

# Perceptions of Cancer Education among Middle and High School Teachers and Factors Related to These Perceptions

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**Background:** In Japan, the Cancer Control Act was enacted in 2006, and cancer education and the dissemination of cancer-related knowledge are among the issues addressed in the Basic Plan to Promote Cancer Control Programs (Phase 4). Cancer education was introduced to all middle schools in 2021, and high schools in 2022. To promote cancer education in schools further, the presence of teachers who are able to play a central role in the cancer education in the schools is the key requirement. School teachers' perceptions of cancer and cancer education may influence cancer education in schools. However, the perceptions regarding cancer and cancer education and related factors of school teachers in Japan have not been clarified.

**Objective:** This study aims to understand the perceptions of cancer education among school teachers in Japan and identify factors related to these perceptions.

**Methods:** A web-based anonymous questionnaire survey was conducted with 800 middle and high school teachers in Japan. The questionnaire is comprised of question items on the perceptions of cancer education (9 items; Questions 1 through 7 ask about positive perceptions of cancer education of middle and high school teachers, Questions 8 and 9 ask about its negative perceptions; Question 8: making students anxious or afraid of cancer"; Question 9: no change in the awareness of cancer), the Cancer Awareness Measures (CAM; Warning signs, Barriers to seeking help, Risk factors), personal factors, and environmental factors. The data were analyzed with Multiple logistic regression analysis.

**Results:** In total 779 responses were included in the analysis. Using the Mann-Whitney U test, age, years of teaching experience, and the scores of CAM positive and negative response groups were compared for the perceptions of cancer education. The relationship between the perceptions of cancer education and personal and environmental factors was analyzed using the chi-square test. Multiple logistic regression analysis was conducted using age and years of teaching experience, Warning signs, Barriers to seeking help, and Risk factors in the CAM, which were found to be significantly different in these univariate analyses, as independent variables, and the perceptions of cancer education as the dependent variable. Questions 1 through 7 showed statistically significant differences in Warning signs (OR = 1.077 to 1.164,  $p < .01$  to  $.001$ ) and Risk factors (OR = 1.041 to 1.053,  $p < .001$ ). There were statistically significant differences in Questions 8 (OR = 1.100,  $p < .001$ ) and 9 (OR = 1.159,  $p < .001$ ) for Warning signs.

**Conclusions:** The findings show that the awareness of Warning signs and Risk factors affect the awareness

that students benefit from cancer education, suggesting the necessity the efforts to improve the knowledge and understanding of cancer among teachers to promote cancer education in schools.

**Keywords:** cancer education, middle school teacher, high school teacher, perceptions of cancer education, cancer awareness

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## I. Introduction

Since 1981 cancer has been the leading cause of deaths in Japan, and the cancer incidence and mortality are still increasing<sup>1)</sup>. In Japan, the Cancer Control Act was enacted in 2006 aiming to promote cancer prevention, improve cancer treatment, and create a social environment to support these efforts. Based on this, the Basic Plan to promote cancer control programs in Japan was established in 2007, with the overall goal of “Overcoming cancers by making the public including cancer patients aware of cancer”<sup>2)</sup>. However, the prevalence of the colorectal cancer screening for people aged 40-69 years in Japan is 47.8% for males and 40.9% for females, and that of the lung cancer screening is a low 53.4% for males and 45.6% for females, while the smoking rate for males aged 20-29 years is 25.5%<sup>1)</sup>. These show that cancer prevention is an urgent issue in Japan, where the cancer screening rate is lower than in USA and European countries.

To prevent cancer, people need to learn about cancer and lifestyles from childhood. For this reason, the promotion of cancer education for children was added to the Second-term Basic Plan to promote cancer control programs in Japan in 2012. With this, it is meaningful to promote health education by addressing cancer in school health education<sup>3)</sup>. Following that, in 2018 when school course guidelines for middle and high schools were revised, education for prevention and recovery from lifestyle-related diseases and cancers were clearly included<sup>4)5)</sup>. Cancer education was introduced to all middle schools in 2021, and high schools in 2022. However, there remain a range of issues in the revised school course guidelines as they do not give detailed information on cancer education, including on issues concerning the consideration for children whose family members are cancer patients and the use of outsourced instructors<sup>6)</sup>.

In the “Guidelines for Cancer Education by Outsourcing Instructors”<sup>7)</sup>, it is stipulated that schools should proactively plan and provide cancer education, ensure that this education should proceed based on a

common understanding among all teaching staff, build collaborative relationships with parents and relevant organizations, and plan the cancer education by the outsourced instructors. However, according to a survey of primary, middle, and high schools nationwide, cancer education by outsourcing instructors accounted for only 8.4% of all schools<sup>8)</sup>, and in many schools the teachers there provide the cancer education. However, it has been reported that school teachers have misconceptions about the causes of cancer and screening<sup>9)</sup>, and that they have a low awareness and insufficient knowledge about cancer, making it difficult for them to know how to teach about this<sup>10)</sup>. Therefore, it is important to clarify what kind of perceptions school teachers have about cancer education at schools and what is relevant to their perceptions.

