K, Athureliya MD, Tang CWY, Redmond DM, et al. Colorectal cancer screening practise is influenced by ethnicity of medical practitioner and patient. J Gastroenterol Hepatol. 2012 Feb;27(2):390–6. doi:10.1111/j.1440-1746.2011.06872.x.
11. Tsuda Y, Suzuki K, Minamiguchi Y, Yamanaka M, Doi T, Tomari Y, et al. Awareness of cancer and its associated factors for parents of adolescents and young adults: A cross-sectional study. Medicine (Baltimore). 2024 July 5;103(27):e38734. doi:10.1097/MD.0000000000038734.
12. Takahashi H, Honda H, Ibayashi M, Saitoh K, Akino K. Cancer screening rates and characteristics of low-participating groups in Sapporo city. Nihon Koshu Eisei Zasshi. 2021 Oct 6;68(10):695–705.doi:10.11236/jph.21-012.
13. Otsuki A, Saito J, Yaguchi-Saito A, Odawara M, Fujimori M, Hayakawa M, et al. A nationally representative cross-sectional survey on health information access for consumers in Japan: A protocol for the INFORM Study. World Med Health Policy. 2022 June;14(2):225–75. doi:10.1002/wmh3.506.
14. Finney Rutten LJ, Blake KD, Skolnick VG, Davis T, Moser RP, Hesse BW. Data Resource Profile: The National Cancer Institute’s Health Information National Trends Survey (HINTS). Int J Epidemiol. 2020 Feb 1;49(1):17–17j. doi:10.1093/ije/dyz083.
15. World Cancer Research Fund International. Diet and Cancer Report 2018 summary [Internet]. United Kingdom: World Cancer Research Fund and American Institute for Cancer Research; c2018 [cited 2018]. Available from: https://www.wcrf.org/research-policy/library/diet-and-cancer-report-2018-summary/.
16. Roberts MC, Ferrer RA, Rendle KA, Kobrin SC, Taplin SH, Hesse BW, et al. Lay Beliefs About the Accuracy and Value of Cancer Screening. Am J Prev Med. 2018 May;54(5):699–703. doi:10.1016/j.amepre.2018.02.002.
17. Volk RJ, Linder SK, Leal VB, Rabius V, Cinciripini PM, Kamath GR, et al. Feasibility of a patient decision aid about lung cancer screening with low-dose computed tomography. Prev Med. 2014 May;62:60–3.doi:10.1016/j.ypmed.2014.02.006.
18. Crothers K, Kross EK, Reisch LM, Shahrir S, Slatore C, Zeliadt SB, et al. Patients’ Attitudes Regarding Lung Cancer Screening and Decision Aids. A Survey and Focus Group Study. Ann Am Thorac Soc. 2016 Nov;13(11):1992–2001. doi:10.1513/AnnalsATS.201604-289OC.
19. Akiyama M, Ishida N, Takahashi H, Takahashi M, Otsuki A, Sato Y, et al. Screening practices of cancer survivors and individuals whose family or friends had a cancer diagnoses-a nationally representative cross-sectional survey in Japan (INFORM Study 2020). J Cancer Surviv. 2023 June;17(3):663–76.doi:10.1007/s11764-023-01367-4.
20. Murata F, Maeda M, Fukuda H. Association between metabolic syndrome and participation in colorectal cancer screening in Japan: A retrospective cohort analysis using LIFE study data. Cancer Epidemiol. 2023 Apr;83:102335. doi:10.1016/j.canep.2023.102335.
21. Ishii K, Tabuchi T, Iso H. Trends in socioeconomic

inequalities in cervical, breast, and colorectal cancer screening participation among women in Japan, 2010-2019. Cancer Epidemiol. 2023 June;84:102353. doi:10.1016/j.canep.2023.102353.

