

The Relationship Between Cancer Screening, Cancer Awareness, and Cancer Beliefs: The Case of American Population

Abstract

Although cancer is a global public health problem, it is at the forefront of the disease burden ranking of countries. It tried to examine the relationship between screening, awareness, and belief variables for cancer, which is a significant health problem. The Health Information National Trends Survey (HINTS 6) data was used. The association between cancer screening, awareness, and belief was evaluated using Pearson's r Correlation Coefficient with data from 6252 American adults. Moderate and high correlations were found between the variables analyzed within the scope of the study. There was a strong positive correlation between interest in cancer screening and concern about getting cancer ($r=0.707$; $p<0.001$) and a strong positive correlation between cancer prevention and cancer treatments, cancer screenings ($r=0.608$; $p<0.001$) and general health status ($r=0.491$; $p<0.001$). It is thought that studies to increase cancer screening and awareness may positively affect individuals' health behaviors. Therefore, it is recommended that strategies be developed that can help improve public health behaviors and make significant progress in the fight against cancer by increasing cancer screening and awareness.

Keywords: Cancer screening, Cancer awareness, Cancer beliefs, Health behaviors, American population

Introduction

Cancer is recognized as an essential health problem worldwide and is the second leading cause of death in the United States of America.^[1] The burden of cancer continues to increase globally, putting significant physical, emotional, and financial pressure on individuals, families, communities, and health systems. In countries with robust health systems, survival rates for many types of cancer can be increased through accessible early diagnosis, quality treatment, and survivorship care.^[2] In order to achieve early diagnosis and thus prolong the life span of patients, it is necessary to increase the level of awareness, consciousness, and knowledge of society about cancer and screening programs. In a study conducted on awareness levels, poor cancer awareness was shown to be an essential reason for lower survival and higher mortality rates, especially among the black American population. It has been stated that low awareness leads to worse outcomes because people present to the medical care system when they are in the advanced stage of cancer.^[3] Therefore, to increase awareness, practices that may lead to an increase in the

belief levels of society towards cancer should be put forward, and the groups at risk should be directed to screening programs by raising awareness of society by health authorities. However, it is also possible to come across studies indicating various barriers to participation in cancer screening programs. Studies are showing that cultural factors such as knowledge, beliefs, and attitudes about cancer disease or screening process, lack of health insurance, communication problems, distrust in the health system, and fatalistic beliefs may prevent participation in cancer screening programs.^[4] As a result of the literature review, it is possible to find studies showing that studies' beliefs about cancer are more directive and may affect patients' cancer awareness and participation in screening programs. For example, in a study conducted with 108 patients, participants' cognitive and emotional beliefs about lung cancer were evaluated. Self-reporting served to gauge the intention to undergo lung cancer screening with a CT scan. Fatalistic beliefs, fear of radiation exposure, and anxiety about CT scans were found to be significantly associated with decreased intention to screen. It was found that

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Access this article online

Website: www.ccij-online.org

DOI: [10.51847/GKdrnoOVBT](https://doi.org/10.51847/GKdrnoOVBT)

Quick Response Code:



How to cite this article: Cakmak C, Cinar F, Çapar H, Cakmak MA. The Relationship Between Cancer Screening, Cancer Awareness, and Cancer Beliefs: The Case of American Population. Clin Cancer Investig J. 2024;13(2):26-33.
<https://doi.org/10.51847/GKdrnoOVBT>

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differences were observed in the beliefs of minority and non-minority participants about lung cancer and screening.^[5]

It is known that various cognitive, emotional, and cultural factors affect belief. Considering that there is a close relationship between belief and action, the relationship between beliefs about cancer, awareness, and screening programs was addressed within the scope of the study. The relationship between these variables was tried to be explicitly revealed for cancer patients.

Materials and Methods

The materials and methods used within the scope of the research are to be explained in the form of sub-headings. Such a way was followed due to the complexity of the method used.

Study setting and timing

This study was conducted from March 7 – November 8, 2022, to obtain 7,000 completed questionnaires in the United States of America by the National Cancer Institute (NCI). The population of this study is Americans who participated in the Health Information National Trends Survey (HINTS) conducted by the NCI.^[6]

Study design

This study was conducted using a descriptive cross-sectional type. The model of the study is the relational screening model, a causal comparison subtype of quantitative research methods. The study complied with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement’s guidelines for reporting cross-sectional studies (**Table 1**).

