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Original Article

Factors associated with health-related quality of life on mental and oral health in patients with cancer and cancer survivors using the Korea National Health and Nutrition Examination Survey (2005–2018)

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ABSTRACT

Objective: To investigate the association of mental and oral health with the health-related quality of life (HRQOL) in patients with cancer and cancer survivors.
Methods: This cross-sectional study involved 1643 patients with cancer and 1628 individuals who survived cancer (aged ≥ 19 years) using data from the 2005–2018 Korean National Health and Nutrition Examination Survey. The data were analyzed using SAS survey procedures (version 9.4), *t*-tests, χ^2 test, and multiple regression.
Results: Regarding differences in mental and oral health factors by group, the results revealed significant differences between depression, suicidal ideation, subjective oral health, chewing problems, and speaking problems due to oral issues. The HRQOL of patients with cancer was lower than that of cancer survivors. The factors influencing HRQOL in both patients with cancer and cancer survivors were education status, economic activity, subjective health, suicidal ideation, and speaking problems due to oral issues. HRQOL was also associated with depression in patients with cancer.
Conclusions: Patients with cancer had a lower HRQOL than cancer survivors. The two groups of patients showed significant differences in the factors associated with HRQOL. Therefore, customized health programs and policies should be developed and implemented for each group to improve their QOL.

Introduction

Advances in technology have led to an increase in human life expectancy; however, this has led to an increased prevalence of various chronic diseases, including cancer. Despite the high prevalence of cancer, the survival rate has increased because of early screening, development of diagnostic and therapeutic tools, and national-level cancer management strategies.[1] In a narrow sense, the term "cancer survivor" is used to describe a person who has lived for at least 6 months after the completion of cancer-related treatment, and the most common definition is a person who has been diagnosed with cancer and has completed treatment.[1] As the number of cancer survivors and survival period increases, new health problems arise; these include late complications, chronic diseases other than cancer, and the prevention of secondary cancers.[2]

Many patients with cancer are burdened with medical bills years after their diagnosis, which can limit their ability to work and contribute to relapse fears, exhaustion, and financial concerns.[2,3] During cancer treatment, some individuals may have daily or social activity restrictions, which may negatively affect their quality of life.[4] Indeed, individuals with cancer are more prone to depression and anxiety than the general population,[5] which varies depending on the type and stage of cancer and the gender and age of the patient. People with colorectal cancer experience depression, which makes it difficult for them to adapt to the physical and psychological changes that may occur after cancer diagnosis and treatment.[4] These problems pose a serious risk to life and have a significant impact on the quality of life of patients with cancer.

A previous study revealed that the prevalence of depressive and anxiety symptoms was higher in cancer survivors than in the general population, indicating a need for psychosocial support after acute treatment and in the longer term.[3,6] Cancer survivors have a high demand for health information because of examination and treatment, management of side effects, and interpersonal or emotional problems.[2] Additionally, depression and stress negatively affect lifestyle factors such as sleep and physical activity, which have a significant impact on quality of life.[7] It

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has been reported that 13%–25% of colorectal cancer survivors experience depression, making it difficult for them to adapt to physical and psychological changes after diagnosis and treatment.[3] Aging and comorbidities in cancer survivors can increase anxiety and depression, necessitating psychosocial support after acute treatment and in the long term.[5] The physical, psychosocial, and functional impairment experienced by cancer survivors affects their quality of life, which is lower than that of the general population even after the completion of cancer-related treatment.[8,9] Therefore, patients with cancer and cancer survivors require comprehensive physical and mental health care.

Oral health affects overall health and quality of life and must be considered in health promotion and systemic disease prevention plans.[10] The number of remaining teeth, dental caries, tooth pain, chewing discomfort, speech discomfort, and subjective oral health perception affect health-related quality of life (HRQOL)[11–14] and may reduce the quality of life because of oral pain, malnutrition, and depression.[13] Oral mucositis, a frequent oral complication associated with antineoplastic therapy, causes pain and oral function disorders, leading to a decrease in oral HRQOL.[15] The more discomfort a person experiences while chewing, the less able they are to perform daily living tasks, the lower their subjective quality of life and the more likely they are to experience depression.[13,16] Chronic oral diseases that persist in cancer survivors after tumor treatment reduce their quality of life.[11] Good oral health is important for maintaining quality of life and overall health; there is a need to confirm the impact of oral health on patients with cancer and survivors.

