

Association Between Health Behaviors and Family History of Cancer in Cancer Survivors: Data From the Korean Genome and Epidemiology Study

ORIGINAL
ARTICLE

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Background: We compared health behaviors, including current smoking, alcohol drinking, regular exercise, obesity, and abdominal obesity, among Korean cancer survivors with and without family history of cancer.

Methods: This study included 5,247 cancer survivors with family history of cancer (1,894 with and 3,353 without), who were recruited from the Health Examinee cohort. Health behaviors were identified using questionnaire. Adjusted ORs (aORs) between health behaviors and family history of cancer were estimated by multivariate logistic regression analysis adjusted for sociodemographic factors. All analyses were conducted separately according to sex.

Results: Prevalence of current smoking, alcohol drinking, no regular exercise, obesity, and abdominal obesity was 16.3%, 48.3%, 36.0%, 31.3%, and 42.3% in male cancer survivors and 1.7%, 20.6%, 43.8%, 28.5%, and 72.5% in female, respectively. Health behaviors in male cancer survivors with and without family history of cancer were not significantly different after being adjusted for other covariates (aOR = 1.04, 95% CI = 0.75-1.44 for current smoking; aOR = 0.96, 95% CI = 0.76-1.22 for current drinking; aOR = 0.85, 95% CI = 0.66-1.10 for regular exercise; aOR = 0.96, 95% CI = 0.73-1.25 for obesity; aOR = 0.97, 95% CI = 0.75-1.25 for abdominal obesity). In female cancer survivors, there were no significant differences in health behaviors according to family history of cancer (aOR = 0.76, 95% CI = 0.44-1.32; aOR = 1.11, 95% CI = 0.94-1.31; aOR = 0.99, 95% CI = 0.87-1.14; aOR = 0.99, 95% CI = 0.85-1.16; aOR = 0.93, 95% CI = 0.80-1.10, respectively).

Conclusions: We identified no significant differences in health behaviors according to family history of cancer in cancer survivors. More studies should be conducted to identify correlations between family history of cancer and prognosis in cancer survivors.

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Key Words: Cancer survivor, Family cancer history, Health behavior

INTRODUCTION

Cancer is one of the important health burdens in Korea since 1983. A total of 217,057 new cancer patients and 76,611 deaths were recorded in 2014. As the 5-year relative cancer survival rate has improved from 41.2% in 1993 to 1995 to 70.3% in 2010 to 2014, the number of long-term cancer survivors has increased rapidly, with 806,780 5-year cancer survivors in 2014.¹

Among cancer survivors, the risks of other health problems,

including short- and long-term side effects of treatment, recurrence, other comorbidities, and decline in functioning, are increased,^{2,4} and health behavior is important to reduce the risk of recurrence and decrease the adverse effects of cancer therapy.⁵⁻⁷ Studies have shown that smoking cessation after the diagnosis of early stage lung cancer delayed the progression and was beneficial for health.⁸ Thus, compared with the general population, tertiary prevention through having healthy lifestyle habits is important for cancer survivors, followed by increased

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attention to smoking, drinking, and physical activity.^{9,11}

Family history of cancer (FHCA) is one of the non-modifiable risk factors of cancer and has been suggested to affect prognosis of cancer survivors. Studies showed that FHCA improved survival in head and neck,¹² gastric,¹³ and colorectal cancer patients,^{14,15} but no association between family history and breast cancer survival was observed.¹⁶⁻¹⁸ In some studies, better survival in cancer survivors was correlated to surveillance monitoring and health behaviors;^{13,15} another study showed that he/she performed more surveillance behaviors influencing their cancer risk when someone knew that he/she had an FHCA.¹⁹ Thus, in cancer survivors where healthy lifestyle behaviors are more important for better survival and life quality, comparison of health behaviors according to FHCA would help explain the increased survival.

This study aimed to investigate and compare health behaviors, including smoking, alcohol drinking, regular exercise, obesity, and abdominal obesity, in cancer survivors with or without FHCA.