Table 1. STROBE Statement—checklist of items that should be included in reports of observational studies.

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	269	
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	269	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	269-270	
Objectives	3	State specific objectives, including any prespecified hypotheses	269-270	
Methods				
Study design	4	Present key elements of study design early in the paper	270	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	270	
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls.	270	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	270	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	270	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	270	
Bias	9	Describe any efforts to address potential sources of bias	270	
Study size	10	Explain how the study size was arrived at	270	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	270	
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	270	
		(b) Describe any methods used to examine subgroups and interactions	270	

		(c) Explain how missing data were addressed	270
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	270-274 270-274 270-274
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount) <i>Cohort study</i> —Report numbers of outcome events or summary measures over time	270 270-274 270-274
Outcome data	15*	<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure <i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	270-274 270-274
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	270-274 270-274 270-274
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	270-274
Discussion			
Key results	18	Summarise key results with reference to study objectives	270-274
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	270-274
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	270-274
Generalisability	21	Discuss the generalisability (external validity) of the study results	270-274
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	270-274

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
 Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org

Participants

Participants were civilian, noninstitutionalized, aged 18 and over, living adults in the United States who participated in the HINTS survey conducted by the NCI.

Sample size and sampling

The sampling strategy for the HINTS 6 survey consisted of a two-stage design. In the first stage, a stratified sample of addresses was selected from a file of residential addresses. In the second stage, one adult was selected within each sampled

household. With this two-stage sampling, the sample size of 6252 people was determined.

Data collection tools

The data were collected with the HINTS 6 survey by NCI, published in 2023. Questions in the HINTS 6 survey, such as gender, age, full-time employment status, occupation, marital status, education level, ethnicity, income range, perceived income level, frequency of going to health institutions, and general health status, were used to collect findings regarding the demographic information of the participants. Questions such as lung cancer, cervical cancer, colorectal cancer, and HPV knowledge were used to collect findings regarding the participants' cancer screening and awareness levels. In addition, findings regarding the participants' beliefs about

cancer were reported regarding the question of the possibility of getting cancer.

Data analysis

Frequency and percentage values were used to report demographic and other discrete variables. Pearson Correlation Coefficient was used for correlation analysis. All analyses employed a two-sided *p*-value < 0.05 at a 95% confidence level. All analyses were performed with Jamovi Version 2.4 computer software.^[7, 8]

Ethical consideration and responsibilities

Ethical approval and participant consent were not required as this study involved publicly available de-identified data.

Results and Discussion

Table 2. Results Regarding the Demographic Information of the Participants

	Variables	n	% of Total
Gender	Missing Data	410	6.6 %
	Male	2307	36.9 %
	Female	3535	56.5 %
Work Full Time	Missing Data	412	6.6 %
	Yes	2778	44.4 %
	No	3062	49.0 %
	Missing Data	390	6.2%
Occupation	Employed only	2761	44.16%
	Homemaker only	221	3.5%
	Student only	63	1.0%
	Retired only	1725	27.6%
	Disabled only	326	5.2%
	Multiple Occupation statuses selected	473	7.6%
	Unemployed for one year or more only	148	2.4%
	Unemployed for less than one year only	101	1.6%
	Other OccupationOccupation only	44	0.7%
	Missing Data	415	6.6%
Marital Status	Married	2624	42.0 %
	Living as married or living with a romantic partner	373	6.0 %
	Divorced	939	15.0 %
	Widowed	646	10.3 %
	Separated	136	2.2 %
	Single, never been married	1119	17.9 %
Education	Missing Data	404	6.5%
	Less than eight years	116	1.9 %
	8 through 11 years	271	4.3 %
	12 years or completed high school	1068	17.1 %
	Post-high school training other than college (vocational or	433	6.9 %
	Some college	1239	19.8 %
	College Graduate	1613	25.8 %
	Postgraduate	1108	17.7 %
Missing Data	644	10.3%	
Ethnicities	Not Hispanic only	4607	73.7 %
	Mexican only	477	7.6 %
	Puerto Rican only	111	1.8 %
	Cuban only	41	0.7 %
	Other Hispanic only	331	5.3 %