Previous studies have shown that HRQOL has several influencing factors, but in low socioeconomic vulnerable groups, HRQOL may be further lowered due to health inequality.[7,12] Factors influencing the quality of life of patients with cancer and survivors include age, education level, economic activity, income level, and subjective health status.[3,17,18] It is necessary to identify the actual quality of life through comparison between the two groups and find ways to improve it.

To provide foundational data on the relationship between the mental health and oral health and HRQOL of patients with cancer and cancer survivors, the specific objectives of the study were as follows: (1) assess the difference in mental health, oral health, and HRQOL and (2) assess the factors of mental and oral health that affect HRQOL among Korean patients with cancer and survivors. To accomplish this, we used raw data from the Korea National Health and Nutrition Examination Survey (KNHANES) 2005–2018, a reliable, large-scale survey that is representative of the general Korean population.

Methods

Study data and participants

The Korea Centers for Disease Control and Prevention Agency (KDCA) has conducted the KNHANES to identify the health and nutrition status of Koreans since 1998. The KNHANES evaluates the health status and health-related behaviors at the national level using multistage probability sampling methods to select a representative cohort of noninstitutionalized Korean civilians.[19] The KNHANES comprises health interviews, nutrition surveys, and physical examinations, with samples considered to represent Koreans extracted through stratified, multistaged, clustered, and probability design to increase representativeness and estimation accuracy.[19] In addition, the KNHANES VIII introduced the rolling survey sampling method so that each rotational sample for each survey year becomes a probability sample representing the entire country, and each rotational sample has independent and homogeneous characteristics.[19] The KNHANES involves a health survey, a nutrition survey, and an examination. The KNHANES is conducted via one-on-one interviews and self-reported methods. The medical examination survey was conducted by a specialized survey team at the KDCA.

This study examined the data of 131,427 adults aged $\geq$ 19 years in health interviews and oral health examination surveys among KNHANES 2005–2018 data. A total of 3271 people had a (responded "yes") cancer diagnosis (including gastric, liver, colorectal, breast, cervical, lung, and thyroid cancers). A total of 1643 patients with cancer and 1628 cancer survivors were included in this analysis (Fig. 1).

Measure

Patients with cancer and cancer survivors

Patients with cancer were defined as those who had been diagnosed with cancer by a physician and who answered "yes" to the questions related to current disease status. At the time of investigation, cancer survivors were described as individuals who had been diagnosed with cancer by a physician and who answered "no" to the same question.

Covariates

The demographic and health-related variables of interest included sex, age, educational level, economic status, living alone, economic activity, and private health insurance. The health-related variables included subjective health, smoking status, alcohol consumption, and physical activity. Educational level was categorized as lower than or equal to elementary school, middle school, high school, and $\geq$ college. We divided the participants into quartiles based on economic status, represented by an equivalent income (monthly household income/ $\sqrt{}$(family members)). We also determined whether the participants lived alone or with other individuals.

Participants answered questions related to current economic activity with either "yes" or "no". Private insurance was defined depending on whether the participants subscribed to private medical insurance that subsidized medical expenses, such as cancer insurance, cardiovascular disease insurance, or accident insurance. Subjective health was assessed using self-reports as a reliable indicator of an individual's overall health. Participants with responses of "very good," "good," and "average" to the question "How do you usually feel about your health?" were categorized as having a good subjective health status, whereas those with the answers "bad" or "very bad" were classified as having a bad subjective health status. We also determined the participants' current smoking status. Conversely, alcohol-consumption-related questions were answered as "yes" (consuming alcohol more than or equal to one time per month in the past year) or "no". Physical activity was classified as "yes" if the participant performed moderately intense physical activity for more than 2.5 h per week, highly intense physical activity for more than 1.25 h per week, or moderate and high-intensity physical activity; otherwise, physical activity was classified as "no".

Mental health

We assessed mental health using measures of stress, depression, and suicidal ideation. We categorized responses to the question "How much stress do you experience in regular day-to-day life?" by defining participants with the responses "I experience very high levels of stress" and "I experience high levels of stress" as "yes", and those with the responses "I tend to experience it a little bit" and "I barely experience it" as "no". We identified depression by a "yes" response to the question "Have you felt such sadness or despair during the previous year that your daily life has been disrupted for more than 2 weeks in a row?" We identified suicidal ideation by a "yes" response to the question "Did you ever think that you wanted to die during the past year?"