MATERIALS AND METHODS

1. Study population

We analyzed data from the Korean Genome and Epidemiology Study (KoGES) conducted by the National Research Institute of Health and Centers for Disease Control and Prevention, which

aimed to develop comprehensive health care guidelines and reduce chronic diseases in Koreans.²⁰ KoGES was classified into six types of cohorts, and this study used baseline data of the Health Examinee (HEXA) cohort, which consists of participants aged 40 to 79 years who were recruited between 2004 and 2013. Participants were invited to health examination centers in eight regions (metropolitan areas or major cities) in Korea. After obtaining informed consent, a survey using standardized questionnaire was conducted by trained research staff.²¹ The questionnaire included sociodemographic characteristics, personal medical history, family medical history, medication usage, lifestyle behaviors (smoking, dietary habits, alcohol drinking, and physical activity), and reproductive factors. Details of the KoGES and HEXA study have been described elsewhere (<http://www.nih.go.kr/NIH/eng/main.jsp>).

With a total of 173,357 subjects in the HEXA cohort, we first selected 5,274 participants who responded that they had never been diagnosed with cancer by a physician. Then, 27 participants who had missing information on questions of FHCA were excluded. The remaining 5,247 participants had an FHCA (Fig. 1). The Institutional Review Board of the National Cancer Center approved the study protocol (approval no. NCC2014-0098).

2. Variables

FHCA was defined as positive family history of any type of cancer in participants' first-degree relatives, including parents.

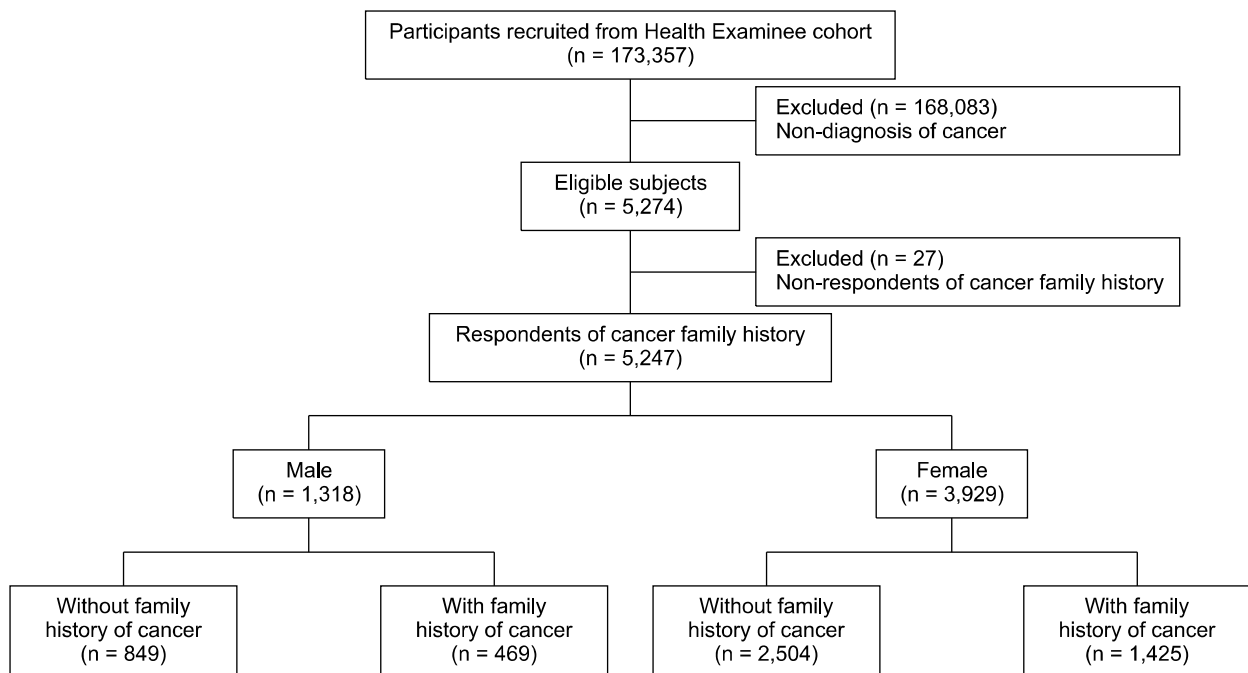


Figure 1. Selection of study population.