In countries other than Japan, it has been reported that cancer prevention programs that instruct school teachers had positive results in the cancer education<sup>11)12)</sup>. High school biology teachers who participated in a training program "Cancer, Educate to Prevent" underwent e-learning in cancer biology, cancer epidemiology, cancer prevention, and a selection of scientific information, and cancer prevention education training<sup>11)</sup>. As a result, 96% of the teachers implemented their own cancer prevention education projects in their schools<sup>11)</sup>. School teachers and school nurses who participated in a workshop on skin cancer prevention learned basic concepts in Cancer Biology, the functional anatomy of the integument, and the causes, diagnosis, and treatment of skin cancer<sup>12)</sup>. As a result, 6 months after attending this workshop, 88.1% of participants actually used/scheduled practical activities with their students<sup>12)</sup>. This shows that knowledge about cancer and understanding of cancer education of teachers influence cancer education in schools. In Japan, there are some school-based surveys, but we have located no studies that quantitatively investigated the awareness of cancer and cancer education among school teachers in Japan. To remedy this lack, this study aims to understand the perceptions of cancer education among school teachers in Japan and identify factors related to the awareness so that the findings will provide data for that will be helpful in discussing efforts to

promote cancer education. In many schools in Japan, physical and health education teachers are in charge of cancer education, but the government recommends that it be provided appropriately throughout all educational activities, particularly in health and physical education classes. Yako-Suketomo et al.<sup>13)</sup> stated that it is possible to introduce elements of cancer education into subjects other than health and physical education. Therefore, it is possible that teachers who are not in charge of the health and physical education may be involved in cancer education. To fully elucidate how cancer education is taught, this study surveyed school teachers without limiting the subjects they teach.

## II. Methods

### 1. Participants

Participants were 400 middle school teachers and 400 high school teachers in Japan who were registered as monitors with NEO Marketing, Inc., an internet survey company in Japan. The inclusion criteria were for full-time teachers of middle and high schools. Based on the information registered by NEO Marketing, teachers who met the inclusion criteria were selected. To eliminate bias in the survey population, we sampled the participants based on the gender and age distribution of teachers in the Basic School Survey of the Ministry of Education, Culture, Sports, Science and Technology, as well as the distribution of the residential areas reported<sup>14)</sup>.

We calculated the sample size required for this survey using the equation  $n = \lambda^2 p(1-p)/d^2$  with a response rate of 0.5, standard error of 5%, and confidence level of 95% ( $\lambda = 1.96$ ). The result was 384 participants, and we determined the number of participants as 400 middle school and 400 high school teachers.

### 2. Data collection

We conducted a web-based anonymous questionnaire survey. Neo Marketing sampled the target population and collected the data. The survey was discontinued when the number of responses from middle and high school teachers reached 800. Neo Marketing entered the survey responses into an Excel worksheet and provided the data to the researchers. The survey was conducted in December 2021.

## 3. Measurements

Based on previous studies we developed a questionnaire which is comprised of question items on demographics, perceptions of cancer education and cancer, personal factors, and environmental factors. Demographics included gender, age, school and organization types, job title, subject in charge of, and last education.

### (1) Perceptions of cancer education

Referring to the Cancer Education in Schools [Report]<sup>3)</sup>, questions about the perceptions of cancer education were developed through an inter-researcher review process. There were nine questions asking about the influence of cancer education on students. Questions in the perceptions of cancer education are as follows; Question 1 (“Q1”) “Students can learn about the importance of health and life,” Q2 “Cancer education can counteract the negative impression of cancer among students,” Q3 “Cancer education can lead to cancer prevention behaviors of students,” Q4 “Cancer education can positively influence the cancer prevention and screening behaviors of parents of students,” Q5 “Cancer education will help students to understand familiar adults and children with cancer or other diseases,” Q6 “Cancer education will contribute to decreasing the number of future cancer cases and deaths,” Q7 “It will be possible to build a community where people can live without worry even if they may develop cancer in the future,” Q8 “Cancer education can make students anxious or afraid of cancer,” and Q9 “Cancer education will not change the awareness of cancer of students”. The answer options are Strongly agree, Agree, Not sure, Disagree, and Strongly disagree. For the analysis, 1 point is assigned to Strongly agree and Agree; and 0 points to Not sure, Disagree, and Strongly disagree. The former was considered a positive response and the latter a negative response. Cronbach alpha coefficients for questions 1 through 9 was from .795 to .850.

### (2) Cancer awareness

Cancer awareness was measured using the Cancer Awareness Measure (CAM)<sup>15)</sup>, which has been used in previous studies of cancer awareness<sup>16)17)</sup> and the reliability and validity have been established<sup>15)</sup>. In the present study, we used 9 items for Warning signs, 10 Barriers to seeking help, and 11 Risk factors, which were all translated into Japanese. Questions in the Warning signs include, for example, “Do you think an unexplained lump or swelling could be a sign of cancer?” and

respondents select an answer from Yes, No, and Don't know. The scores were totaled by assigning 1 point to Yes, and 0 to No and Don't know. The highest possible score is 9 points. Questions about Barriers to seeking help include "I would be too embarrassed;" and "I would be too busy to make time to go to the doctor." Here the respondents select an answer from Yes often, Yes sometimes, No, and Don't know. The scores were totaled by assigning 3 points to Yes often, 2 to Yes sometimes, and 0 to No and Don't know. The highest possible score is 30 points. Questions about Risk factors include "Smoking any cigarettes at all." The answer options are Strongly agree, Agree, Not sure, Disagree, and Strongly disagree. The scores were totaled by assigning 5 points to Strongly agree, 4 to Agree, 3 to Not sure, 2 to Disagree, and 1 to Strongly disagree. The highest possible score is 55 points.