22. Yamaguchi T, Matsubayashi S, Miyata A, Koide Y, Morichika T, OoKawa T, et al. Review of Colorectal Cancer Examination Results in Male Workers by Occupation. Health Evaluation and Promotion. 2020;47(2):334–44. doi:10.7143/jhep.47.334.
23. Hama H, Tabuchi T, Ito Y, Fukushima W, Matsunaga I, Miyashiro I, et al. Smoking behavior and participation in screening for lung, gastric, and colorectal cancers. Nihon Koshu Eisei Zasshi. 2016;63(3):126–34. doi:10.11236/jph.63.3_126.
24. Ohara K, Saeki K, Nezu S, Obayashi K, Tomioka K, Okamoto N, et al. Examination of the determinants of cancer screening behavior. J Health Welf Stat. 2014 Sept;61(11):13–20.
25. Katoh K, Kanno S. Factors Associated with Cancer Screenings Participation Rates: Results from Tadami Town Health Survey 2003. Bull Fukushima Sch Nurs. 2009 Mar;11:29–37.
26. Fukuda Y, Nakamura K, Takano T, Nakao H, Imai H. Socioeconomic status and cancer screening in Japanese males: Large inequality in middle-aged and urban residents. Environ Health Prev Med. 2007 Mar;12(2):90–6. doi:10.1007/BF02898155.
27. Fukuda Y, Nakamura K, Takano T. Reduced likelihood of cancer screening among women in urban areas and with low socio-economic status: a multilevel analysis in Japan. Public Health. 2005 Oct;119(10):875–84. doi:10.1016/j.puhe.2005.03.013.
28. Little RJ, Vartivarian S. On weighting the rates in non-response weights. Stat Med. 2003 May 15;22(9):1589–99. doi:10.1002/sim.1513.
29. University of Michigan Survey Research Center. Search: Software for Exploring Data Structure [Internet]. United States of America: University of Michigan Survey Research Center; c2024 [cited 2024]. Available from: https://smponline.isr.umich.edu/search-software-for-exploring-data-structure/.
30. Momosaka T, Saito J, Otsuki A, Yaguchi-Saito A, Fujimori M, Kuchiba A, et al. Associations of individual characteristics and socioeconomic status with heated tobacco product harmfulness perceptions in Japan: A nationwide cross-sectional study (INFORM study 2020). J Epidemiol. 2024 Sept 5;34(9):411–8. doi:10.2188/jea.JE20230177.
31. National Cancer Institute. Methodology Reports; HINTS 5, Cycle 4. Methodology Report [Internet]. United States of America: National Cancer Institute; c2020 [cited 2020 Dec]; 2020. Available from: https://hints.cancer.gov/data/methodology-reports.aspx.
32. Sung JJY, Choi SYP, Chan FKL, Ching JY, Lau JT, Griffiths S. Obstacles to colorectal cancer screening in Chinese: a study based on the health belief model. Am J Gastroenterol. 2008 Apr;103(4):974–81. doi:10.1111/j.1572-0241.2007.01649.x.
33. Mandelson MT, Curry SJ, Anderson LA, Nadel MR, Lee NC, Rutter CM, et al. Colorectal cancer screening participation by older women. Am J Prev Med. 2000 Oct;19(3):149–54. doi:10.1016/s0749-3797(00)00193-8.
34. Edwardson N, Cartwright K, Sheche J, Pankratz VS, Kosich M, Kanda D, et al. Colorectal Cancer Screening Among Adults in Zuni Pueblo: Factors Associated with FOBT and Colonoscopy Utilization. J Community Health. 2023 Aug;48(4):565–75. doi:10.1007/s10900-023-01196-7.
35. Bhimla A, Mann-Barnes T, Park H, Yeh MC, Do P, Aczon F, et al. Effects of Neighborhood Ethnic Density and Psychosocial Factors on Colorectal Cancer Screening Behavior Among Asian American Adults, Greater Philadelphia and New Jersey, United States, 2014-2019. Prev Chronic Dis. 2021 Sept 30;18:E90.doi:10.5888/pcd18.210062.
36. Berkowitz Z, Hawkins NA, Peipins LA, White MC, Nadel MR. Beliefs, risk perceptions, and gaps in knowledge as barriers to colorectal cancer screening in older adults. J Am Geriatr Soc. 2008 Feb;56(2):307–14. doi:10.1111/j.1532-5415.2007.01547.x.
37. Matthews BA, Nattinger AB, Venkatesan T, Shaker R, Anderson RC. Objective risk, subjective risk, and colorectal cancer screening among a clinic sample. Psychol Health Med. 2007 Mar;12(2):135–47. doi:10.1080/13548500500429312.
38. Mc Queen A, Vernon SW, Meissner HK, Klabunde CN, Rakowski W. Are There Gender Differences in Colorectal Cancer Test Use Prevalence and Correlates? Cancer Epidemiol Biomarkers Prev. 2006;2006:782-91. doi:10.1158/1055-9965.EPI-05-0629.
39. Harewood GC, Wiersema MJ, Melton LJ 3rd. A prospective, controlled assessment of factors influencing acceptance of screening colonoscopy. Am J Gastroenterol. 2002 Dec;97(12):3186–94. doi:10.1111/j.1572-0241.2002.07129.x.
40. Rawl SM, Skinner CS, Perkins SM, Springston J, Wang HL, Russell KM, et al. Computer-delivered tailored intervention improves colon cancer screening knowledge and health beliefs of African-Americans. Health Educ Res. 2012 Oct;27(5):868–85. doi: 10.1093/her/cys094.
41. Machii R, Takahashi H. Japanese cancer screening programs during the COVID-19 pandemic: Changes in participation between 2017-2020. Cancer Epidemiol. 2023 Feb;82:102313. doi:10.1016/j.canep.2022.102313.
42. van Agt HME, Korfage IJ, Essink-Bot ML. Interventions to enhance informed choices among invitees of screening programmes-a systematic review. Eur J Public Health. 2014 Oct;24(5):789–801. doi:10.1093/eurpub/ckt205.

This work is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License.