Oral health

The raw data were used to determine oral health variables, including decayed teeth, oral pain, chewing problems, masticatory function difficulties, speaking problems, and subjective oral health. We clarified subjective oral health by assessing the participants' responses to the question "How do you feel about your oral health in daily life, including your teeth and gums?" ("good" or "bad").

We classified decayed teeth on the basis of whether infantile caries (cavities) were prevalent. The existence of oral pain was based on the

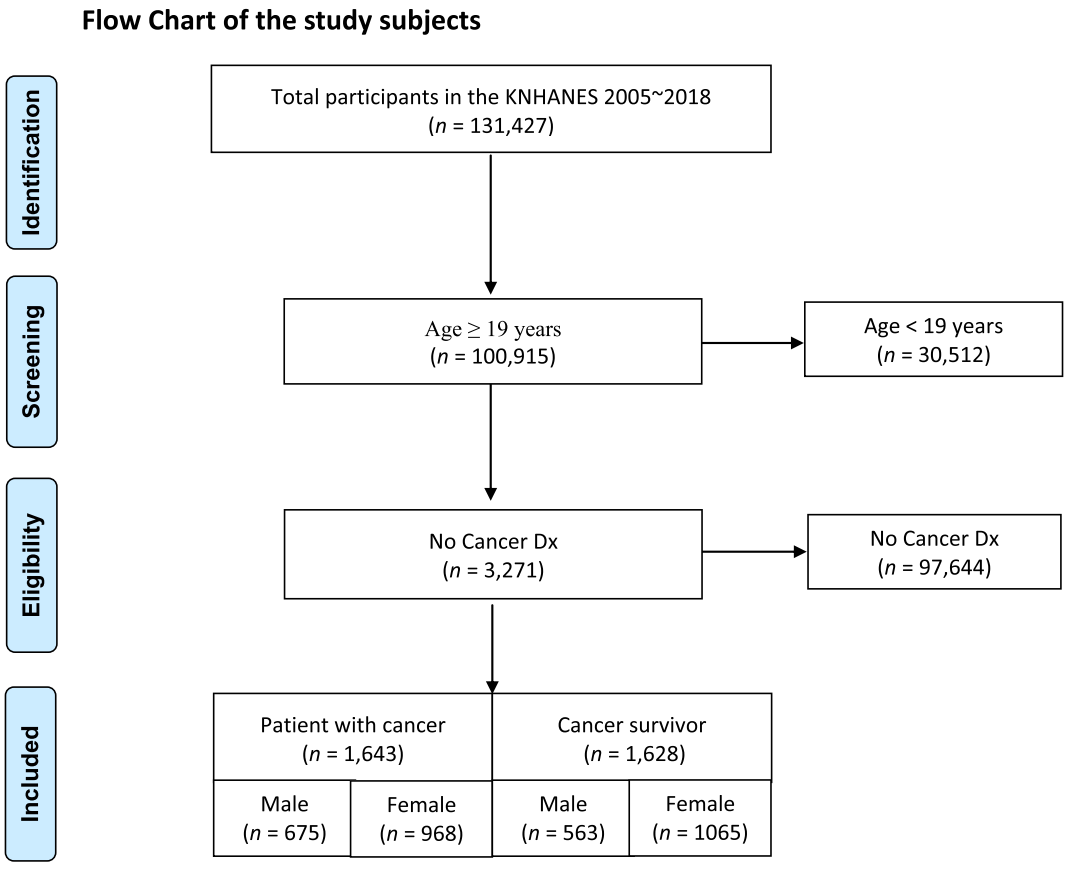

Fig. 1. Flow chart of the study participants.

answer to "Have you experienced toothache in the last year?" Chewing problems were based on the participants' answers to the question "Do you feel uncomfortable chewing food due to problems in your mouth, such as teeth, dentures, and gums?" The numerator was the number of people who responded "yes" and "no" and the denominator was a generative variable of the number of participants aged ≥ 19 years. Lastly, difficulty in pronouncing words due to mouth problems indicated speaking problems.[12]

