

Sex-Specific Factors Associated with Suicidal Ideation among Patients with Cancer in Korea: A Population-Based Study

Sun-Young Park*

Abstract

Objective: Given the higher rate of suicide among patients with cancer, which exhibits different patterns and rates according to sex, this study aimed to examine the prevalence of suicidal ideation in Korean patients with cancer and to explore sex-specific factors with suicidal ideation. **Methods:** This cross-sectional study analyzed a nationally representative sample derived from the 2020 Korea Health Panel Survey, which encompassed 14,741 participants surveyed in 2019 and 2020. A weighted sample of cancer patients who reported on their suicidal ideation was analyzed (N = 511). Multinomial logistic regression analysis was employed to assess the relationships between sex-specific factors and suicidal ideation. **Results:** Among cancer patients, 8.6% had suicidal ideation, which was slightly higher in females (8.7%) than males (8.5%) ($p < 0.001$). Cancer patients' suicidal ideation factors varied by sex: males' suicidal ideation was associated with older age, lower education, unemployment, being unmarried, bed-ridden, underweight, comorbidities, and better self-rated health; females' suicidal ideation was associated with younger age, being married, employed, higher body mass index, and worse self-rated health (all p -values < 0.001). Pain/discomfort and depression were more strongly associated with male cancer patients, while anxiety was more strongly related to female cancer patients; however, all these factors were linked to increased suicidal ideation in both groups. **Conclusion:** Suicidal ideation among male cancer patients increased with low financial status, whereas suicidal ideation among female cancer patients was influenced by poor health status and social burden. Given that the factors associated with suicidal ideation differ by sex, healthcare providers need to consider sex-specific differences when assessing suicide risk among patients with cancer, particularly those experiencing pain, depression, or anxiety. Further research is needed to better understand these sex-based differences and their implications for cancer care.

Keywords: Cancer- suicidal ideation- risk factors- sex difference- second data analysis

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Introduction

Suicide is a crucial public health issue, with approximately 703,000 people worldwide dying by suicide in 2019 [1]. Among these individuals, patients with cancer face a particularly elevated risk, experiencing a 1.3-2.0 fold increase in suicidal ideation [2,3] and a 1.5-fold higher rate of suicide than the general population [4]. Approximately 0.15 - 2.28% of patients with cancer have died by suicide [4,5]. The highest rate of suicide attempts is observed within the first year following a cancer diagnosis [6].

The increased risk of suicide among patients with cancer is associated with the challenges of dealing with cancer, including compromised physical abilities and interruptions in daily life, changes in social interactions, financial security, and family dynamics, which collectively contribute to psychological distress among patients with cancer [3, 6]. Therefore, regardless of the type of cancer, patients often experience anxiety, depression, and distress

[7]. This heightened emotional turmoil increases the vulnerability of patients with cancer to suicide compared with the general population [7].

Various factors contribute to suicide risk among cancer patients, including socio-demographic, clinical, and psychological factors [2, 5, 8, 9]. In particular, individuals who are over the age of 65, unemployed, unmarried, white, and males are at a higher risk of suicide [2, 8, 9]. Additionally, among various cancer type, gynecological cancers and central nervous system cancer further elevate suicide risk [5]. Psychological distress is another major influent of suicide risk, and patients with depression, anxiety, or sense of hopelessness elevate the risk of suicide [8]. The identification of these factors is important for identifying vulnerable cancer patients at risk of suicide and providing them with appropriate targeted interventions [9].

Suicide is a continuous process involving suicidal ideation, suicide attempts, and completed suicide [10]. Suicidal ideation is defined as general thoughts about wanting to be dead or ending one's life [11]. While not

all individuals who experience suicidal ideation will attempt suicide, such ideation is an important indicator of potential suicide attempts [12]. In fact, approximately 30% of individuals with suicidal ideation make actual suicide attempts [12]. As a result, suicidal ideation is a significant predictor of suicide and, as an indirect measure of mental health, it serves as a crucial guide for policy interventions aimed at preventing suicide [11].