	Multiple Hispanic ethnicities selected	41	0.7 %
	Missing Data	732	11.7%
	\$0 to \$9,999	389	6.2 %
	\$10,000 to \$14,999	304	4.9 %
	\$15,000 to \$19,999	266	4.3 %
Income Ranges	\$20,000 to \$34,999	729	11.7 %
	\$35,000 to \$49,999	732	11.7 %
	\$50,000 to \$74,999	937	15.0 %
	\$75,000 to \$99,999	694	11.1 %
	\$100,000 to \$199,999	1012	16.2 %
	\$200,000 or more	457	7.3 %
	Missing Data	485	7.8%
Income Feelings	Living comfortably on present income	2518	40.3 %
	Getting by on present income	2140	34.2 %
	Finding it difficult on present income	763	12.2 %
	Finding it very difficult on present income	346	5.5 %
	Missing Data	117	1.9%
	None	698	11.2 %
	One time	862	13.8 %
Frequencies Go, Provider,	Two times	1165	18.6 %
	Three times	973	15.6 %
	Four times	881	14.1 %
	5-9 times	962	15.4 %
	Ten or more times	594	9.5 %
	Missing Data	234	3.7%
	Excellent	600	9.6 %
General Health Statues	Very good	2081	33.3 %
	Good	2249	36.0 %
	Fair	932	14.9 %
	Poor	156	2.5 %

The majority of the participants were women; the number of people working full time was less than those who were not working; the majority of them were working and retired, the majority of them were married, college graduates, and not only Hispanic; the majority of them had an annual income between

100 thousand and 200 thousand dollars and live comfortably with their current income. It was determined that the majority of them receive service from health institutions at least twice a year. Their general health condition is good or excellent (**Table 2**).

Table 3. Participants Results Regarding Cancer Screening and Awareness Levels

Variables	n	% of Total
	Missing Data	389 6.2 %
Has a healthcare professional talked to you about checking for lung cancer?	I have never heard of this test	1408 22.5 %
	Yes	261 4.2 %
	No	3955 63.3 %
	Do not know	239 3.8 %
	Missing Data	549 9.9%
How long ago did you have your most recent Pap test to check for cervical cancer?	Inapplicable, coded 1 in BirthGender	1069 17.1 %
	A year ago or less	1148 18.4 %
	More than 1, up to 2 years ago	605 9.7 %
	More than 2, up to 3 years ago	424 6.8 %
	More than 3, up to 5 years ago	287 4.6 %
	More than five years ago	829 13.3 %
Has a doctor or other health professional	I have never had a Pap test	169 2.7 %
	I am male (Web only)	1172 18.7 %
	Missing Data	454 7.3%

ever told you there are a few different tests to detect colorectal cancer?	Yes	3011	48.2 %
	No	1379	22.1 %
	I have never discussed these tests with a doctor, or other he	1408	22.5 %
	Missing Data		
Have you ever heard of HPV?	Yes	3942	63.1 %
	No	1945	31.1 %
	Mising Data	585	9.4%
Do you think HPV can cause cervical cancer?	Inapplicable, coded 2 in HeardHPV	1753	28.0 %
	Yes	2468	39.5 %
	No	63	1.0 %
	Not sure	1383	22.1 %
Before today, have you ever heard of the cervical cancer vaccine or HPV shot?	Missing Data	417	6.7%
	Yes	3730	59.7 %
	No	2105	33.7 %

A large portion of participants reported not speaking to a healthcare professional to check for lung cancer. On the other hand, 18.4 percent of female participants reported having had a Pap test for cervical cancer in the last year or more recently. Most participants stated that a physician or healthcare

professional informed them that several tests were available to detect colorectal cancer. The majority of the participants stated that they had heard of HPV and thought that it caused cervical cancer and that they also had information about the cervical cancer vaccine or HPV shot (**Table 3**).