Health-related quality of life

We used the EuroQol-5 Dimension (EQ-5D) and the EQ-5D index developed by the EuroQol Group to assess HRQOL.[20] The EQ-5D was developed to measure the overall health for clinical and economic evaluation. The measure assesses the following five HRQOL dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension can be classified as "no problems," "some problems," or "severe problems." In this study, "some problems" and "severe problems" were grouped as "yes". We calculated the EQ-5D index, the actual HRQOL score, by applying a weight to each of the five dimensions. The range of values was between 1 point, indicating a completely healthy condition, and −1 point, representing a more serious health condition.[21]

EQ-5D = 1 (0.05 + 0.096*M2 + 0.418*M3 + 0.046*SC2 + 0.136*SC3 + 0.051*UA2 + 0.208*UA3 + 0.037*PD2 + 0.151*PD3 + 0.043*AD2 + 0.158*AD3 + 0.05*N3).

Data analysis

All data are presented as the mean ± standard deviation for continuous variables or as *n* (%) for categorical variables. We used the SAS survey procedure (ver. 9.3; SAS Institute Inc., Cary NC, USA) to run a complex sample design based on survey data analysis. We determined statistical significance using a *P*-value < 0.05. We used the *t* test and χ^2 test to determine the differences in demographic data, health-related characteristics, and HRQOL between the two groups. For the socio-demographic and health-related characteristics, means and standard deviations or frequencies were calculated when analyzing the data, without using weights. Finally, we conducted regression analysis using mental and oral health factors as factors associated with HRQOL.

Results

Differences in demographic and health-related characteristics by group

This study included 1643 patients with cancer and 1658 cancer survivors. Table 1 presents the differences in demographic and health-related characteristics between the two groups. Female cancer survivors comprised the largest proportion of participants, and there were more adult patients with cancer than older adults ($P < 0.001$).

The proportion of cancer survivors living alone was higher than that of patients with cancer ($P < 0.001$), and a higher proportion of patients with cancer had private health insurance ($P < 0.001$). Cancer survivors most often recognized themselves as healthy ($P < 0.001$). The proportion of cancer survivors who currently smoked was low ($P < 0.001$); however, the current drinking rate was higher among cancer survivors than among those with cancer ($P < 0.001$). The physical activity rate was lower in cancer survivors ($P = 0.040$).

Differences in mental and oral health according to group

The results revealed that compared to cancer survivors, there were more patients with cancer who felt depressed and had suicidal ideation in the past year ($P < 0.001$). A higher percentage of cancer survivors

Table 1
Demographic and health-related characteristics by group.

Classification		Patients with cancer	Cancer survivors	t/χ^2	*P*-value
		n (%)			
Demographic and socioeconomic status					
Gender	Male	675 (41.1)	563 (34.6)	14.69	< 0.001
	Female	968 (58.9)	1065 (65.4)		
Age (years)	< 65	963 (58.6)	787 (48.3)	34.67	< 0.001
	≥ 65	680 (41.4)	841 (51.7)		
Education level	≤ Elementary school	608 (37.4)	668 (41.3)	5.78	0.123
	Middle school	261 (16.1)	228 (14.1)		
	High school	445 (27.4)	424 (26.2)		
	≥ College	310 (19.1)	298 (18.4)		
Economic status	Very low	486 (30.1)	519 (32.1)	1.96	0.581
	Low	427 (26.4)	403 (24.9)		
	High	352 (21.8)	354 (21.9)		
	Very high	351 (21.7)	340 (21.1)		
Living alone	Yes	160 (9.7)	228 (14.0)	14.24	< 0.001
	No	1483 (90.3)	1400 (86.0)		
Economic activity	Yes	439 (37.9)	671 (41.5)	3.50	0.061
	No	718 (62.1)	947 (59.5)		
Private health insurance	Yes	751 (59.5)	832 (51.5)	18.58	< 0.001
	No	511 (40.5)	785 (48.5)		
Health behavior status					
Subjective health	Good	878 (53.4)	1063 (65.3)	50.49	< 0.001
	Bad	765 (46.6)	564 (34.7)		
Currently smoking	Yes	507 (30.9)	225 (13.8)	136.65	< 0.001
	No	1136 (69.1)	1403 (86.2)		
Currently consumes alcohol	Yes	620 (37.7)	957 (58.8)	145.09	< 0.001
	No	1023 (62.3)	671 (41.2)		
Engages in physical activity	Yes	252 (42.9)	310 (37.4)	4.22	0.040
	No	336 (57.1)	518 (62.6)		

considered that their subjective oral health was poor and that they had chewing problems ($P < 0.001$). A higher percentage of patients with cancer indicated that they had speaking problems ($P < 0.001$). Further details are presented in Table 2.

