

## Health Behaviors of Cancer Survivors: The Fourth Korea National Health and Nutrition Examination Survey (KNHANES IV, 2007–09)

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**Objective:** This study aimed to describe the health behaviors of cancer survivors in the Republic of Korea and to compare them with the health behaviors of two control groups: (i) individuals with no history of cancer but with other chronic diseases and (ii) individuals with no history of cancer or other chronic diseases.

**Methods:** This is a cross-sectional study of 17 311 adults at least 19 years of age who participated in the Fourth Korea National Health and Nutrition Examination Survey (2007–09). Smoking, alcohol drinking, physical activity and cancer screening behaviors of cancer survivors were assessed and compared with those of the two control groups.  $\chi^2$  tests and multiple logistic regression analyses were performed to determine the likelihood and predictors of health behaviors.

**Results:** The proportion of cancer survivors who were current smokers, heavy drinkers and engaged in physical activity were 9.6, 6.6 and 26.0%, respectively. Cancer screening rates reported among survivors were 44.2, 17.0, 49.8 and 47.7% for stomach, colorectal, breast and cervical cancers, respectively. Cancer survivors showed lower smoking and alcohol drinking rates compared with both control groups after adjusting for sex, age, marital status, education, household income and health insurance. Cancer survivors also showed stomach, breast and cervical cancer screening rates that differed from both control groups. However, in multiple analyses, these differences were not significant.

**Conclusions:** Cancer survivors are more likely to adopt good health behaviors than individuals without a history of cancer. Further study is needed to determine the factors that lead to continued unhealthy behaviors after cancer diagnosis.

*Key words:* alcohol drinking – early detection of cancer – health behaviors – neoplasm – physical activity – smoking

### INTRODUCTION

There are an estimated 28.7 million cancer survivors worldwide (1). In 2008, 178 816 individuals were diagnosed with cancer in the Republic of Korea, joining the 724 663 existing cancer survivors in the country at the time (2). Because of advancements in early detection and treatment, many adult cancer survivors can expect to live for decades after diagnosis. While there are

many positive aspects of improved cancer survival, there are also a number of associated consequences. For example, cancer survivors are at an increased risk of recurrence, secondary cancers, long-term effects of treatment and show a variety of symptoms that can adversely affect their quality of life (3). Thus, the secondary health problems of cancer survivors are becoming one of the main issues in health care.

One area receiving increased attention is the post-diagnosis health behaviors of cancer survivors. Indeed, health behavior is the main determinant of health among cancer survivors, as well as among individuals without cancer (4–6).

Several studies exist on the health behaviors of cancer survivors, with conflicting results. Cancer survivors tended to adopt more negative health behaviors: they were more likely to be current smokers, particularly younger survivors, and were more likely to have higher levels of alcohol consumption (7). However, cancer survivors have positive health behaviors compared with individuals without cancer (8,9). Adverse drinking behavior was reported to be less frequent in cancer survivors than in the general population in a recent study (9). Survivors were more likely than controls to comply with physical activity recommendations. Additionally, female cancer survivors were more likely to follow breast and cervical cancer screening recommendations (3).

In Korea, Cho et al. (8) reported screening rates of 48.5, 54.7, 34.7 and 28.6% among cancer survivors for breast, cervical, stomach and colorectal cancers, respectively. Cancer survivors were also reported to be more likely than individuals without a history of cancer to undergo screening regimens according to the recommended guidelines. However, information on other modifiable health behaviors such as smoking, alcohol consumption, and any differences in health behaviors is limited.

This study aimed to describe the health behaviors of cancer survivors in Korea. It is unclear whether the health behaviors of cancer survivors are similar to those of patients with other comorbid chronic conditions, which may also increase the frequency of contact with health professionals. Therefore, we compared the health behaviors of cancer survivors with those of two control groups: (i) individuals with no history of cancer but with other chronic diseases and (ii) individuals with no history of cancer or other chronic diseases, using data from the Fourth Korea National Health and Nutrition Examination Survey (KNHANES IV, 2007–09).