### (3) Personal and environmental factors

Questions about the personal and environmental factors were developed through an inter-researcher review process. Abu-Shammala, et al.<sup>18)</sup> have reported that having clinical breast examination and mammography screening is statistically significantly related to family history of breast cancer. For this reason, we included the following items in the personal factor section: age, years of teaching experience, gender, last education, marital status, own cancer history, cancer histories of spouse, family members, relatives, and friends. The questions on environmental factors were as follows: whether working in middle or high school, public or private schools, subject in charge, presence of teachers in charge of cancer education, and experience of participation in workshops on cancer education.

## 4. Data analysis

Descriptive statistics were used to describe the demographic data of the participants and all variables. Using the Mann-Whitney U test, age, years of teaching experience, and the scores of the CAM were compared between positive and negative response groups for the perceptions of cancer education. The relationship between the perceptions of cancer education and personal and environmental factors was analyzed using the chi-square test. Multiple logistic regression analysis was conducted using age and years of teaching experience, Warning signs, Barriers to seeking help, and Risk factors in the CAM, which were found to be significantly different in these univariate analyses, as independent

variables, and the perceptions of cancer education as the dependent variable. The significance level was set at 5%.

For statistics analysis, IBM® SPSS® Statistics version 28 was used.

## 5. Ethical considerations

We explained the purpose of the study and ethics issues, such as the voluntary participation, that individual respondents could not be identified, and that the results would be published to the prospective participants on the web. Placing a check box to express "I agree to participate in the study" at the beginning of the questionnaire, and putting a check mark in the check box was deemed to be agreement to the participation. Neo Marketing has been certified by the Japanese Industrial Standards as a business operator with permission to handle personal information. The company has signed a contract with the registered monitors (potential participants), who have agreed not to disclose or leak to any third party any information obtained in the course of answering questionnaires or the content of questionnaires, including the handling of personal information, the sharing of information with survey clients, and requests for disclosure of personal information. It had been decided that the personal information of the monitors, such as addresses, names, and email addresses, will not be provided to the researchers, and the responses given to the researchers were completely anonymized.

The study was approved by the Institutional Review Research Ethics Board of the Osaka Medical and Pharmaceutical University (No. 2021-093).

## III. Results

### 1. Number of participants and response rate

We received responses from 800 middle and high school teachers, and determined 316 responses from middle school teachers and 463 responses from high school teachers ( $n = 779$ , 97.4%) to be valid for analysis.

### 2. Participants data

**Table 1** details the demographic data of the participants. Mean scores of the Cancer Awareness Measure (CAM) were as follows: 4.5 (standard deviation: SD 3.3) for Warning signs, 14.5 (SD 4.1) for Barriers to seeking help, and 37.6 (SD 7.5) for Risk factors.

**Table 1** Characteristics of Participants (n = 779)

Characteristics		n	(%)
Gender	Male	541	(69.4)
	Female	238	(30.6)
Age	20s	49	(6.3)
	30s	140	(18.0)
	40s	201	(25.8)
	50s	279	(35.8)
	60s	110	(14.1)
School Type	Junior high school	316	(40.6)
	High Schools	463	(59.4)
Set up the group	National and Public	606	(77.8)
	Private	173	(22.2)
Job Title	Administration	49	(6.3)
	Teachers	692	(88.8)
	Other	38	(4.9)
Teach	Faculty of Humanities	303	(38.9)
	Faculty of Science	242	(31.1)
	Department of Art	32	(4.1)
	Health and Physical	67	(8.6)
	Other	135	(17.3)
Final Education	University	637	(81.8)
	Graduate School	126	(16.2)
	Unknown	16	(2.1)
Introduction of Cancer Education	Yes	126	(16.2)
	No	593	(76.1)
	Unknown	60	(7.7)
Participate in cancer education workshops	Yes	83	(10.7)
	No	668	(85.8)
	Unknown	28	(3.6)
		Mean	SD
Years of teaching experience		23.5	11.3
CAM	Warning signs	4.5	3.3
	Barriers to seeking help	14.5	4.1
	Risk factors	37.6	7.5

SD: standard deviation, CAM: Cancer Awareness Measure



### 3. Comparing the CAM scores of the positive and negative response groups for the perceptions of cancer education of middle and high school teachers

There were statistically significant differences ( $p < .001$ ) in all questions on perceptions of cancer education in the Warning signs, and the positive response group had higher scores than the negative response group. For the Barriers to seeking help, there were statistically significant differences in Questions 1 ( $p < .001$ ), 5 ( $p < .05$ ), and 9 ( $p < .001$ ), and the positive response group had higher scores than the negative response group. For the Risk factors, there were statistically significant differences in Questions 1 to 7 ( $p < .001$ ), and the positive response group had higher scores than the negative response group (Table 2).

### 4. Personal versus environmental factors in the perceptions of cancer education among middle and high school teachers

For the relation between perceptions of cancer education and age, there were statistically significant differences in Questions 2 ( $p < .01$ ) and 8 ( $p < .001$ ), and the age of respondents of the positive response group was higher than that of the negative response group. For the relation between perceptions of cancer education and years of teaching experience, there were statistically significant differences in Questions 2 ( $p < .01$ ), 8 ( $p < .001$ ), and 9 ( $p < .05$ ), and the positive response group had longer teaching experience than the negative response group. For the relation between perceptions of cancer education and the following items: gender, last education, marital status, own cancer history, cancer histories of spouse, family members, relatives, and friends, some items had statistically significant differences. However, all of these had low coefficients of correlation ( $\phi = .077$  to  $.152$ ), showing an absence of relations between these items (Table 3).