Differences in HRQOL according to group

Table 3 presents the differences in HRQOL according to the age group. The participants with cancer had higher rates of self-care problems ($t = 4.49$, $P = 0.034$), difficulties with usual activities ($t = 22.32$, $P < 0.001$), pain/discomfort ($t = 26.68$, $P < 0.001$), and anxiety/depression ($t = 46.77$, $P < 0.001$). Patients with cancer had a difference in the EQ-5D index of 0.88 ± 0.17, whereas cancer survivors had a difference of 0.90 ± 0.15 ($t = -3.82$, $P < 0.001$).

Factors associated with HRQOL

We performed multiple regression analysis to confirm the factors affecting HRQOL in patients with cancer and in cancer survivors. We analyzed economic status, education level, living arrangements, economic activity, and subjective health as variables meaningful to HRQOL. We used mental-health-related and oral-health-related variables that showed significant differences in a simple difference test as independent variables. We also adjusted for gender, age, physical activity, smoking status, alcohol consumption, and decayed teeth and performed regression analysis.

The regression model for factors affecting HRQOL in patients with cancer was statistically significant ($F = 13.46$, $P < 0.001$) and had an explanatory power (adjusted R^2) of 30.9%. The results revealed that

Table 2
Differences in mental health and oral health factors by group.

Classification			Patients with cancer	Cancer survivors	t/χ^2	*P*-value
			n (%)			
Mental health	Stress	Yes	284 (24.7)	383 (23.7)	0.33	0.567
		No	867 (75.3)	1231 (76.3)		
	Depression	Yes	209 (25.1)	203 (17.7)	16.24	< 0.001
		No	624 (74.9)	947 (82.3)		
	Suicidal ideation	Yes	181 (21.6)	174 (15.1)	13.82	< 0.001
		No	657 (78.4)	976 (84.9)		
Oral health	Subjective oral health	Good	1232 (75.0)	1108 (68.1)	19.26	< 0.001
		Bad	411 (25.0)	520 (31.9)		
	Decayed teeth	Yes	201 (26.8)	262 (25.1)	0.71	0.399
		No	548 (73.2)	783 (74.9)		
	Oral pain	Yes	211 (37.7)	250 (33.7)	2.24	0.550
		No	348 (62.3)	491 (66.3)		
	Chewing problems	Yes	916 (55.7)	601 (36.9)	116.65	< 0.001
		No	727 (44.3)	1027 (63.1)		
	Masticatory function difficulties	Yes	322 (33.7)	421 (32.5)	0.36	0.550
		No	634 (66.3)	875 (67.5)		
	Speaking problems	Yes	666 (40.5)	255 (15.7)	250.07	< 0.001
		No	977 (59.5)	1373 (84.3)		

Table 3
Difference in HRQOL by group.

Classification	Patients with cancer	Cancer survivors	t/χ^2	*P*-value
	n (%) or Mean ± SD			
Mobility problems	448 (27.3)	435 (26.7)	0.12	0.724
Self-care problems	156 (9.5)	121 (7.4)	4.49	0.034
Difficulty with usual activities	390 (23.7)	278 (17.1)	22.32	< 0.001
Pain/discomfort	676 (41.1)	528 (32.4)	26.68	< 0.001
Anxiety/depression	410 (25.0)	250 (15.4)	46.77	< 0.001
EQ-5D index	0.88 ± 0.17	0.90 ± 0.15	−3.82	< 0.001

EQ-5D, Euro Quality-of-Life-5 Dimension; HRQOL, health-related quality of life; SD, standard deviation.

education level (β = 0.036), economic activity (β = −0.032), subjective health (β = −0.072), depression (β = −0.040), suicidal ideation (β = −0.052), and speaking problems (β = −0.038) were significantly associated with the HRQOL of patients with cancer.