Patterns of suicide vary by sex [8, 13-15]. Specifically, females have a two-fold higher occurrence of suicidal ideation and suicide attempts than males, whereas the actual death rate by suicide among males is 2.2 times higher than that among females [13]. In other words, females are vulnerable to suicidal ideation, whereas males tend to choose riskier and more extreme methods of suicide [16]. These differences can also be influenced by societal gender-roles and cultural expectations, which dictate proper behavior and attitudes based on sex in dealing with cancer-related experiences [17]. This can cause a burden for both males and females, impacting suicide rates, reasons for suicide, and suicide methods [17, 18].

Previous studies have investigated suicide factors among patients with cancer [2, 5, 8]. However, there is still a lack of understanding of sex-specific risk factors associated with suicide, with remaining inconclusive results [7]. For example, while sex is a known suicide risk factor, sex-related differences in suicidal ideation and their underlying reasons are understudied [7]. In addition, contrary to the commonly known trend, in China, the suicide rate among females is higher than that among males [13]. Thus, further research is needed to identify the unique sex-based attributes of suicidal ideation for targeted interventions among vulnerable patients with cancer. Accordingly, the purposes of the present study were as follows: (1) to examine the prevalence of suicidal ideation and (2) to explore and compare the factors associated with suicidal ideation among Korean patients with cancer based on the sex.

Materials and Methods

Study design

This study employed a cross-sectional observational design based on secondary data from the Korea Health Panel Survey (KHPS).

Data source: 2020 Korea Health Panel Survey

The KHPS is a longitudinal survey conducted nationally by the Korea Institute for Health and Social Affairs (KIHASA) and the National Health Insurance Service (NHIS) Consortium [19]. Since 2008, surveys have been conducted annually to assess healthcare use, healthcare expenditure, perceived health status, health behaviors, and chronic disease status among Korean civilians [19]. The KHPS was established in two distinct panels: the first panel was surveyed between 2008 and 2019, and the second panel's survey began in 2019 and is still ongoing [19]. This study analyzed data from the second panel that was surveyed in 2019 and 2020, which was the first-year survey for the second panel (hereafter,

2020 KHPS).

The 2020 KHPS employed the 2016 Korea Population Census as the sampling framework for selecting households and their family members by trained interviewers [19]. This selection was performed using a probability proportional stratified methodology [19]. The samples were stratified based on the various stratification variables, including the characteristics of the survey area, number of household members, and number of elderly people in the household [19]. Subsequently, the actual sampling was derived by considering the number of households in the survey area [19].

The 2020 KHPS obtained the data through a self-reported questionnaire and computer-assisted personal interviewing (CAPI) method [19]. The 2020 KHPS consisted of 14,741 participants from 6,689 households [19]. Among these participants, this study analyzed patients who had been diagnosed with gastric, lung, colon, breast, cervical, thyroid, or other types of cancer. Of the 14,741 participants, 540 had been diagnosed with cancer and 29 had missing data for suicidal ideation because another family member answered instead of the patients. In total, 511 participants were included in the study (Figure 1). The KHPS provides detailed information on its official website (<https://www.khp.re.kr/>, accessed on 15th August 2024).

Secondary analysis of observational data does not require the calculation of the sample size; however, this study attempted to ensure that the sample size was sufficient to answer present study's research questions. According to Harrell, [20], the number of independent variables for multinomial logistic regression is 10–20 events per independent variable. Using Harrell's guide, 19 independent variables were recommended for this study, which exceeded the 12 independent variables used. Consequently, the number of independent variables was appropriate for conducting a multinomial logistic regression analysis.

Measurements and variables

In this study, variables were selected based on prior studies that identified factors influencing suicidal ideation in patients with cancer [2, 8, 21]. Figure 2 illustrates the conceptual framework of this study.