## PATIENTS AND METHODS

### DATA SOURCE

The KNHANES has been conducted periodically since 1998 to assess the health and nutritional status of the civilian non-institutionalized population of Korea. The KNHANES IV was a cross-sectional, nationally representative survey conducted by the Division of Chronic Disease Surveillance, Korean Centers for Disease Control and Prevention, from 2007 to 2009. Unlike previous KNHANES, which were conducted as short-term surveys over 2 to 3 months every 3 years, the KNHANES IV was conducted over the course of 1 year (10). In the KNHANES IV, 600 enumeration districts and 12 000 household units were randomly sampled using systematic sampling methods. A total of 24 871 individuals participated in the KNHANES IV (4594 in 2007, 9744 in 2008 and 10 533 in 2009). In this study, we analyzed data only from the adult sample ( $\geq 19$  years;  $n = 17\,311$ ). The KNHANES was

approved by the Korean Centers for Disease Control and Prevention Institutional Review Board, and all participants provided written informed consent.

### MEASURES

Demographic characteristics, disease history and health behaviors were collected. Demographic characteristics included age, sex, marital status (single, married, widowed/divorced/separated), education ( $\leq$  elementary school, middle school, high school,  $\geq$  college), household income (classified into quartiles of low, middle-low, middle-high, high) and health insurance (National Health Insurance, Medical Aid Program, uninsured).

Participants were classified as cancer survivors if they reported having ever been diagnosed by a physician with any kind of cancer, and these participants were also asked about the cancer site and their age at the time of diagnosis. The time since diagnosis was calculated by subtracting the years between the person's age at the time of the interview and the person's reported age at the time of the initial diagnosis. If multiple cancer diagnoses were reported, the age at the time of the first diagnosis was used. The current cancer status could not be assessed because no data were collected in the KNHANES on cancer symptoms or cancer treatments.

Because frequent contact with health professionals is associated with health behaviors, we divided the remaining participants into two non-cancer control groups: participants with no history of cancer but with chronic diseases (non-cancer chronic disease controls) and participants with no history of cancer or other chronic diseases (non-cancer non-chronic disease controls). Participants without a history of cancer, who had been diagnosed by a physician with arthritis, hypertension, diabetes mellitus, heart disease, stroke, asthma or chronic obstructive pulmonary disease, comprised the non-cancer chronic disease control group.

### HEALTH BEHAVIORS

At present, there are no health behavior recommendations specific to cancer survivors in Korea. Thus, the recommendations of Health Plan 2010 for the general Korean adult population were used in the present study (11); these included smoking, alcohol drinking, physical activity and cancer screening.

#### SMOKING

Participants were categorized as never, former and current smokers based on their answers to questions on lifetime and current smoking status.

#### ALCOHOL DRINKING

Participants were asked about lifetime alcohol drinking status, current drinking status and volume of alcohol consumed on any one occasion. Subjects who drank alcohol on more than one occasion in the month before the interview were defined

as current alcohol users. Heavy drinking was defined as consuming seven or more drinks on one occasion for men and five or more drinks for women.

#### PHYSICAL ACTIVITY

Physical activity was measured by frequency (per week) and duration (in min) of each physical activity. Subjects who performed 30 min or more of moderate activity at least 5 days a week or 20 min of vigorous physical activity at least 3 days a week were regarded as doing physical activity. Levels below these were regarded as not meeting the recommendations for physical activity.

#### CANCER SCREENING

Four types of cancer screening are recommended for the general population in Korea (8): breast cancer screening every

2 years for women aged  $\geq 40$  years; cervical cancer screening every 2 years in women aged  $\geq 30$  years; stomach cancer screening every 2 years in adults aged  $\geq 40$  years and colorectal cancer screening by fecal occult blood test within 1 year, by barium enema within 5 years or by colonoscopy within 10 years in adults aged  $\geq 50$  years. Cancer survivors who were diagnosed with a type of cancer that is the object of one of the screening programs considered in this report were excluded from the calculations of screening rates for that site.