The regression model of factors influencing the HRQOL of cancer survivors was statistically significant ($F = 17.23$, $P < 0.001$), with an explanatory power (adjusted R^2) of 30.0%. Economic status (β = 0.044), education level (β = 0.051), economic activity (β = −0.029), subjective health status (β = −0.065), suicidal ideation (β = −0.065), and speaking problems (β = −0.056) were significantly associated with the HRQOL of cancer survivors. See Table 4.

Discussion

Discussion of this study

This study used data from the KNHANES to identify the characteristics of patients with cancer and cancer survivors and the factors influencing the HRQOL of both groups. We aimed to identify the HRQOL for patients with cancer and cancer survivors to support the development of intervention strategies to improve HRQOL.

Our results revealed significant differences between patients with cancer and cancer survivors regarding gender, age, living arrangements, private health insurance, subjective health, smoking status, alcohol consumption, and physical activity levels. Previous studies[17,18] have reported sex differences in social and physical factors, emotional functioning, symptoms, financial difficulties, and quality of life in cancer survivors and people with cancer. In the KNHANES data, the cancer survivor group contained more women, more adults aged > 65 years, and more people who lived alone, as well as fewer people with private health insurance. Although the cancer survival period after cancer treatment is unknown, cancer survivors were older than cancer patients. Medical organizations and governments must pay careful attention to patients with cancer and survivors and establish vocational rehabilitation programs and policies to improve economic standards. It is also necessary to develop and apply long-term programs, including multidimensional approaches and improvement of quality of life, early screening of cancer and cancer prevention education, management of depression symptoms, and social support.

Alcohol consumption and smoking status are related to oral health and are known risk factors for secondary cancers or cancer recurrence.[22,23] The smoking rate of patients with cancer was higher than that of cancer survivors, and 58.8% of cancer survivors reported having recently consumed alcohol. However, until recently, alcohol consumption was more common among cancer survivors than among patients with cancer, possibly because many cancer survivors abstain from consuming alcohol during active treatment and then begin to drink again afterward. Long-term cancer survivors need continuous alcohol abstinence education. Because smoking cigarettes and consuming alcohol are modifiable risk factors for oral health and cancer, cancer survivors must be educated regarding the health risks of these behaviors and the benefits of healthy lifestyle choices. Follow-up of patients with cancer must include a lifestyle evaluation with an assessment of an education regarding drinking alcohol and smoking cigarettes.

In this study, patients with cancer had a higher rate of physical activity than cancer survivors. Cancer survivors may experience side effects after cancer treatment, such as cancer-related fatigue and pain, loss of muscle strength, and physical function limitations due to lymphedema or

Table 4
Factors associated with HRQOL.

Variables	Patients with cancer				Cancer survivors			
	β	SE	*t*	*P*-value	*β*	SE	*t*	*P*-value
Constant	1.004	0.046	21.77	< 0.001	0.916	0.046	19.90	< 0.001
Economic status (high level) (reference very low level)	0.023	0.017	1.35	0.177	0.049	0.016	3.04	0.003
Education status (high school) (reference elementary school)	0.036	0.014	2.51	0.012	0.051	0.014	3.76	< 0.001
Living alone	−0.002	0.022	−0.10	0.924	−0.001	0.015	−0.09	0.930
Economic activity (reference yes)	−0.032	0.012	−2.74	0.006	−0.029	0.011	−2.71	0.007
Subjective health status (reference good)	−0.072	0.012	−5.97	< 0.001	−0.065	0.012	−5.44	< 0.001
Stress (reference no)	−0.025	0.013	−1.88	0.060	0.001	0.013	0.04	0.971
Depression (reference no)	−0.040	0.016	−2.48	0.013	−0.001	0.015	0.07	0.888
Suicidal ideation (reference no)	−0.052	0.018	−2.88	0.004	−0.065	0.017	−3.87	< 0.001
Subjective oral health (reference good)	−0.021	0.012	−1.77	0.078	−0.012	0.011	−1.02	0.306
Chewing problem (reference no)	−0.017	0.013	−1.25	0.212	−0.021	0.013	−1.60	0.111
Oral pain (reference no)	−0.004	0.011	−0.43	0.669	−0.013	0.011	−1.19	0.236
Speaking problem (reference no)	−0.038	0.018	−2.11	0.036	−0.056	0.017	−3.23	0.001
R^2	0.334				0.319			
Adjusted R^2	0.309				0.300			
F	13.46				17.23			
P-value	< 0.0001				< 0.0001			