siblings, or children. The outcomes of this study included current smoking, current alcohol drinking, regular exercise, obesity, and abdominal obesity at the time of survey. Current smokers were defined as those who had smoked ≥ 100 cigarettes in their life time and still smoked at the time of survey. Current alcohol drinkers were defined as those who reported that they were current drinkers at the time of survey. Regular exercise was defined as performing regular exercise enough to sweat once a week or more. Body mass index (BMI) was used as an index for obesity and calculated using height and weight. Participants with BMI ≥ 25 kg/m² were considered obese.²² Waist-hip ratio (WHR), which reflects abdominal obesity, was calculated, and women and men with WHR ≥ 0.80 and ≥ 0.90 , respectively, were

considered as having abdominal obesity.²³

Other considered covariates included age (40-49/50-59/ ≥ 60 years), education (below high school/high school diploma/collegiate level), household income ($< 1,500,000/1,500,000-2,999,999/3,000,000-3,999,999/\geq 4,000,000$ KRW), employment condition (yes/no), any chronic disease in the past diagnosed by a physician (yes/no), and self-rated health (healthy/normal/unhealthy). In case of women, numbers of children (0/1-2/3-4/ ≥ 5) and menopause (yes/no) were included.

3. Statistical analysis

All analyses were conducted separately according to sex. The chi-square test was used to assess whether there were differences

Table 1. Characteristics according to FHCA in males and females diagnosed with cancer (KoGES 2004-2013)

Characteristic	Male			Female		
	No FHCA (n = 849)	FHCA ^a (n = 469)	Pvalue ^b	No FHCA (n = 2,504)	FHCA ^a (n = 1,425)	Pvalue ^b
Age (yr)						
40-49	92 (10.8)	62 (13.2)		732 (29.2)	374 (26.3)	
50-59	244 (28.7)	164 (34.9)		1,060 (42.3)	657 (46.1)	
≥ 60	513 (60.4)	243 (51.8)	0.010	712 (28.4)	394 (27.7)	0.049
No. of children						
0	-	-		25 (1.1)	20 (1.5)	
1-2	-	-		1,526 (63.9)	894 (65.1)	
3-4	-	-		742 (31.1)	426 (31.0)	
≥ 5	-	-	-	97 (4.1)	33 (2.4)	0.039
Education						
Below high school	268 (31.9)	127 (27.1)		1,018 (41.2)	552 (39.2)	
High school diploma	267 (31.8)	149 (31.8)		933 (37.8)	530 (37.5)	
Collegiate level	305 (36.3)	192 (41.0)	0.134	520 (21.0)	331 (23.4)	0.187
Income (KRW)						
$< 1,500,000$	216 (29.5)	108 (25.8)		582 (27.4)	300 (24.0)	
1,500,000-2,999,999	242 (33.0)	127 (30.3)		746 (35.1)	446 (35.7)	
3,000,000-3,999,999	122 (16.7)	74 (17.7)		383 (18.0)	228 (18.2)	
$\geq 4,000,000$	152 (20.8)	109 (26.1)	0.148	415 (19.5)	277 (22.1)	0.102
Job						
No	329 (39.4)	157 (34.0)		282 (11.5)	111 (7.8)	
Yes	506 (60.6)	305 (66.0)	0.054	2,165 (88.5)	1,285 (90.2)	<0.001
Self-rated health						
Healthy	277 (32.9)	177 (37.8)		650 (26.2)	355 (25.1)	
Normal	362 (43.0)	184 (39.3)		1,111 (44.7)	599 (42.3)	
Unhealthy	202 (24.0)	107 (22.9)	0.198	725 (29.2)	461 (32.6)	0.082
Menopause						
No	-	-		504 (20.3)	297 (21.0)	
Yes	-	-	-	1,979 (79.7)	1,119 (79.0)	0.615
Chronic disease ^c						
No	355 (41.8)	225 (48.0)		1,140 (45.5)	635 (44.6)	
Yes	494 (58.2)	244 (52.0)	0.031	1,364 (54.5)	790 (55.4)	0.559

Values are presented as number (%). FHCA, family history of cancer; KoGES, Korean Genome and Epidemiology Study. ^aFHCA included a family history of any type of cancer. ^bP-values were determined using chi-square excluding the missing data. ^cChronic diseases included the diagnosis of any kind of chronic disease by a physician in the past.

in sociodemographic characteristics among cancer survivors with and without FHCA. The proportion of current smoking, drinking, regular exercise, obesity, and abdominal obesity among cancer survivors with and without FHCA was compared using chi-square as well. We used multivariate logistic regression to assess independent associations between health behaviors and FHCA in cancer survivors, adjusting for age, education, monthly household income, job status, self-rated health, and chronic disease. In case of women, menopause and number of children were additionally included as covariates. The results were presented as adjusted OR (aOR) and 95% CIs. To evaluate the clustering effects of health behaviors, multivariate logistic regression was performed, clustering health behaviors after being adjusted for covariates. All statistical analyses were performed with SAS software ver. 9.3 (SAS Institute, Cary, NC, USA).