#### STATISTICAL ANALYSIS

All estimates presented are weighted to provide national estimates, considering the sampling method. Descriptive statistics and  $\chi^2$  tests were used to examine the differences between the demographic characteristics of the cancer survivors and the two control groups.  $\chi^2$  tests and logistic regression models

**Table 1.** Characteristics of cancer survivors and controls, KNHANES IV, 2007–09

Characteristics	Cancer survivors (n = 504)	Non-cancer chronic disease controls (n = 5944)	Non-cancer non-chronic disease controls (n = 10 863)	P value
Sex				
Male	179 (35.0)	2405 (46.5)	4757 (51.1)	<0.001
Female	325 (65.0)	3539 (53.5)	6106 (48.9)	
Age (years)				
19–44	61 (15.2)	727 (18.3)	6670 (68.8)	<0.001
45–64	206 (46.6)	2562 (49.1)	3174 (26.2)	
$\geq 65$	237 (38.2)	2655 (32.7)	1019 (5.0)	
Marital status				
Single	11 (3.1)	179 (5.1)	2129 (26.7)	<0.001
Married	376 (74.3)	4250 (73.1)	7704 (66.4)	
Widowed/divorced/separated	117 (22.6)	1485 (21.7)	966 (6.9)	
Education				
$\leq$ Elementary school	234 (39.5)	2919 (40.1)	1554 (9.4)	<0.001
Middle school	86 (17.8)	927 (15.9)	1023 (8.2)	
High school	97 (22.0)	1223 (24.6)	3622 (34.0)	
$\geq$ College	87 (20.8)	865 (19.4)	4617 (48.4)	
Household income				
Low	167 (28.9)	1996 (28.1)	1456 (11.3)	<0.001
Middle-low	123 (25.6)	1498 (26.0)	2595 (24.7)	
Middle-high	93 (19.2)	1184 (23.3)	3212 (31.3)	
High	107 (26.3)	1075 (22.6)	3367 (32.8)	
Health insurance				
National Health Insurance	457 (91.8)	5474 (94.0)	10 514 (98.0)	<0.001
Medical Aid Program	44 (8.0)	401 (5.8)	247 (1.9)	
Uninsured	1 (0.2)	13 (0.2)	14 (0.1)	

Data are expressed with N (weighted %).

P values are obtained from  $\chi^2$  tests.

KNHANES IV, the Fourth Korea National Health and Nutrition Examination Survey.

were used to investigate whether health behaviors differed between cancer survivors and the two control groups. All data analyses were performed using SAS software (version 9.2).

## RESULTS

### CHARACTERISTICS OF CANCER SURVIVORS

There were significant differences in the demographic characteristics of cancer survivors and the two control groups overall ( $P < 0.001$ ; Table 1). More than one-half of the cancer survivors were diagnosed  $\leq 5$  years before the interview, and the most common cancer type was stomach cancer (Table 2).

### SMOKING

$\chi^2$  tests revealed significant differences in smoking status between cancer survivors and non-cancer controls ( $P < 0.001$ ). In the multiple analysis, controls from both the groups were around 1.91–2.57 times more likely to be current smokers than were cancer survivors [non-cancer chronic disease controls: odds ratio (OR) = 1.91, 95% confidence interval (CI) = 1.26–2.90; non-cancer non-chronic disease controls: OR = 2.57, 95% CI = 1.70–3.90; Table 3].

### ALCOHOL DRINKING

There were statistically significant differences in current alcohol drinking between cancer survivors and the two control

**Table 2.** Clinical characteristics of 504 cancer survivors, KNHANES IV, 2007–09

Characteristics	<i>n</i>	Weighted %
Age at diagnosis (years)		
19–44	124	30.4
45–64	265	51.3
$\geq 65$	115	18.3
Time since diagnosis (years)		
$\leq 5$	267	54.9
6–10	103	19.6
11–15	66	12.5
$\geq 16$	68	13.1
Cancer site <sup>a</sup>		
Stomach	106	19.2
Liver	19	4.4
Colorectum	39	8.9
Breast <sup>b</sup>	60	20.8
Cervix <sup>b</sup>	77	25.1
Lung	19	3.1
Other	206	38.3

<sup>a</sup>Allows for patient to have more than one type of cancer.