Dependent variable

Suicidal Ideation

Suicidal ideation was assessed using the following question: "Have you ever considered the possibility of dying within the past year?" Respondents who answered "Yes" to this question were classified as individuals with suicidal ideation.

Independent variables

The independent variables were socio-demographic factors, physical health status, and psychological distress. These variables were selected based on prior research that has identified them as influences on suicide risk [2, 5, 8].

Socio-demographic factors

Age was categorized into two groups: 65 years

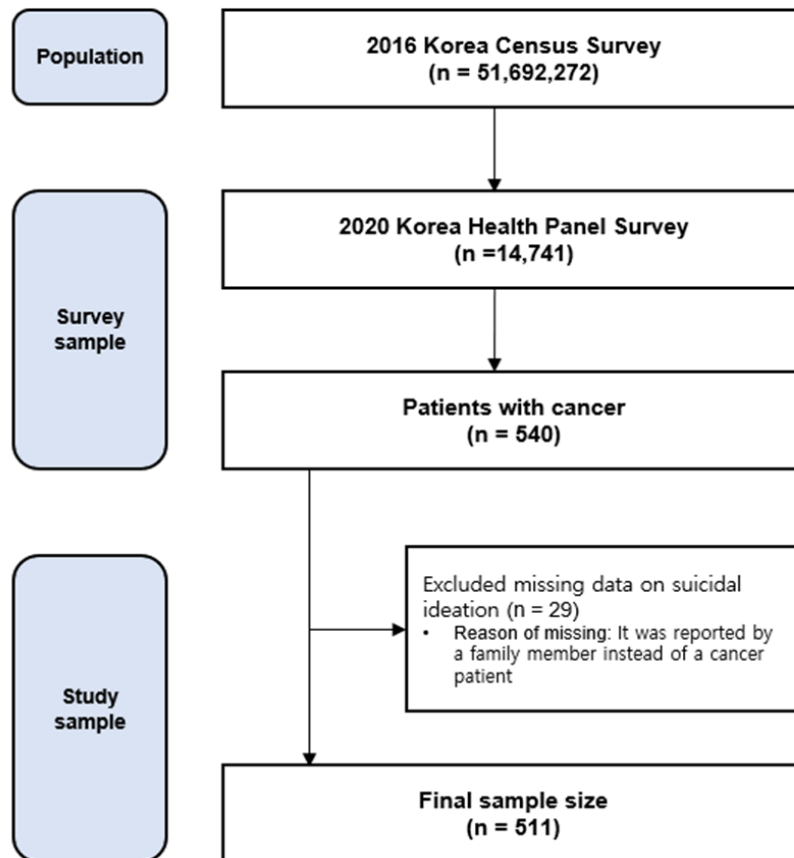


Figure 1. Flowchart of Study Samples

and older and under 65 years. Educational level was classified into two categories: elementary school or lower and middle school or higher. Marital status was grouped into two categories: married and living with a spouse and unmarried, which included individuals who were widowed, divorced, separated, or never married. The employment status of the participants was classified into two categories: employed and unemployed, which included those who did not work or were engaged in household duties. Monthly household income was divided into low and high categories separated by USD 1,500, which represents 40% of the mean household income in Korea.

Physical health status

The variables included in the dimension of physical health status were as follows: bed-ridden status (yes or no), body-mass index (BMI) (categorized into two groups based on weight in kilograms divided by the square of height in meters: less than 18.5 indicates underweight, while greater than 18.5 indicates normal to obese as defined by the World Health Organization [22]). Additionally, variables included the presence of pain or discomfort (yes or no), presence of comorbidities (having more than one comorbidity and not having one), self-rated health status (good, which includes excellent, good, or fair, and bad, which includes poor or bad), and the type

