

# Health-Related Behaviours of Cancer Survivors: A Nationwide Korean Study

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## ABSTRACT

This cross-sectional study investigated health-related behaviours in Korean cancer survivors by time after cancer diagnosis. The data of 50,532 subjects (aged 40 to 79 years) who participated in the 2007–2019 Korean National Health and Nutrition Examination Surveys (KNHANES) were subjected to analysis. Health-related behaviours included obesity, current smoking, frequent drinking, influenza vaccination, health screening, and cancer screening. The odds for these behaviours were estimated by multivariate logistic regression models with adjustment for potential covariates. Approximately 5% of subjects were cancer survivors, and among these three-fifths were long-term ( $\geq 5$  years) survivors. Cancer survivors had healthier behaviours than non-survivors for almost all behaviours. However, these trends were attenuated in long-term survivors. In conclusion, healthy behaviour should be emphasised for long-term cancer survivors.

**Key Words:** Cancer survivors, Cross-sectional studies, Health-related behaviours.

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Cancer survivorship has become a major public issue due to rapidly increasing numbers. Given the higher incidences of various conditions (e.g., recurrence, second primary cancer, and chronic illnesses involving cardiovascular diseases), cancer survivors need comprehensive healthcare, and should adopt healthy behaviours throughout life.<sup>1</sup> A number of studies have reported better health-related behaviours among cancer survivors than non-survivors (those without a cancer history).<sup>2</sup> However, the information is lacking on adherence to these behaviours over time after cancer diagnosis, and the majority of studies have been conducted in Western countries and tended to investigate specific aspects of health-related behaviours. In addition, the influence of mental health conditions,<sup>3</sup> such as depression, has not been considered. Thus, in this study, health-related behaviours among cancer survivors and adherence to these behaviours after cancer diagnosis were examined using nationwide data obtained in one homogenous population.

Korean National Health and Nutritional Examination Survey (KNHANES) data collected in 2007–2019 were used. KNHANES has a multistage, stratified, complex design that ensures recruitment of a representative sample of the Korean population and is conducted annually by the Korean Centres for Disease Control and Prevention to assess the health and nutritional statuses of the Korean civilian non-institutionalised population.

Initially, 54,269 subjects aged 40 to 79 years were identified; for those aged  $\geq 80$  years, age at cancer diagnosis was not specified. The exclusion criteria were major cardiovascular diseases (i.e., myocardial infarction or stroke) or currently treated major depressive disorder by primary physicians or psychiatrists ( $n = 3,737$ ) that could critically influence the health-related habits or survey responses. Data of 50,532 subjects (47,998 non-cancer survivors, 1,018 short-term cancer survivors, and 1,516 long-term cancer survivors) were included in the final analysis. Time from cancer diagnosis was calculated by subtracting age at diagnosis from age at survey. Subjects were dichotomised for the analysis into short-term and long-term cancer survivors about 5 years after diagnosis.

The primary outcomes were health-related behaviours, that is, habits [obesity, current smoking, frequent drinking (over twice per week)] and health-promoting behaviours (influenza vaccination within the past year, and health screening and cancer screening within the last two years). Obesity was defined as the body mass index (BMI) of  $\geq 25$  Kg/m<sup>2</sup>, according to WHO recommendations for Asians. The following were collected as covariates: Demographics (age, gender, economic status, educational attainment, marital status, and current job status), comorbidities (hypertension and Type 2 diabetes as diagnosed by a physician), stress, and depressive mood.

Mean family size-adjusted monthly income was used as an indicator of economic status, and the median value in the current sample was a cut-off value for high-income or low-income. Educational level was categorised as middle school or lower and high school or beyond. Unmarried statuses were classified as single and divorced/separated/widowed.