RESULTS

1. Characteristics of cancer survivors according to family history of cancer

The baseline sociodemographic characteristics by family history in male and female cancer survivors are shown in Table 1. Of 1,318 male cancer survivors, 469 had an FHCA. Of 3,929 female cancer survivors, 1,425 had an FHCA. Of the male cancer survivors, age distribution and chronic disease status were significantly different according to FHCA. Of the female cancer survivors, age distribution, number of children, and job status were significantly different according to FHCA, suggesting minimally different distribution of baseline characteristics in cancer survivors according to family history.

2. Health behaviors in cancer survivors

The prevalence of current smoking, alcohol drinking, no regular exercise, obesity, and abdominal obesity was 16.3%, 48.3%, 36.0%, 31.3%, and 42.3% in male cancer survivors (Fig. 2A) and 1.7%, 20.6%, 43.8%, 28.5%, and 72.5% in female cancer survivors, respectively (Fig. 2B). The comparison of lifestyle factors according to FHCA in male and female survivors did not show significant differences (Table 2).

Health behaviors, including current smoking, current drinking, regular exercise, obesity, and abdominal obesity in male cancer survivors with FHCA, were not significantly different compared with those without FHCA after being adjusted for other covariates (aOR = 1.04, 95% CI = 0.75-1.44; aOR = 0.96, 95% CI = 0.76-1.22; aOR = 0.85, 95% CI = 0.66-1.10; aOR = 0.96, 95% CI = 0.73-1.25; aOR = 0.97, 95% CI = 0.75-1.25, respectively). Similarly, no associations were observed in female cancer survivors according to family history as well (aOR = 0.76, 95% CI = 0.44-1.32 for current smoking; aOR = 1.11, 95% CI = 0.94-1.31 for current drinking; aOR = 0.99, 95% CI = 0.87-1.14 for regular exercise; OR = 0.99, 95% CI = 0.85-1.16 for obesity; OR = 0.93, 95% CI = 0.80-1.10 for abdominal obesity) (Table 3).

3. Clustering of health behaviors in cancer survivors

When the association between FHCA and clustering of two health behaviors was estimated, male cancer survivors with FHCA were less likely to smoke and regularly exercised (OR = 0.76, 95% CI = 0.58-1.00) and were less likely to drink and regularly exercised (OR = 0.68, 95% CI = 0.48-0.97). In female cancer survivors, when two health behaviors were combined and

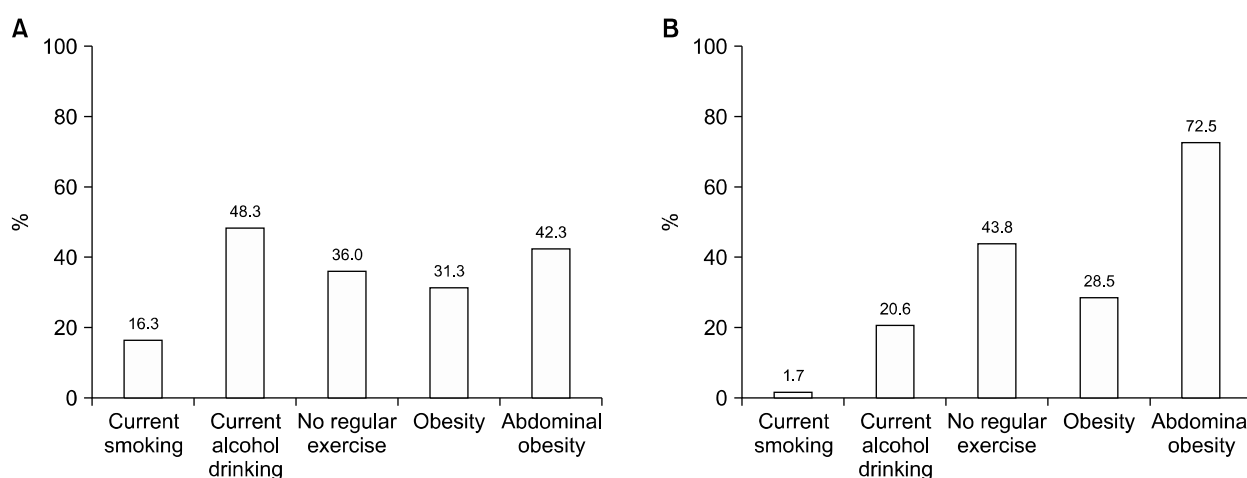


Figure 2. Prevalence of current smoking, drinking, no regular exercise, obesity, and abdominal obesity status in cancer survivors. (A) Prevalence in males with family history of cancer (FHCA); (B) Prevalence in females with FHCA.