**Table 2** Comparing the CAM scores of the positive and negative response groups for the awareness of cancer education of middle and high school teachers (n=779)

Item		n	Warning signs		Barriers to seeking help		Risk factors	
			median	P-value	median	P-value	median	P-value
			[lower quartile- upper quartile]		[lower quartile- upper quartile]		[lower quartile- upper quartile]	
Q1: Students can learn about the importance of health and life.	Negative	215	2 [0-6]	<.001	13 [10-17]	.001	34 [32-39]	<.001
	Positive	564	5 [3-8]		14 [11-17]		39 [34-43]	
Q2: Cancer education can counteract the negative impression of cancer among students.	Negative	342	3 [0-7]	<.001	13 [11-17]	.065	36 [33-40]	<.001
	Positive	437	5 [3-8]		14 [12-17]		39 [35-44]	
Q3: Cancer education can lead to cancer prevention behaviors of students.	Negative	261	3 [0-6]	<.001	14 [11-17.5]	.811	34 [32-40]	<.001
	Positive	518	5 [2-8]		14 [11-17]		39 [35-44]	
Q4: Cancer education can positively influence the cancer prevention and screening behaviors of parents of students.	Negative	325	4 [0-6]	<.001	13 [11-17]	.213	3 [32-10]	<.001
	Positive	454	5 [2-8]		14 [11-17]		39 [35-44]	
Q5: Cancer education will help students to understand familiar adults and children with cancer or other diseases.	Negative	252	3 [0-6]	<.001	14 [10-17]	.041	34.5 [33-40]	<.001
	Positive	527	5 [3-8]		14 [12-17]		39 [35-43]	
Q6: Cancer education will contribute to decreasing the number of future cancer cases and deaths.	Negative	362	4 [0-7]	<.001	14 [11-17]	.431	36 [32.8-40]	<.001
	Positive	417	5 [2-8]		14 [11-17]		40 [35-44]	
Q7: It will be possible to build a community where people can live without worry even if they may develop cancer in the future.	Negative	385	4 [1-7]	<.001	14 [11-17]	.585	36 [33-40]	<.001
	Positive	394	5 [2-8]		14 [11-17]		40 [35-44]	
Q8: Cancer education can make students anxious or afraid of cancer. [reversal item]	Negative	531	4 [0-7]	<.001	14 [11-17]	.293	38 [33-43]	.153
	Positive	248	5 [3-8]		14 [11-17]		37 [32-42]	
Q9: Cancer education will not change the awareness of cancer of students. [reversal item]	Negative	470	3.5 [0-7]	<.001	13 [11-17]	.001	37 [33-42]	.075
	Positive	309	5 [3-8]		14 [12-17]		39 [34-43]	

Mann-Whitney U test

**Table 3** Personal factors in the awareness of cancer education among middle and high school teachers (n = 779)

		Awareness of cancer education											
		Question 1				Question 2				Question 3			
		Negative n=215		Positive n=564		Negative n=342		Positive n=437		Negative n=261		Positive n=518	
		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]	
				<i>p</i>				<i>p</i>				<i>p</i>	
Age		49 [40-57]	50 [40-58]	.472		48 [38-56]	51 [41-58]	.004		49 [40-57]	50 [40-58]	.552	
Years of teaching		24 [12.5-32]	25 [15-34]	.100		22 [11-32]	26 [15-34]	.002		25 [14-32]	25 [14-34]	.230	
		FREQ %	FREQ %	<i>p</i>	$\phi$	FREQ %	FREQ %	<i>p</i>	$\phi$	FREQ %	FREQ %	<i>p</i>	$\phi$
Gender	Male	153 71	388 69	.521	.023	237 69	304 70	.938	-.003	193 74	348 67	.058	.069
	Female	62 29	176 31			105 31	133 30			68 26	170 33		
Last education	UNIV	161 75	476 84	<.001	.184	279 82	358 82	.032	.094	215 82	422 81	.272	.058
	Grad school	41 19	85 15			51 15	75 17			38 15	88 17		
	N/A	13 6	3 1			12 4	4 1			8 3	8 2		
Marital status	Married	148 69	415 74	.348	.052	237 69	326 75	.099	.077	178 68	385 74	.101	.077
	Single	66 31	148 26			105 31	109 25			83 32	131 25		
	N/A	1 0	1 0			0 0	2 0			0 0	2 0		
Own cancer history	Yes	17 8	25 4	.003	.122	19 6	23 5	.734	.028	14 5	28 5	.362	.051
	No	181 84	520 92			305 89	396 91			231 89	470 91		
	N/A	17 8	19 3			18 5	18 4			15 6	20 4		
Cancer history: spouse	Yes	12 6	16 3	.047	.088	15 4	12 3	.327	.054	13 5	15 3	.186	.066
	No	181 84	509 90			298 87	392 90			224 86	466 90		
	N/A	22 10	39 7			28 8	33 8			24 9	37 7		
Cancer history: family	Yes	67 31	260 46	<.001	.147	117 34	210 48	.001	.140	89 34	238 46	.003	.121
	No	132 61	284 50			208 61	208 48			155 59	261 50		
	N/A	15 7	20 4			17 5	19 4			17 7	19 4		
Cancer history: relative	Yes	58 27	226 40	.003	.124	104 30	180 41	.008	.112	84 32	200 39	.208	.063
	No	131 61	289 51			203 59	217 50			151 58	269 52		
	N/A	26 12	49 9			35 10	40 9			26 10	49 9		
Cancer history: friend	Yes	41 19	171 30	.007	.113	75 22	137 31	.008	.112	57 22	155 30	.054	.087
	No	141 66	322 57			223 65	240 55			168 64	295 57		
	N/A	33 15	71 13			44 13	60 14			36 14	68 13		