<sup>b</sup>Percentages are restricted to women.

groups in both single and multiple analyses. Controls from both the groups were around 1.78–2.03 times more likely to be current alcohol drinkers than were cancer survivors (non-cancer chronic disease controls: OR = 1.78, 95% CI = 1.36–2.33; non-cancer non-chronic disease controls: OR = 2.03, 95% CI = 1.54–2.67). The proportion of heavy drinkers among cancer survivors was 6.6%. On the other hand, the proportion of heavy drinkers among non-cancer chronic disease controls and non-cancer non-chronic disease controls were 12.3% and 14.7%, respectively ( $P < 0.001$ ). However, in multiple analyses, there were no significant differences between cancer survivors and the two control groups (Table 3).

### PHYSICAL ACTIVITY

The proportions of participants performing the recommended levels of physical activity were 26.0, 23.9 and 25.5% for cancer survivors, non-cancer chronic disease controls and non-cancer non-chronic disease controls, respectively. There were no significant differences in the levels of physical activity between cancer survivors and the two control groups ( $P = 0.114$ ; Table 3).

### CANCER SCREENING

The proportions of cancer survivors screened for stomach, colorectal, breast and cervical cancers were 44.2, 17.0, 49.8, and 47.7%, respectively, which were significantly different from the two control groups. However, in multiple analyses, these differences were not significant (Table 4).

## DISCUSSION

In this study, we described the health behaviors of cancer survivors and investigated differences in their health behaviors compared with the two control groups. Among 504 cancer survivors, 9.6% were current smokers, 6.6% were heavy drinkers and 26.0% exercised at the recommended level. Cancer survivors were more likely to adopt good health behaviors compared with the two control groups used in this study.

The proportion of current smokers was lower, and the proportion of never smokers was higher, in cancer survivors compared with the two control groups. Smoking is a well-known risk factor for the development of cancer (12). The smoking rate in our study might be underestimated due to selection bias as a result of selective survival. In our cross-sectional study, cancer patients who had smoked might have died at an earlier time after their cancer diagnosis and might have not enrolled in this study. Although the current smoking rate of cancer survivors in the present study was 9.6%, which was lower than that of the two control groups, smoking has been reported to be a risk factor for a second primary cancer in cancer patients (13) and an independent prognostic factor for cancer recurrence and mortality (6,14,15). Therefore, it is important that

**Table 3.** Health behaviors among cancer survivors compared with the two control groups, KNHANES IV, 2007–09

	Cancer survivors		Non-cancer chronic disease controls		Non-cancer non-chronic disease controls		P value
	n	% (SE)	n	% (SE)	n	% (SE)	
Smoking status							
Never	310	63.6 (2.55)	3545	54.7 (0.74)	6227	52.2 (0.56)	<0.001
Former	145	26.8 (2.46)	1367	24.5 (0.75)	1823	17.7 (0.43)	
Current	48	9.6 (1.58)	1013	20.8 (0.69)	2769	30.1 (0.53)	
OR (95% CI) for current smoking <sup>a</sup>		1.00		1.91 (1.26–2.90)		2.57 (1.70–3.90)	
Current alcohol drinking							
No	352	69.1 (2.54)	3421	52.1 (0.79)	4473	36.9 (0.56)	<0.001
Yes	152	30.9 (2.54)	2508	47.9 (0.79)	6350	63.1 (0.56)	
OR (95% CI) for alcohol drinking <sup>a</sup>		1.00		1.78 (1.36–2.33)		2.03 (1.54–2.67)	
Heavy drinking							
No	480	93.4 (1.57)	5386	87.7 (0.55)	9462	85.3 (0.44)	<0.001
Yes	24	6.6 (1.57)	558	12.3 (0.55)	1401	14.7 (0.44)	
OR (95% CI) for heavy drinking <sup>a</sup>		1.00		1.42 (0.84–2.42)		1.26 (0.74–2.15)	
Physical activity							
No	378	74.0 (2.35)	4508	76.1 (0.78)	8029	74.5 (0.57)	0.114
Yes	126	26.0 (2.35)	1418	23.9 (0.78)	2782	25.5 (0.57)	
OR (95% CI) for physical activity <sup>a</sup>		1.00		0.83 (0.65–1.08)		0.84 (0.65–1.08)	