Table 2. Comparison of health behaviors according to FHCA in males and females (KoGES 2004-2013)

Factor	Male			Female		
	No FHCA	FHCA ^a	P-value ^b	No FHCA	FHCA ^a	P-value ^b
Current smoking						
No	712 (83.9)	386 (83.0)	0.656	2,446 (98.1)	1,402 (98.6)	0.231
Yes	136 (16.0)	79 (17.0)		46 (1.9)	19 (1.3)	
Current alcohol drinking						
No	439 (51.8)	240 (51.4)	0.896	1,994 (79.8)	1,114 (78.5)	0.327
Yes	409 (48.2)	227 (48.6)		504 (20.2)	305 (21.5)	
Regular exercise						
No	318 (37.5)	157 (33.6)	0.161	1,100 (44.0)	621 (43.6)	0.804
Yes	530 (62.5)	310 (66.4)		1,399 (56.0)	803 (56.4)	
Obesity						
No	576 (68.1)	322 (69.1)	0.728	1,772 (71.0)	1,020 (71.9)	0.555
Yes	269 (31.8)	144 (30.9)		724 (29.0)	399 (28.1)	
Abdominal obesity						
No	471 (56.2)	271 (58.8)	0.369	650 (26.3)	393 (27.8)	0.297
Yes	367 (43.8)	190 (41.2)		1,826 (72.8)	1,021 (72.2)	

Values are presented as number (%). FHCA, family history of cancer; KoGES, Korean Genome and Epidemiology Study. ^aFHCA included a family history of any type of cancer. ^bP-values were determined using chi-square excluding the missing data.

Table 3. Association between FHCA and health behaviors among cancer survivors in multivariate logistic regression analysis

Factor	Male				Female			
	OR ^a	P-value	aOR ^b	P-value	OR ^a	P-value	aOR ^b	P-value
Current smoking	1.07 (0.79-1.45)	0.656	1.04 (0.75-1.44)	0.810	0.72 (0.42-1.24)	0.233	0.76 (0.44-1.32)	0.334
Current alcohol drinking	1.02 (0.81-1.27)	0.896	0.96 (0.76-1.22)	0.766	1.08 (0.92-1.27)	0.328	1.11 (0.94-1.31)	0.204
No regular exercise	0.84 (0.67-1.07)	0.161	0.85 (0.66-1.10)	0.221	0.98 (0.86-1.12)	0.804	0.99 (0.87-1.14)	0.949
Obesity	0.96 (0.75-1.22)	0.728	0.96 (0.73-1.25)	0.736	0.96 (0.83-1.11)	0.556	0.99 (0.85-1.16)	0.925
Abdominal obesity	0.90 (0.72-1.13)	0.369	0.97 (0.75-1.25)	0.810	0.93 (0.80-1.07)	0.297	0.93 (0.80-1.10)	0.405

FHCA, family history of cancer; aOR, adjusted OR. ^aReference was cancer survivors who did not have any FHCA. ^bLogistic regression analysis was adjusted for age, education, household income, employment condition, chronic disease, and self-rated health. In case of women, numbers of children and menopause were included.

the association with family history was estimated, there were no significant associations (data not shown).

DISCUSSION

The aim of this study was to compare health behaviors, including current smoking, current alcohol drinking, regular exercise, obesity, and abdominal obesity, among cancer survivors with or without FHCA to identify possible reasons of better survival in cancer patients. We identified that there were no significant differences in health behaviors according to FHCA in cancer survivors. Although there were no differences according to

family history, the prevalence of unhealthy behaviors in cancer survivors was high. More than 40% of male cancer survivors drank alcohol and had abdominal obesity. More than 30% of them did not exercise regularly and were obese, and 16% smoked. In female cancer survivors, 43% did not exercise regularly, and about 20% drank alcohol or were obese. Most especially, more than 70% of female survivors had abdominal obesity.