SE, Standard error; HRQOL, health-related quality of life.
*Adjusted for gender, age, physical activity, smoking status, and alcohol consumption, decayed teeth.

surgery, which decrease their physical activity levels.[24] Cancer-related daily-activity problems or activity limitations due to the condition can negatively affect a person's quality of life.[25] For cancer survivors, moderate or higher levels of physical activity and a lifestyle tailored to prevent secondary cancers and chronic diseases will serve to reduce cancer recurrence and pain or complications associated with cancer treatment.[24,26] In this study, patients with cancer were found to engage in more physical activity than cancer survivors by actively participating in their recovery despite experiencing pain or difficulties that interfered with their daily lives. Long-term strategies are needed to continue maintaining lifestyle habits to improve quality of life even after cancer treatment.

Subjective health is a major predictor of survival rate and HRQOL in patients with cancer and survivors.[17,26] We found that a higher percentage of cancer survivors considered their subjective health to be good. Individually perceived health status or subjectively perceived physical well-being were significant factors influencing the quality of life of cancer survivors.[25,27] Subjective health is a major predictor of quality of life and must be considered in the management of cancer survivors. Therefore, the subjective health status of patients with cancer and survivors needs attention and proper enhancement strategies.

A high percentage of patients with cancer perceived their subjective oral health as being good, but a higher percentage experienced chewing discomfort and speaking problems. People with cancer may develop mucositis, salivary gland dysfunction, taste disorders, dental caries, periodontal disease, dysphagia, and jawbone disease during treatment.[28] Oral health complications associated with cancer or cancer treatment can affect oral HRQOL.[14] The oral cavity undergoes significant changes due to the patient's oral condition before cancer treatment, specific cancer type, location, and application of radiation treatment and chemotherapy.[8] Older age is also associated with chronic diseases and dry mouth due to medication use, which may contribute to poor perception of subjective oral health.[12,29] Management of oral disease may be neglected because it typically does not constitute a health emergency. Oral health care is essential to manage oral health factors caused during the treatment of patients with cancer.

In this study, the average EQ-5D index for patients with cancer was lower than that of cancer survivors, which is consistent with the results of previous studies.[17,30,31] In previous studies, the EQ-5D index of people who have experienced cancer was lower than that of the general population. Discomfort persists after treatment and may be accompanied by various health problems that impact daily activities and reduce the quality of life of cancer survivors.[8,9,26] Patients with cancer had a lower HRQOL than cancer survivors, and also struggled with self-care, engaging in usual activities, pain/discomfort, and anxiety/depression. Patients with cancer and cancer survivors with lower income and education levels had a lower quality of life. The lower socioeconomic group demonstrated differences in physical activity, self-management, daily activities, and pain/discomfort.[25] Cancer survivors may feel a lot of pain/discomfort because of treatment side-effects and chronic diseases post treatment. Future studies should investigate the quality-of-life recovery process in patients with cancer and explore intervention programs covering cancer diagnosis, treatment, recovery, and social return.

The factors affecting HRQOL in both patients with cancer and cancer survivors were educational status, economic activity, subjective health status, suicidal ideation, speaking problems due to oral problems, and depression. Moreover, subjective health was a strong HRQOL-influencing factor for patients with cancer and cancer survivors. Indeed, previous studies have consistently found that subjective health is a major predictor of quality of life.[12,17] A positive perception of health is important for patients with cancer and cancer survivors, and a systematic healthcare program that supports this is necessary for this population.[17] Therefore, the medical staff must develop multifaceted and effective interventions covering associated disease control, side-effect adjustment, increases in physical activity, and so forth, with the aim to improve their subjective health status, which can lead to an elevated HRQOL.