		Awareness of cancer education											
		Question 4				Question 5				Question 6			
		Negative n=325		Positive n=454		Negative n=252		Positive n=527		Negative n=362		Positive n=417	
		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]	
				<i>p</i>				<i>p</i>				<i>p</i>	
Age		50 [40-57]	49 [39-58]	.874		49 [41-56.5]	50 [39-58]	.602		49 [40-57]	50 [39-58]	.678	
Years of teaching		25 [14-33]	25 [14-34]	.803		25 [14-32]	25 [14-34]	.308		24 [14-33]	25 [14-34]	.423	
		FREQ %	FREQ %	<i>p</i>	$\phi$	FREQ %	FREQ %	<i>p</i>	$\phi$	FREQ %	FREQ %	<i>p</i>	$\phi$
Gender	Male	240 74	301 66	.024	.081	188 75	353 67	.031	.077	255 70	286 69	.575	.020
	Female	85 26	153 34			64 25	174 33			107 30	131 31		
Last education	UNIV	265 82	372 82	.073	.082	200 79	437 83	.393	.049	294 81	343 82	.430	.047
	Grad school	49 15	77 17			45 18	81 15			58 16	68 16		
	N/A	11 3	5 1			7 3	9 2			10 3	6 1		
Marital status	Married	224 69	339 75	.209	.063	175 69	388 74	.265	.058	257 71	306 73	.291	.056
	Single	100 31	114 25			77 31	137 26			105 29	109 26		
	N/A	1 0	1 0			0 0	2 0			0 0	2 0		
Own cancer history	Yes	22 7	20 4	.325	.054	20 8	22 4	.011	.108	26 7	16 4	.117	.074
	No	287 88	414 91			215 85	486 92			319 88	382 92		
	N/A	16 5	20 4			17 7	19 4			17 5	19 5		
Cancer history: spouse	Yes	13 4	15 3	.536	.040	14 6	14 3	.034	.093	15 4	13 3	.708	.030
	No	283 87	407 90			213 85	477 91			320 88	370 89		
	N/A	29 9	32 7			25 10	36 7			27 7	34 8		
Cancer history: family	Yes	109 34	218 48	<.001	.146	79 31	248 47	<.001	.152	132 36	195 47	.014	.104
	No	197 61	219 48			157 62	259 49			211 58	205 49		
	N/A	19 6	17 4			16 6	20 4			19 5	17 4		
Cancer history: relative	Yes	101 31	183 40	.027	.096	71 28	213 40	.004	.120	122 34	162 39	.181	.066
	No	188 58	232 51			155 62	265 50			208 57	212 51		
	N/A	36 11	39 9			26 10	49 9			32 9	43 9		
Cancer history: friend	Yes	82 25	130 29	.541	.040	59 23	153 29	.188	.065	92 25	120 29	.195	.043
	No	200 62	263 58			161 64	302 57			223 62	240 58		
	N/A	43 13	61 13			32 13	72 14			47 13	57 14		

chi-squared test, FREQ: Frequency,  $\phi$ : phi coefficient, UNIV: university, Grad school: Graduate school, N/A: not applicable

**Table 3** Personal factors in the awareness of cancer education among middle and high school teachers (Continued) (n = 779)

		Awareness of cancer education											
		Question 7				Question 8				Question 9			
		Negative n=385		Positive n=394		Negative n=531		Positive n=248		Negative n=470		Positive n=309	
		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]		Median [lower quartile- upper quartile]	
				<i>p</i>				<i>p</i>				<i>p</i>	
Age		50 [41-58]		49 [39-57]		.245		48 [39-57]		53 [41-58]		<.001	
Years of teaching		25 [14-33]		25 [14-33]		.344		23 [13-33]		29 [16-35]		<.001	
		FREQ	%	FREQ	%	<i>p</i>	$\phi$	FREQ	%	FREQ	%	<i>p</i>	$\phi$
Gender	Male	280	73	261	66	.050	.070	368	69	173	70	.898	-.005
	Female	105	27	133	34			163	31	75	30		
Last education	UNIV	312	81	325	82	.117	.074	428	81	209	84	.340	.053
	Grad school	61	16	65	16			90	17	36	15		
	N/A	12	3	4	1			13	2	3	1		
Marital status	Married	276	72	287	73	.937	.013	360	68	203	82	<.001	.148
	Single	108	28	106	27			169	32	45	18		
	N/A	1	0	1	0			2	0	0	0		
Own cancer history	Yes	20	5	22	6	.970	.009	26	5	16	6	.099	.077
	No	347	90	354	90			475	89	226	91		
Cancer history: spouse	Yes	18	5	10	3	.271	.058	18	3	10	4	.099	.077
	No	338	88	352	89			464	87	226	91		
Cancer history: family	Yes	150	39	177	45	.219	.062	206	39	121	49	.023	.098
	No	215	56	201	51			297	56	119	48		
Cancer history: relative	Yes	128	33	156	40	.184	.066	177	33	107	43	.020	.100
	No	218	57	202	51			297	56	123	50		
Cancer history: friend	Yes	39	10	36	9			57	11	18	7		
	No	101	26	111	28	.750	.027	132	25	80	32	.007	.113
N/A	Yes	234	61	229	58			316	60	147	59		
	No	50	13	54	14			83	16	21	8		