With respect to FHCA and health behaviors, most studies targeted the general population. An earlier study found that female relatives of patients with breast cancer were more likely to undergo breast cancer screening than those without breast cancer, and male relatives of patients with prostate cancer were

more likely to undergo prostate cancer screening than those without prostate cancer.^{24,25} Similarly, another study found that FHCA was related to higher probability of cancer screening. However, FHCA was not related to other lifestyle behaviors, such as smoking, physical activity, alcohol consumption, BMI, or eating habits. Even family history was negatively associated with these behaviors in some subgroups.²⁶ In addition, previous studies reported that there were no associations between lifestyle factors, including smoking, drinking, physical exercise, and dietary habits, and FHCA in first-degree relatives with gastric, breast, colorectal, and lung cancer.^{26,27} Studies conducted in Korea showed conflicting results. In a study that targeted Korean females, women with FHCA presented poorer health behaviors—more likely to smoke and have experience of passive smoking and less likely to exercise regularly—than women without FHCA.²⁸ However, another study reported that relatives of gastric cancer patients did not show significant differences in dietary habits and smoking compared with control groups, despite having significantly higher gastric cancer screening experience.²⁹

Based on previous results, it could be suggested that people with FHCA were more likely to receive cancer screening than people without FHCA; however, in the aspect of lifestyle behaviors, there was no association with FHCA. Our results were similar with previous studies in terms of lifestyle behaviors, adding evidence that FHCA was not associated with health behaviors. One major difference between previous studies and ours was that we recruited cancer survivors for our study population.

This study was based on the hypothesis that there is an association between health behaviors and FHCA in cancer survivors, which may explain better prognosis or survival in cancer patients with FHCA compared with those without FHCA.¹²⁻¹⁵ However, the non-differences between the two groups in our study did not support the association between FHCA and survival.¹⁶⁻¹⁸ Previous studies that compared health behaviors in cancer survivors with the general population showed more healthy behaviors, including less current drinking, smoking, and physical inactivity.³⁰ Thus, the diagnosis of cancer may have already changed the lifestyle behaviors of cancer survivors,³¹ and the effect of FHCA after the diagnosis of cancer would not be significant. In this study, because people without cancer were not included in the analysis, it was impossible to compare their health behaviors with those of cancer survivors directly, despite the prevalence of current smoking, drinking, and physical inactivity being much lower than previous studies conducted in the Korean population.³⁰ Thus, it could be suggested that the

impacts of cancer diagnosis were strong enough to change health behaviors and offset the impacts of FHCA.

To the best of our knowledge, this study was the first to examine the association between health behaviors and FHCA in cancer survivors. This means health providers would be more aware of preventive recommendation of cancer survivors regardless of FHCA, and more studies need to be performed to investigate the underlying effect of FHCA on cancer prognosis.

Although we have examined valuable information, several limitations were considered for the interpretation of the results. First, some questionnaires of the KoGES data had been changed during the 2004 to 2013 period. It may influence the accuracy of the information. Second, HEXA data were collected at several different centers and included individuals aged over 40 years, so the study populations might be heterogeneous according to recruitment center; however, we did not adjust for the center. In addition, the participants were health examinees visiting health examination centers located in metropolitan areas or major cities. Thus, they may have different social, economic, and health status compared with the general population, limiting generalization. In addition, we defined cancer survivors as those who responded yes to the question "Have you ever been diagnosed with cancer in the past?" Moreover, survival bias should also be considered because we did not include those who were admitted to the hospital or died. All of the information regarding both FHCA and lifestyle behaviors were from questionnaires and may not be valid due to recall bias or information bias. However, the potential bias related to survival, recall, or information bias was non-differential; thus, the effect on the results would be minimal. In addition, the number of cancer survivors included in the study was not enough to determine the association of FHCA according to cancer types and health behaviors. Due to the above limitation, we suggest that further research is necessary to examine the association between FHCA and health behaviors in cancer survivors, with more representative samples and larger sample size.

In conclusion, health behaviors of cancer survivors were not different according to FHCA. However, although health behaviors may be modifiable, the prevalence of unhealthy behaviors was still high. Thus, these kinds of health behaviors need to be assessed in cancer survivors irrespective of FHCA. In addition, more studies need to be conducted to identify the underlying mechanisms between FHCA and prognosis in cancer survivors.

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CONFLICTS OF INTEREST

No potential conflicts of interest were disclosed.

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