In this study, patients with cancer had a high rate of depression and suicidal ideation. Psychological symptoms experienced by patients with cancer include fear of recurrence, stress, anxiety, and depression. Anxiety and depression greatly affect the quality of life of patients with cancer, as they worry about their prognosis and possible recurrence.[26,31] Cancer survivors showed lower rates of depression and suicidal ideation than patients with cancer; however, previous studies have reported that cancer survivors experience depression and anxiety, making it difficult for them to adapt to the physical and psychological changes that occur after cancer diagnosis and treatment.[4,5] Some breast cancer survivors experience depression as they undergo a long recovery process, with a low overall quality of life and a vulnerable psychological state.[3,18] Negative emotions, such as anxiety and depression, worsen adaptation to cancer and treatment and require psychosocial interventions that control negative emotions.[32] In this study, patients with cancer struggled with oral health problems and low HRQOL, consistent with previous studies demonstrating an association between oral health problems and depression.[13,22,29] The rates of suicidal ideation and suicide attempts were high in patients with cancer and were related to gender, cancer stage, depression and anxiety, and social support.[33] The psychological HRQOL for those with cancer was significantly lower than that for the noncancer group because the rates of depression and suicidal ideation were higher.[25,26] Mental health problems must be systematically managed through counseling and emotional support after cancer treatment. Depressive symptoms can be reduced by managing complications and active treatments, such as taking medications. Continuous mental health management is necessary even after the cancer treatment has ended. Therefore, intervention methods must establish a psychological health support system for cancer survivors regarding depression and stress.

In this study, only speaking problems due to oral problems were found to affect HRQOL of patients with cancer and survivors. Pain and depression are highly correlated, and mouth pain has been shown to have a substantial harmful impact on daily life activities, psychological distress level, and quality of life in seniors.[29] Considering the complications of patients with cancer, such as oral mucositis, dry mouth, and dental caries, more careful management is required than for the general population, and education on oral care for patients with cancer is necessary. Poor oral health can cause language and pronunciation disorders, and loss of teeth can affect pronunciation, which can hinder relationships and communication with others.[12,29] The importance of oral health care for patients with cancer is emphasized because complications of oral problems cause tooth loss, oral tissue damage, and ultimately impede oral functions such as chewing and speaking.

Implications for nursing practice and research

Patients experiencing chewing problems were significantly correlated with those experiencing speaking problems. Regular education is needed to help patients recognize the need for active treatment to improve and prevent chewing and pronunciation discomfort in oral patients with cancer. Further research is required to confirm the relationship between oral health problems and HRQOL in patients with cancer and survivors.

Quality of life is an index of cancer survivability and a predictor of prognosis.[31,34] Multilateral interventions must be prepared to help patients with cancer and survivors overcome their psychosocial problems and improve their quality of life. Studies must identify differences in the characteristics and quality-of-life factors of patients with cancer and cancer survivors.

Limitations

In this study, we did not consider variables such as cancer stage, chemotherapy, or cancer treatment progress. This study may have low accuracy because the patients' answers to the questionnaire depended on recall. Additionally, the data up to 2018 did not include the most recent

data, so they did not reflect the latest information. Moreover, the results of this cross-sectional study cannot explain a causal relationship, suggesting the need for future longitudinal studies, and the results are limited in terms of generalizability because the results pertained to the patients who participated in the survey.

Despite these limitations, this study has high reliability because it uses a large dataset that represents the entire country. Our results provide basic data for intervention strategies by identifying multilateral influencing factors, including mental and oral health, for patients with cancer and cancer survivors.

Conclusions

Patients with cancer and survivors require mental and oral health management to improve their quality of life. Multilateral interventions must consider various factors that affect the quality of life of these individuals.

Ethics statement

The KNHANES was conducted with approval from the Institutional Review Board of the KDCA.

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CRediT authorship contribution statement

Lee MY: Conceptualization, Methodology, Formal analysis, Writing – Original draft preparation. **Kwak YH**: Methodology, Formal analysis, Writing – Revised draft preparation. **Jang IS**: Writing – Revised draft preparation. All authors had full access to all the data in the study, and the corresponding author had final responsibility for the decision to submit for publication. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Declaration of competing interest

The authors declare no conflict of interest.

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Data availability statement

This study used primary data from KNHANES 2005 to 2018 (Available online: https://www.knhanes.kdca.go.kr/knhanes/sub03/sub03_02_05.do).

Declaration of Generative AI and AI-assisted technologies in the writing process

No AI tools/services were used during the preparation of this work.

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