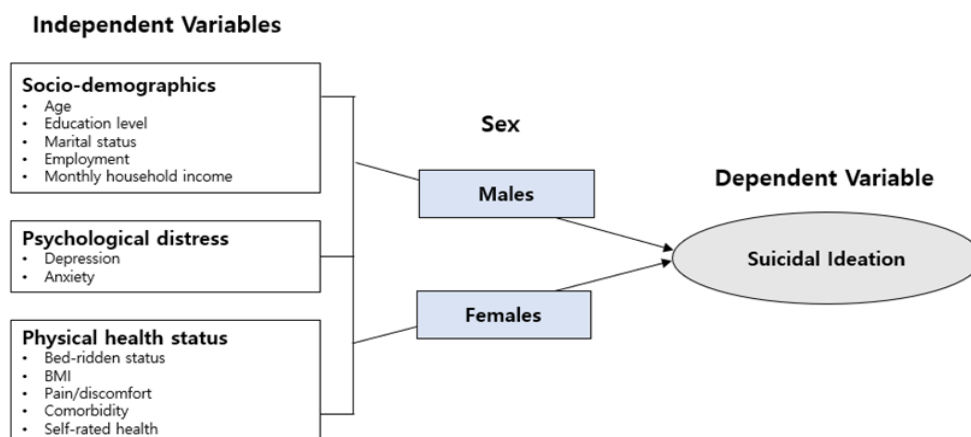


Figure 2. Conceptual Framework of This Study

of diagnosed cancer (gastric, colon, lung, breast, cervical, thyroid, and other cancers).

Psychological distress

The assessment of depression and anxiety involved two specific questions: “Have you ever felt so sad or unhappy during the past year that it interfered with your daily activities for more than two consecutive weeks?” and “Have you ever experienced excessive anxiety or worry that interfered with your daily life for more than six months during the past year?” Individuals who answered “yes” to these questions were categorized as having depression and anxiety, respectively.

Ethical considerations

The KHPS has been approved by the Institutional Review Board (IRB) of the KIHASA since 2008 [19]. The author’s affiliated university’s IRB approved the study as exempt from obtaining participant consent and other ethical requirements (Exemption No. CUIRB-2023-E012) because this study used de-identified secondary data. This study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement to ensure rigor [23].

Statistical analysis

Based on the guidelines for KHPS data analysis [19] and recommendations by Si et al. [24], the data were analyzed using sampling weights to adjust for selection probabilities and to better reflect the characteristics of the entire target population (in this study, cancer patients in South Korea). The KHPS provides weighted values for each participant that were calculated based on sampling errors due to differences between the sampling design and actual survey, unequal selection probabilities, non-response patterns of non-participants, and characteristics of survey participants including survey area, sex, and age [19]. In this study, these weights were applied in the statistical analysis to improve the representativeness of the estimates for the target population of Korean cancer patients.

All data were analyzed using IBM SPSS version 25.0 (SPSS Corp., College Station, TX). The significance threshold was two-tailed alpha set at 0.05. Descriptive statistics were used to analyze the characteristics of the patients with cancer based on unweighted counts and weighted percentages for categorical variables. For continuous variables, weighted mean, standard deviation, and ranges were reported. Differences of prevalence suicidal ideation by sex were analyzed through χ^2 testing using weighted sample. To investigate the factors associated with suicidal ideation, we conducted multinomial logistic regression analyses, as the dependent variable is binomial. The significant variables ($p < 0.05$) in the χ^2 tests were included in the multinomial logistic regression analyses with weighted samples to identify the associations between suicidal ideation and the independent variables described above. Odds ratios (ORs), p -values, and 95% confidence intervals (CIs) were used to present the results.