P values are obtained from chi-square tests.

OR, odds ratio; CI, confidence interval; SE, standard error.

<sup>a</sup>Adjusted for age, sex, marital status, education, household income and health insurance.

cancer survivors stop smoking, and their physicians should remind them of this point.

The proportions of current alcohol drinkers or heavy drinking among cancer survivors were lower than those in the two control groups. Nevertheless, 30% of cancer survivors still drank alcohol, and a portion of them reported that they drank heavily. Perhaps, cancer survivors were drinking alcohol for its known cardiovascular benefits, as light-to-moderate drinking is associated with a reduced risk of multiple cardiovascular outcomes (16). However, alcohol drinking after cancer diagnosis may also increase the risk of a second primary cancer (17) or a poor prognosis (5,14,18). Further study is needed to identify the benefits and risks of alcohol drinking for cancer survivors, considering cancer type and comorbid cardiovascular risks.

Only 26.0% of cancer survivors met the recommended level of physical activity, and their levels did not differ from those found in the two control groups. These findings differ greatly from previous research, which reported that 72% of breast cancer survivors (19) and 58% of prostate and breast cancer survivors engaged in routine exercise after treatment (20). Physical activity can improve aerobic fitness, upper and lower body strength, body weight, functional quality of life, anxiety and self-esteem (21). While physical activity

guidelines for cancer survivors do exist in other countries (22,23), to the best of our knowledge, there are no such guidelines in Korea. It is hard to use the guidelines from other countries due to differences in demographic characteristics and cancer types. For this reason, physical activity guidelines for cancer survivors must be established in Korea. Indeed, cancer survivors could benefit from information on physical activity recommendations, and oncologist recommendations may increase this behavior and serve as a promising method to promote exercise in cancer survivors (24). Although regular physical activity is important for cancer survivors, we could not assess any physical conditions that cancer survivors may have had which would interrupt physical activity, such as motor disability or pain. Further study is needed to investigate the levels of physical activity in cancer survivors, taking into account their physical condition.

The one area in which cancer survivors appear to have better patterns of health behaviors was cancer screening. It was encouraging that cancer survivors were more likely than controls to report that they were undergoing cancer screening according to recommendations. Previous studies also reported higher rates of cancer-specific screening among cancer survivors (3,8). The differences in cancer screening patterns between survivors and the two control groups in the present

**Table 4.** Cancer screening rates among cancer survivors and two control groups, KNHANES IV, 2007–09

Cancer site	Cancer survivors		Non-cancer chronic disease controls		Non-cancer non-chronic disease controls		<i>P</i> value
	<i>n</i>	Weighted % (SE)	<i>n</i>	Weighted % (SE)	<i>n</i>	Weighted % (SE)	
Stomach <sup>a,b</sup>	156	44.2 (3.12)	2418	43.8 (0.77)	2363	40.8 (0.87)	0.013
Total	364		5518		5559		
OR (95% CI) for screening <sup>c</sup>		1.00		1.02 (0.79–1.33)		0.80 (0.61–1.03)	
Colorectum <sup>b,d</sup>	57	17.0 (2.54)	830	16.9 (0.72)	500	16.4 (0.83)	0.781
Total	364		4783		2971		
OR (95% CI) for screening <sup>c</sup>		1.00		0.92 (0.65–1.32)		0.82 (0.57–1.17)	
Breast <sup>b,e</sup>	116	49.8 (3.89)	1574	46.7 (1.04)	1532	51.1 (1.19)	0.014
Total	239		3327		3019		
OR (95% CI) for screening <sup>f</sup>		1.00		0.95 (0.68–1.33)		0.83 (0.59–1.17)	
Cervix <sup>b,g</sup>	107	47.7 (3.89)	1437	43.2 (1.00)	2465	52.0 (0.89)	<0.001
Total	246		3491		4866		
OR (95% CI) for screening <sup>f</sup>		1.00		0.90 (0.65–1.26)		0.82 (0.59–1.13)	