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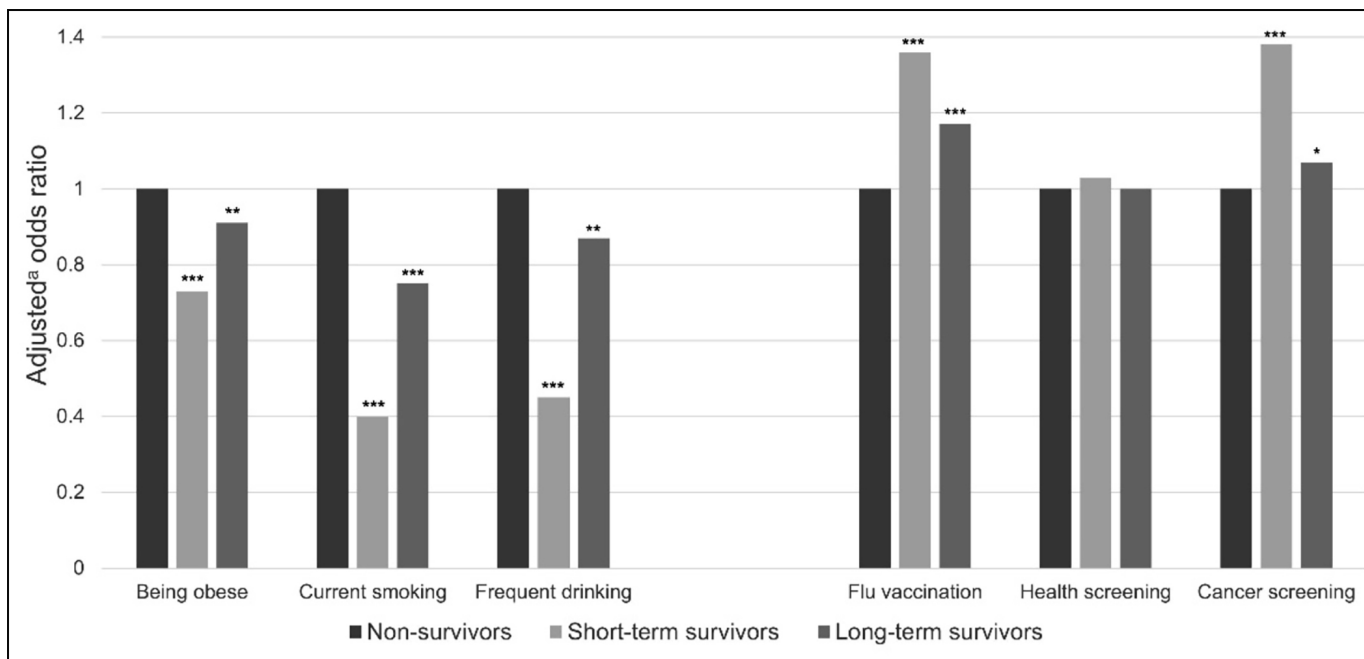
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**Table I: Subjects' characteristics by cancer history and duration.**

	Cancer diagnosis			p-value <sup>a</sup>
	Non-survivor (n = 47,998)	Within 5 years (n = 1,018)	Over 5 years (n = 1,516)	
<b>Covariates</b>				
Demographics				
Age, years	57.2 ± 11.0	60.5 ± 10.5	62.9 ± 9.9	<0.001
Female gender	26,657 (55.5)	593 (58.3)	1,003 (66.2)	<0.001
Low income	22,294 (47.1)	507 (50.4)	835 (55.7)	<0.001
Low education	19,437 (44.9)	507 (49.9)	798 (52.4)	<0.001
Unmarried	8,655 (18.1)	176 (17.3)	338 (22.3)	<0.001
No current job	16,226 (37.5)	600 (59.1)	842 (55.9)	<0.001
Co-morbidities				
Hypertension	12,568 (26.2)	353 (34.7)	500 (33.0)	<0.001
Type 2 diabetes	4,788 (10.0)	147 (14.4)	235 (15.5)	<0.001
Mental health				
Stressful	10,051 (22.7)	212 (21.0)	347 (23.0)	0.435
Depressed	5,837 (12.2)	186 (18.3)	243 (16.0)	<0.001
<b>Outcomes</b>				
Health-related habits				
Being obese	18,755 (39.1)	299 (29.4)	466 (30.7)	<0.001
Current smoking	8,160 (18.4)	76 (7.5)	123 (8.2)	<0.001
Frequent drinking	10,127 (27.0)	114 (13.7)	212 (18.0)	<0.001
Health promotion				
Influenza vaccination	17,652 (43.9)	551 (57.5)	884 (62.5)	<0.001
Health screening	30,715 (70.9)	725 (71.2)	1,060 (70.2)	0.806
Cancer screening	28,530 (65.9)	739 (72.6)	1,050 (69.4)	<0.001

<sup>a</sup> Determined by one-way ANOVA or the Chi-square test.