Results

Characteristics of participant

Table 1 presents the participants’ characteristics. Of the 511 participants who were diagnosed with cancer, 38.3% were males and 61.7% were females. In this study, 54.9% of the patients with cancer were older than 65 years, with a mean age of 62.1 years (SD=12.9, range: 23–97 years). Most had attained a higher level of education (\geq middle school) (74.5%), were married and living with a spouse (80%), and over half were employed (54.2%). The mean household income was 2,466 USD (SD=2,159, range: 0–13,958 USD). Approximately 41.9% had a lower income ($<$ 1,500 USD per month for household), while 58.1% had higher incomes (\geq 1,500 USD per month). Around one-quarter (25.2%) of the patients were bed-ridden. Most patients with cancer reported experiencing pain/discomfort (58.3%), having comorbidities (61.1%), and having a better self-rated health status (66.1%). Most patients’ BMI were greater than 18.5 (96.4%) with mean of 23.4 (SD=3.4, range 15.1–37.9). Regarding the type of cancer, thyroid cancer was the most prevalent (22.5%), followed by breast cancer (13.9%) and gastric cancer (13.5%). Colon cancer affected 11.4% of participants, while lung cancer (6.7%) and cervical cancer (5.1%) were less common. Approximately 9% of patients with cancer experienced depression and 6.1% experienced anxiety.

Prevalence of suicidal ideation

A total of 8.6% of patients with cancer reported experiencing suicidal ideation within the past year. Suicidal ideation was slightly more prevalent in female cancer patients (8.7%) than in male cancer patients (8.5%) ($\chi^2 = 20.19$, $p < 0.001$).

Sex-specific factors associated with suicidal ideation

As shown in Table 2, the χ^2 test revealed statistically significant associations between all independent variables and suicidal ideation in both sex groups (all p -values $<$ 0.001). Consequently, most independent variables were included in the multinomial logistic regression analyses, which revealed varying directions and degrees of association between the variables and suicidal ideation based on sex (Table 2). The majority of the independent variables (9 out of 12) were associated with suicidal ideation in contrasting directions for male cancer patients and female cancer patients. The common factors associated with suicidal ideation in both sexes were pain/discomfort, depression, and anxiety.

Male cancer patients’ suicidal ideation factors

Male cancer patients with suicidal ideation were more likely to be older than 65 years (adjusted odds ratio [aOR], 1.39; 95% confidence interval [CI], 1.35 - 1.43), with lower education (aOR, 0.59; 95% CI, 0.57 - 0.61), unmarried (aOR, 0.43; 95% CI, 0.41 - 0.44), unemployed (aOR, 0.13; 95% CI, 0.13 - 0.14), lower household income (aOR, 1.21; 95% CI, 1.18 - 1.25), bed-ridden (aOR, 1.40; 95% CI, 1.35 - 1.44) and underweight (aOR, 2.86; 95% CI, 2.63 - 3.03), better self-rated health (aOR, 3.02; 95% CI, 2.92 - 3.12), and comorbidity (aOR, 1.15 95% CI, 1.12 - 1.19) (all p -values $<$ 0.001) (Table 3).

Table 1. General Characteristics of Patients with Cancer (N=511)

Variables	Categories	N		Mean (SD) Weighted	Range Weighted
		Unweighted	Weighted		
Suicidal ideation	Yes	51	8.6		
	No	460	91.4		
Sex	Male	217	38.3		
	Female	294	61.7		
Age (years)	< 65	196	45.1	62.1 (12.9)	23–97
	≥ 65	315	54.9		
Education level	≤ Elementary school	175	25.5		
	≥ Middle school	336	74.5		
Marital status	Married, living with a spouse	384	80		
	Unmarried	127	20		
Employment	Employed	315	54.2		
	Unemployed	196	45.8		
Monthly household income (USD)	< 1,500	254	41.9	2,466 (2,159)	0–13,958
	≥ 1,500	257	58.1		
Bed-ridden status	Yes	175	25.2		
	No	336	74.8		
BMI	< 18.5 (underweight)	26	3.6	23.4 (3.4)	15.1–37.9
	≥ 18.5 (normal to obese)	485	96.4		
Pain/discomfort	Yes	274	58.3		
	No	237	41.7		
Self-rated health	Good	322	66.1		
	Bad	189	33.9		
Comorbidity	Yes	334	61.1		
	No	177	38.9		
Type of cancer	Gastric cancer	69	13.5		
	Colon cancer	58	11.4		
	Lung cancer	34	6.7		
	Breast cancer	71	13.9		
	Cervical cancer	26	5.1		
	Thyroid cancer	115	22.5		
	Other cancers	175	34.2		
Depression	Yes	55	9		
	No	456	91		
Anxiety	Yes	38	5.3		
	No	473	94.7		