*P* values are obtained from chi-square tests.

<sup>a</sup>Males and females  $\geq 40$  years.

<sup>b</sup>Only patients not having the specific type of cancer were included for cancer screening.

<sup>c</sup>Adjusted for age, gender, marital status, education, household income and health insurance.

<sup>d</sup>Males and females  $\geq 50$  years of age.

<sup>e</sup>Females  $\geq 40$  years of age.

<sup>f</sup>Adjusted for age, marital status, education, household income and health insurance.

<sup>g</sup>Females  $\geq 30$  years of age.

study are likely due to close follow-up care for survivors, as opposed to the standard of care, or perhaps lack of care, for those without cancer (3). However, there was also the potential for selective survival bias, as subjects who did not receive regular cancer screening might have been diagnosed with an advanced stage cancer and subsequently died before baseline enrollment in this study. Although cancer screening rates of survivors were higher than those of the two control groups, cancer screening practices among survivors were still below the optimal levels. According to recommendations, more than one-half of survivors were not screened. Recently, Korean studies reported that a lack of information (25) or misperception (26) was a main barrier for cancer screening among cancer survivors. Moreover, survivors reported that they would have undergone screening if they had known about its existence (25). Health care professionals should provide information on the risk of other cancers, as well as appropriate screening guidelines, to cancer survivors.

Because of the large number of cancer sites included in this study and the heterogeneity in the effects of health behaviors on cancer, we could not examine the two or more behaviors (e.g. smoking and drinking, or smoking and physical activity) by a specific cancer site. Previous studies observed that a composite measure of multiple health behaviors can predict preventable death, above and beyond the predictive value of any single lifestyle behavior (27). In a further study, site-specific studies or investigations of multiple health behavior by

specific cancer site are more appropriate to detect high-risk groups of cancer survivors.

There are several limitations to the use of KNHANES data to examine the health behaviors of cancer survivors. First, this study relied on self-reported data. Hence, the rates of reported smoking and alcohol drinking might have been underestimated, whereas physical activity levels and screening might have been overestimated, as a result of social desirability. Second, because of the cross-sectional nature of the data, we were unable to examine health behaviors prior to cancer diagnosis. Therefore, we were unable to assess whether survivors reduced their pre-diagnosis exposure to harmful behaviors as a result of their diagnosis. Third, the KNHANES did not include information on cancer care status. Thus, we were unable to determine the proportion of cancer survivors who were actively dealing with treatment or recurrent/advanced disease versus those living with disease and/or were symptom-free. This point also raises the possibility that the physical activity findings were skewed toward inactivity if cancer survivors were actively dealing with their disease. Fourth, cancer survivors who live in nursing homes, long-term care facilities or hospitals were not included in the KNHANES IV, and so our results might not completely reflect the behaviors of all cancer patients in Korea. Finally, in this cross-sectional study, there was potential for selection bias as a result of selective survival, as individuals who had been diagnosed with cancer and subsequently died before the

KNHANES IV took place would not have had the opportunity to participate (28).

This study provides population-based measures of health behaviors among cancer survivors in Korea. Cancer survivors are more likely than individuals without a history of cancer to adopt good health behaviors, yet a considerable proportion of cancer survivors engage in unhealthy behaviors. These findings indicate a need for further research to understand why these individuals continue unhealthy behaviors despite their risk for adverse effects and to design interventions that might influence a shift toward better health behaviors.

### Conflict of interest statement

None declared.

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