Table 4. Relationship Between Cancer Screening, Awareness and Cancer Beliefs (n=6552)

Variables	n	% of Total
Missing Data	91	1.5 %
I already had cancer	562	9.0 %
Very unlikely	482	7.7 %
Unlikely	678	10.8 %
Neither likely nor unlikely	1636	26.2 %
Likely	905	14.5 %
Very likely	287	4.6 %
I do not know	1304	20.9 %

Most of the participants marked "neither likely nor unlikely" for their risk of getting cancer compared to their peers (**Table 4**).

Table 5. Mean and Standard Deviation Values for Continuous Variables for Participants

	InterestedCaScreening	FreqWorryCancer	P3_Total	P4_Total	P5_Total	P6_Total	General Health	Age
n	6252	6252	6252	6252	6252	6252	6252	6252
Mean	2.40	2.04	7.07	3.49	7.95	3.61	2.28	54.6
Standard deviation	2.82	2.75	10.4	5.41	12.8	5.52	2.14	19.1

InterestedCaScreening: Interested in having a cancer screening test in the next year; FreqWorryCancer: Worried about getting cancer; P3_Total: Everything causes cancer, prevention not possible, too many recommendations, cancer fatal; P4_Total: Increase cancer soda sugar, Increase cancer alcohol; P5_Total: Increase cancer too much-processed meat, Increase cancer too much red meat, Increase cancer too much fast food, Not eating enough fruits and vegetables, Not getting enough sleep; P6_Total: Cancer progress prevention, cancer progress cures.

It seemed that very few of the participants had cancer, and almost one in two were interested in cancer screening tests. Very few of the participants are worried about getting cancer.

It was determined that the majority of the participants believe that everything causes cancer, that it is unpreventable, that there are many recommendations for cancer, and that cancer

is a fatal disease. Many participants stated that soda, sugar, alcohol use, too much processed meat, too much red meat, too

much fast food, not eating enough fruits and vegetables, and not getting enough sleep increased cancer (**Table 5**).

Table 6. Relationship Between Cancer Screening, Awareness and Cancer Beliefs (n=6552)

		Interested Ca Screening	FreqWorryCancer	P3_Total	P4_Total	P5_Total	P6_Total	General Health
InterestedCaScreening	Pearson's r	1						
	p-value							
FreqWorryCancer	Pearson's r	0.707***	1					
	p-value	< .001						
P3_Total	Pearson's r	0.688***	0.741***	1				
	p-value	< .001	< .001					
P4_Total	Pearson's r	0.626***	0.665***	0.776***	1			
	p-value	< .001	< .001	< .001				
P5_Total	Pearson's r	0.648***	0.686***	0.802***	0.875***	1		
	p-value	< .001	< .001	< .001	< .001			
P6_Total	Pearson's r	0.608***	0.665***	0.738***	0.777***	0.838***	1	
	p-value	< .001	< .001	< .001	< .001	< .001		
general health	Pearson's r	0.491***	0.505***	0.487***	0.490***	0.510***	0.488***	1
	p-value	< .001	< .001	< .001	< .001	< .001	< .001	

* p<0.05; **p<0.01; ***p<0.001; InterestedCaScreening: Interested in having a cancer screening test in the next year; FreqWorryCancer: Worried about getting cancer; P3_Total: Everything cause cancer, prevent not possible, too many recommendations, cancer fatal; P4_Total: Increase cancer soda sugar, Increase cancer alcohol; P5_Total: Increase cancer too much-processed meat, Increase cancer too much red meat, Increase cancer too much fast food, Not eating enough fruits and vegetables, Not getting enough sleep; P6_Total: Cancer progress prevention, cancer progress cures.

A strong positive relationship was detected between interest in cancer screening and concern about getting cancer (r=0.707; p<0.001). A strong positive relationship was found between the variable consisting of the combined variables that everything causes cancer, that it is not possible to protect from cancer, that there are many recommendations for cancer, and that cancer is fatal, and being interested in cancer screening (r = 0.688; p < 0.001). A statistically significant positive relationship was detected between a composite variable indicating that cancer increases with soda, sugar, and alcohol and interest in cancer screening (r=0.626; p<0.001). A positive relationship was detected between cancer and the composite variable of high consumption of processed meat, red meat consumption, fast food consumption, low fruit and vegetable consumption, and inadequate sleep (r = 0.648; p < 0.001). Finally, it was determined that there was a strong positive relationship between cancer prevention and cancer treatments, cancer screening (r=0.608; p<0.001), and general health status (r=0.491; p<0.001) (**Table 6**).