**Figure 1: Odds ratios of health-related behaviours among cancer survivors (reference group: non-cancer survivors). Two independent multivariate logistic models were used to evaluate each behaviour. <sup>a</sup>Adjusted for age, gender, economic status, attained education level, marital status, current occupational status, hypertension, Type 2 diabetes, stressful state, and depressed mood.**

\*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001.

Stress was defined based on the responses of ‘moderate’ or ‘severe’ to the question “How much stress do you have in your daily life?” Depressive mood, was assessed as a yes/no response to the questionnaire item: “Have you experienced sadness or despair continuously for more than two weeks during the past year?”

Means ± standard deviations or numbers (percentages) were used to describe the subject characteristics. The significances of intergroup differences were determined by one-

way ANOVA or the Chi-square test, as appropriate. Multivariate logistic regression models were used to estimate the odds ratios of each health-related behaviour with adjustment for potential covariates. The analysis was performed using STATA MP 17.0 (STATA Corp., College Station, TX), and p-values of <0.05 were considered statistically significant.

Subjects' characteristics are presented in Table I. The cancer survivors were more likely to be older, of female

gender, more depressed than non-survivors, have a poorer socioeconomic state, and have more comorbidities, and these differences tended to be greater for long-term survivors. U-shaped time-related patterns were observed for most health-related behaviours.

Figure 1 depicts the odds ratios of specific behaviours by cancer history and cancer duration. The cancer survivors had healthier behaviours than non-survivors for nearly all items, excluding health screening. However, these healthy behaviours attenuated over time.

The nationally representative data indicates that adherence to healthy behaviours diminishes with time after the diagnosis of cancer. This is consistent with the results of a recent meta-analysis, in which pooled analysis of cancer survivors' adherence to at least two lifestyle behaviours revealed that short-term survivors reported better adherence than long-term survivors (31% vs. 25%).<sup>2</sup> Cancer diagnosis *per se* probably motivates individuals to make behavioural changes during the acute treatment phase but these changes may not be long-lasting. A recent Australian longitudinal data supported this notion: Compliance with healthy behaviour was the highest in recent survivors ( $\leq 3$  years post-diagnosis) and it decreased over time.<sup>4</sup> Physicians should periodically remind patients of the risks associated with unhealthy lifestyles.

In this study, returned adherence after 5 years from diagnosis was the most remarkable in cancer screening. Previous Korean studies have investigated cancer screening rates among cancer survivors, with a focus on gender or trends rather than the duration since cancer diagnosis. As the risk of death from secondary cancer is far higher than that of primary cancer, screening for second primary cancers is critical. Overall, cancer survivors are more likely to undergo cancer screening than those without a cancer history,<sup>5</sup> but this should be sustained long-term. Since people experiencing cancer usually have high levels of trust in their physicians, physicians' advice is likely to impact cancer screening rates positively among cancer survivors.<sup>6</sup>

This study has several limitations. First, the cross-sectional nature of KNHANES precludes inferences regarding causal and temporal relationships, and thus, longitudinal studies are required to confirm or refute this study's findings. Second, a self-reported survey was used to assess most outcomes, which introduces the possibility of recall bias. Third, sampling may have been biased by the exclusion of institutionalised individuals. Fourth, the study population comprised Korean adults, which may limit the generalisability of this study's results. Despite these limitations, this is the first study to examine the health-related behavioural

patterns of Korean cancer survivors and shows that beneficial behavioural changes regress over time. Sustained efforts are required to support health-related behavioural changes among survivors across the cancer continuum.

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#### ETHICAL APPROVAL:

The Institutional Review Board (IRB) of Gachon University Gil Medical Centre (IRB no. GFIRB2021-481) approved the study protocol.

#### PATIENTS' CONSENT:

All participants provided written informed consent, and researchers followed the guidelines set forth in the Declaration of Helsinki.

#### COMPETING INTEREST:

The authors declared no conflict of interest.

#### AUTHORS' CONTRIBUTION:

ICH: Conceptualisation, methodology, manuscript preparation, review, and editing.

HYA: Formal analysis and interpretation.

Both authors approved the final version of the manuscript to be published.

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