chi-squared test, FREQ: Frequency,  $\phi$ : phi coefficient, UNIV: university, Grad school: Graduate school, N/A: not applicable

For the relation between perceptions of cancer education and the following items: whether working in middle or high school, public or private schools, subject in charge, whether cancer education had been introduced, and experience of participation in workshops on cancer education, some items showed statistically significant differences. However, all of these had low coefficients of correlation ( $\phi = .0071$  to  $.1$ ), showing an absence of relations between the items (Table 4).

### 5. Logistic regression analysis of the perceptions of cancer education by middle and high school teachers

We performed a logistic regression analysis of the perceptions of cancer education of the participants. The analysis showed that there were statistically significant differences in Warning signs (Odds Ratio [OR] = 1.077 to 1.164,  $p < .01$  to  $.001$ ) and Risk factors (OR = 1.041 to 1.053,  $p < .001$ ) for Questions 1 through 7. There were statistically significant differences in Question 8 (OR = 1.100,  $p < .001$ ) and in Question 9 (OR = 1.159,  $p < .001$ ) for Warning signs (Table 5).

## IV. Discussion

### 1. Background of participants

The number of participants working in schools that had introduced cancer education was a low 126 (16.2%). According to a national survey conducted in 2018, the rates of introducing cancer education were 56.3% in primary, 71.4% in middle, and 63.7% in high schools<sup>19</sup>). These low rates may be because the survey was conducted in December 2021, in the midst of the COVID19 pandemic. Further, the participant standards for conducting cancer education are not identical. However, we may assume that overall the schools where the participants worked had not actively promoted the cancer education. And only 83 (10.7%) participants had participated in cancer education workshops; 8.6% of the participants were Health and Physical teachers. From this, we may assume that non-Health and Physical teachers participate in training sessions on cancer education.



**Table 4** Environmental factors in the awareness of cancer education among middle and high school teachers (n = 779)

		Awareness of cancer education																	
		Question 1				Question 2				Question 3									
		Negative n=215		Positive n=564		Negative n=342		Positive n=437		Negative n=261		Positive n=518							
		FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%						
School type	Middle school	91	42	225	40	.537	0	145	42	171	39	.375	.033	111	43	205	40	.428	.028
	High school	124	58	339	60			197	58	266	61			150	57	313	60		
Organization type	Public	169	79	437	77	.736	.012	268	78	338	77	.735	.012	192	74	414	80	.044	-.072
	Private	46	21	127	23			74	22	99	23			69	26	104	20		
Subject in charge	Health & Physical	21	10	59	10	.776	-.010	33	10	47	11	.614	-.018	18	7	62	12	.028	-.079
	Other	194	90	505	90			309	90	390	89			243	93	456	88		
Introduction of cancer education	No	185	86	468	83	.299	.037	297	87	356	81	.043	.072	227	87	426	82	.090	.061
	Yes	30	14	96	17			45	13	81	19			34	13	92	18		
Workshop attendance	No	190	88	506	90	.587	-.019	309	90	387	89	.421	.029	234	90	462	89	.842	.007
	Yes	25	12	58	10			33	10	50	11			27	10	56	11		

		Question 4				Question 5				Question 6									
		Negative n=325		Positive n=454		Negative n=252		Positive n=527		Negative n=362		Positive n=417							
		FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%						
School type	Middle school	132	41	184	41	.981	.001	104	41	212	40	.782	.010	156	43	160	38	.180	.048
	High school	193	59	270	59			148	59	315	60			206	57	257	62		
Organization type	Public	246	76	360	79	.233	-.043	190	75	416	79	.266	-.040	286	79	320	77	.448	.027
	Private	79	24	94	21			62	25	111	21			76	21	97	23		
Subject in charge	Health & Physical	27	8	53	12	.127	-.055	24	10	56	11	.635	-.017	32	9	48	12	.221	-.044
	Other	298	92	401	88			228	90	471	89			330	91	369	88		
Introduction of cancer education	No	278	86	375	83	.272	.039	214	85	439	83	.566	.021	311	86	342	82	.141	.053
	Yes	47	14	79	17			38	15	88	17			15	4	75	18		
Workshop attendance	No	297	91	399	88	.119	.056	225	89	471	89	.970	-.001	332	92	364	87	.046	.071
	Yes	28	9	55	12			27	11	56	11			30	8	53	13		