Within the scope of this study, the relationship between the data obtained from 6252 American adults and the level of cancer screening, cancer awareness, and beliefs about cancer of these individuals was examined. When the literature was examined, it was seen that there are different studies on this subject. However, the fact that the studies found in the literature generally focus on specific cancer patients and conducted research on smaller populations distinguishes this study from other studies. For example, in a study conducted by Tari Selçuk *et al.* (2020), the study sample consists of women over 40, and it is seen that it is directed towards a more

specific group.^[9] This study used a data set representing American society in general.

The findings obtained within the scope of the study are generally in line with the findings of the studies in the literature. This study found a strong positive correlation between willingness to undergo cancer screening and concern about getting cancer (r=0.707; p<0.001). A medium- and high-level relationship between cancer screening and other variables was found. In addition, a strong positive relationship was found between cancer prevention and cancer treatments, cancer screenings (r=0.608; p<0.001), and general health status (r=0.491; p<0.001). In the study conducted by Maladze *et al.* (2023), positive attitudes toward cancer prevention and cancer screening were reported.^[10] However, adverse reports were made about the effectiveness of treatments. In a study conducted by Özdemir *et al.* (2023), it was determined that prostate cancer men who participated in the study had low levels of knowledge about cancer screening, medium levels of sensitivity, seriousness, and barrier perceptions, and high levels of health motivation and benefit perceptions.^[11] In another study by Lin *et al.* (2023), age and socioeconomic status were associated with more positive cancer attitudes and beliefs and more knowledge about cancer screening.^[12]

A strong positive relationship was found between interest in cancer screening and concern about getting cancer (r=0.707; p<0.001). A study by Kong *et al.* (2022) found a positive relationship between concerns about getting cancer and participation behaviors in cancer screening.^[13] It has been reported that lack of participation in screenings due to the

concerns above and failure to detect cancer at an early stage will cause negative situations. In a study conducted by Katherine *et al.* (2018), individuals with a low perception of cancer screening are more likely to report information overload, fatalistic attitudes toward cancer, a lack of knowledge about cancer prevention, and frequent concerns about cancer.^[14]

Within the scope of the study, it is also possible to come across studies that examine issues such as cancer screening and attitudes towards cancer at the level of different cultures and different societies. For example, in a study by Kam *et al.* (2016), Chinese culture strongly influences beliefs and attitudes towards cancer.^[15] In another study conducted by Lesley *et al.* (2015), it is stated that the inclusion of a narrative brochure can positively affect beliefs about cancer screening.^[16] With the findings obtained in this study, it can be stated that the levels of cancer awareness, cancer screening, and beliefs about cancer in American society in general may be high and interrelated factors.

Conclusion

This study examined the relationships between cancer screening, cancer awareness, and cancer beliefs in the American population. The study included data from 6252 American adults. The findings showed a strong positive relationship between cancer prevention and treatment, cancer screenings, and general health status. On the other hand, according to the cancer beliefs examined in the study, it was revealed that many participants believed that everything causes cancer, cancer is not preventable, and there are too many suggestions.

It was determined that individuals interested in cancer screening were more concerned about cancer risks and cared more about their general health status. Therefore, it is thought that efforts to increase cancer screening and awareness may positively affect individuals' health behaviors. According to the results obtained within the scope of this study, the following recommendations may be appropriate;

- Campaigns and trainings for cancer screening and raising awareness should be accessible to citizens.
- Awareness-raising activities should be carried out to correct false beliefs about cancer and the importance of early diagnosis.
- Health policies realized in the context of public health should focus on strategies to increase cancer screening and awareness.
- Efforts to increase cancer screening and awareness should be planned and implemented, considering ethnic and socioeconomic differences.

Implementing these recommendations can help improve community health behaviors and make significant strides in the fight against cancer by increasing cancer screening and awareness.

Acknowledgments

None.

Conflict of interest

None.

Financial support

None.

Ethics statement

None.

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