		Awareness of cancer education																	
		Question 7				Question 8				Question 9									
		Negative n=385		Positive n=394		Negative n=531		Positive n=248		Negative n=470		Positive n=309							
		FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%						
School type	Middle school	160	42	156	40	.577	.020	221	42	95	38	.380	.031	194	41	122	39	.618	.018
	High school	225	58	238	60			310	58	153	62			276	59	187	61		
Organization type	Public	302	78	304	77	.666	.015	401	76	205	83	.025	-.080	363	77	243	70	.644	-.017
	Private	83	22	90	23			130	24	43	17			107	23	66	21		
Subject in charge	Health & Physical	34	9	46	12	.191	-.047	54	10	26	10	.893	-.005	50	11	30	10	.676	.015
	Other	351	91	348	88			477	90	222	90			420	89	279	90		
Introduction of cancer education	No	332	86	321	81	.071	.065	455	86	198	80	.039	.074	399	85	254	82	.318	.036
	Yes	53	14	73	19			76	14	50	20			71	15	55	18		
Workshop attendance	No	356	92	340	86	.005	.100	478	90	218	88	.373	.032	425	90	271	88	.228	.043
	Yes	29	8	54	14			53	10	30	12			45	10	38	12		

chi-squared test, FREQ: Frequency,  $\phi$ : phi coefficient

## 2. Factors related to the perceptions of cancer education among middle and high school teachers, and the promotion of cancer education in schools

This survey provides useful data for building cancer education for children in Japan, where cancer education is still at an introductory stage.

Factors related to the perceptions of cancer education in Questions 1 through 7 were Warning signs and Risk factors. In Questions 8 and 9 only Warning signs are

related to awareness. The results show that the awareness of Warning signs and Risk factors influences the awareness that “cancer education has a positive effect on students.” Improving the knowledge of cancer among teachers may be effective in promoting cancer education in schools.

This study identified Warning signs and Risk factors as factors related to the perceptions of cancer education, and these are important factors that can lead to cancer prevention and early diagnosis of cancer. However, previous studies have reported that knowledge about

**Table 5** Logistic regression analysis of the awareness of cancer education by middle and high school teachers (n=779)

	Odds ratio	95% confidence interval	P-value
<b>Question 1: Students can learn about the importance of health and life.</b>			
Warning signs	1.163	1.103 - 1.226	< .001
Barriers to seeking help	0.991	0.949 - 1.035	.682
Risk factors	1.051	1.027 - 1.075	< .001
<b>Question 2: Cancer education can counteract the negative impression of cancer among students.</b>			
Age	1.000	0.964 - 1.037	.992
Years of teaching experience	1.020	0.985 - 1.056	.259
Warning signs	1.091	1.042 - 1.143	< .001
Risk factors	1.051	1.030 - 1.074	< .001
<b>Question 3: Cancer education can lead to cancer prevention behaviors of students.</b>			
Warning signs	1.123	1.070 - 1.180	< .001
Risk factors	1.052	1.029 - 1.075	< .001
<b>Question 4: Cancer education can positively influence the cancer prevention and screening behaviors of parents of students.</b>			
Warning signs	1.101	1.051 - 1.153	< .001
Risk factors	1.049	1.027 - 1.071	< .001
<b>Question 5: Cancer education will help students to understand familiar adults and children with cancer or other diseases.</b>			
Warning signs	1.164	1.107 - 1.224	< .001
Barriers to seeking help	0.973	0.934 - 1.014	.193
Risk factors	1.041	1.018 - 1.064	< .001
<b>Question 6: Cancer education will contribute to decreasing the number of future cancer cases and deaths.</b>			
Warning signs	1.080	1.032 - 1.131	< .001
Risk factors	1.050	1.028 - 1.072	< .001
<b>Question 7: It will be possible to build a community where people can live without worry even if they may develop cancer in the future.</b>			
Warning signs	1.077	1.029 - 1.127	.001
Risk factors	1.053	1.031 - 1.076	< .001
<b>Question 8: Cancer education can make students anxious or afraid of cancer. [reversal item]</b>			
Age	1.009	0.970 - 1.049	.652
Years of teaching experience	1.015	0.977 - 1.053	.445
Warning signs	1.100	1.050 - 1.153	< .001
<b>Question 9: Cancer education will not change the awareness of cancer of students. [reversal item]</b>			
Years of teaching experience	1.013	0.999 - 1.027	.062
Warning signs	1.159	1.107 - 1.213	< .001
Barriers to seeking help	1.004	0.966 - 1.043	.849

cervical cancer and the human papillomavirus (HPV) vaccine among teachers<sup>20</sup>, and breast cancer awareness were low<sup>21</sup>). In the present study, the mean scores of

Warning signs (9-point scale) and Risk factors (55-point scale) were not very high with 4.5 (SD 3.3) and 37.6 (SD 7.5) averages, respectively. Correct knowledge of cancer

among teachers has been reported to create a sense of possible cancer education<sup>13</sup>). From this point of view, to improve the perceptions of education among teachers, it is necessary for teachers to improve their knowledge and understanding of cancer signs and the risk factors for carcinogenesis. In addition, the Ministry of Education, Culture, Sports, Science and Technology has released "Teaching Materials for Promoting Cancer Education"<sup>22</sup>), which is voluminous and covers a wide range of topics including epidemiology, prevention, screening and treatment of cancer<sup>23</sup>). Time for cancer education is reserved for a limited number of teaching hours. Given these situations, it is necessary to improve the knowledge of cancer among teachers in order to refine the contents of cancer education and to develop education programs.

However, previous studies have reported that attitudes of teachers did not change even after information about cancer had been provided. Kamada et al.<sup>20</sup>) provided 846 Japanese teachers with information about the risk of developing cervical cancer and the adverse reactions and efficacy of the HPV vaccine, and investigated changes in the awareness before and after the information was provided. These studies reported that 72% to 91% of the respondents had a good understanding of the content of the information<sup>20</sup>). However, before the information was provided 22% answered that the HPV vaccine was safe and this number increased to 43% after the information was provided; and 29% answered that they would recommend the HPV vaccine to their daughters and students after the information provision and this number did not change after the information was provided<sup>20</sup>). In Japan, there were complaints of adverse reactions to the HPV vaccine, causing the government to temporarily suspend recommendations of the vaccine. However, school teachers may not provide cancer education even if they have gained knowledge about cancer in the medical field. We think that there is a need for teachers to improve their skills in planning and implementing cancer education. Barros, et al.<sup>11</sup>) provided a training program, "Cancer, Educate to Prevent," for high school biology teachers, and have reported that the program increased teacher cancer literacy, and empowered teachers to implement cancer prevention campaigns, and that the teachers expanded the campaigns to be applied throughout the school and to the families and community. "Cancer, Educate to Prevent" incorporates a session on developing cancer prevention projects to be implemented in schools<sup>11</sup>). The teachers who participated in this program were able to promote cancer education. This may be because the hands-on program improved their

skills to apply their knowledge about cancer.

Benedikt Heuckmann et al.<sup>21</sup>) conducted an interview survey with biology teachers in charge of cancer education, and reported that the narratives of teachers were categorized into three types of beliefs: behavioral beliefs, such as increasing knowledge of students; normative beliefs, such as social pressure to teach about cancer; and controlling beliefs, such as availability of teaching materials and skills in dealing with emotional responses of students, suggesting the complexity of cancer education. It must also be borne in mind that there is a limit to how much individual teachers can address cancer education. The Japanese Ministry of Education, Culture, Sports, Science and Technology started the "Comprehensive Support Project for Cancer Education" in 2014 to support cancer education in each municipality and provide teaching materials<sup>22</sup>). In addition, it may be effective to develop cancer education programs for teachers, such as the "Cancer, Educate to Prevent," to support teachers who provide cancer education.

Further, to improve the knowledge of cancer among teachers, they need to receive instruction from outsourced instructors who specialize in cancer, as Takahashi<sup>10</sup>) described. Sugisaki et al.<sup>24</sup>) surveyed cancer awareness among students aged 10-16 and reported that students who had a parent or relative with cancer had a stronger negative awareness of cancer, such as "I think cancer is scary" and "I think I will develop cancer in the future." As these reactions show, there are issues that are difficult for school teachers to address alone, and this makes it necessary to collaborate with cancer specialists. However, according to a 2021 national survey, the types of the outsourced instructors were physicians (39.7%), persons with cancer experience (22.9%), nurses including public health nurses (19.4%), and pharmacists (13.7%)<sup>7</sup>). In the future, it is desirable that specialists in cancer other than physicians will actively participate in cancer education and contribute to the development of cancer education in schools. Physicians are the most common outsourced instructors in cancer education among the medical professionals<sup>3</sup>), but there are many Cancer Nursing Certified Nurse Specialists and Certified Nurses in the field of cancer nursing among nurses. By utilizing not only physicians but also other healthcare professionals as outsourced instructors, teachers and students will be able to acquire accurate knowledge about cancer, and teachers will be able to respond appropriately to students who have negative views on cancer.

### 3. Limitations

Cancer education in Japan was fully introduced in middle schools in April of 2021 and in high schools in April of 2022. As this survey was conducted in December 2021, it may not fully reflect the actual situation of school teachers at this time. Further, there may be generational and income disparities in the use of the Internet because we used a web-based survey method. In addition, there may be sampling bias because the participants of this survey were monitors of a research company.

### V. Conclusions

This study identified factors related to the perceptions of cancer education among school teachers by conducting a web-based anonymous questionnaire survey with 779 Japanese middle and high school teachers in Japan. Factors related to the perceptions of cancer education in this population for Warning signs and Risk factors in terms of the following questions were: Q1 “Students can learn about the importance of health and life,” Q2 “Cancer education can counteract the negative impression of cancer among students,” Q3 “Cancer education can lead to cancer prevention behaviors of students,” Q4 “Cancer education can positively influence the cancer prevention and screening behaviors of parents of students,” Q5 “Cancer education will help students to understand familiar adults and children with cancer or other diseases”, Q6 “Cancer education will contribute to decreasing the number of future cancer cases and deaths,” and Q7 “It will be possible to build a community where people can live without worry even if they may develop cancer in the future.” The factors related to Q8 “Cancer education can make students anxious or afraid of cancer,” and Q9 “Cancer education will not change the awareness of cancer of students” were determined to be Warning signs, only. These findings suggest that the promotion of cancer education needs to focus the efforts on improving the knowledge and understanding of cancer among teacher.

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### Declaration of competing interest

The authors declare no conflict of interest.

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**Membership in Learned Societies:**

- Japanese Society of Cancer Nursing
  - Japan Academy of Nursing Science
  - Japan Society of Nursing Research
  - Japanese Nursing Society for Simulation and Learning
  - Japanese Society for Palliative Medicine
  - Japanese Association of Supportive Care in Cancer
-