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); SD, standard deviation; USD, United States dollar

Female cancer patients' suicidal ideation factors

In contrast to male cancer patients, female cancer patients with suicidal ideation were more likely to be younger than 65 years old (aOR, 0.47; 95% CI, 0.46 - 0.48), married and living with a spouse (aOR, 1.06; 95% CI, 1.04 - 1.08), employed (aOR, 1.55; 95% CI, 1.52 - 1.58), with a higher household income (aOR, 0.95; 95% CI, 0.93 - 0.97), not bed-ridden (aOR, 0.52; 95% CI, 0.50 - 0.53), with a BMI above 18.5 (aOR, 0.74; 95% CI, 0.72 - 0.76), to have self-rated poor health (aOR, 0.31; 95% CI, 0.31 - 0.32), and not having comorbidity (aOR, 0.80; 95% CI, 0.78 - 0.82) (all p-values < 0.001).

Educational level was not associated with suicidal ideation in females (aOR, 1.00; 95% CI, 0.97 - 1.02) (Table 3).

Factors associated with suicidal ideation in both sexes

In both sex groups, pain/discomfort, depression, and anxiety were associated with an increased prevalence of suicidal ideation, although the degree of association varied by sex (all p-values were <0.05). The risk of suicidal ideation among male cancer patients was 6.49 times higher (95% CI, 6.26 - 6.72) when they were experiencing pain/discomfort, and 10.94 times higher (95% CI, 10.59 - 11.30) when they were depressed. In female cancer patients,

Table 2. Comparison of Subgroups in Suicidal Ideation Based on Characteristics of Patients with Cancer

Variables	Categories	Male cancer patients (38.3%)			Female cancer patients (61.7%)		
		Yes (8.50%)	No (91.5%)	χ^2 (p)	Yes (8.70%)	No (91.3%)	χ^2 (p)
<i>Socio-demographics</i>							
Age	< 65 years	40.4	45.5	387.57 (<0.001)	42.6	66.5	15236.96 (<0.001)
	≥ 65 years	59.6	54.5		57.4	33.5	
Education level	≤ Elementary school	20.5	26	587.04 (<0.001)	43.4	23.6	12547.95 (<0.001)
	≥ Middle school	79.5	74		56.6	76.4	
Marital status	Married, living with a spouse	69.4	80.9	3034.56 (<0.001)	56.6	69.5	4656.47 (<0.001)
	Unmarried	30.6	19.1		43.4	30.5	
Employment	Employed	8.7	58.4	36744.87 (<0.001)	33.9	38.7	602.07 (<0.001)
	Unemployed	91.3	41.6		66.1	61.3	
Monthly household income	< 1,500 USD	48.7	40.2	12210.14 (<0.001)	52.6	39.3	4488.94 (<0.001)
	≥ 1,500 USD	51.3	59.8		47.4	60.7	
<i>Physical health status</i>							
Bed-ridden status	Yes	40.6	23.8	5521.17 (<0.001)	38.5	33.2	781.15 (<0.001)
	No	59.4	76.2		61.5	66.8	
BMI	< 18.5 (underweight)	6.9	3.3	1416.04 (<0.001)	9.0	4.4	2804.21 (<0.001)
	≥ 18.5 (normal to obese)	93.1	96.7		91.0	95.6	
Pain/discomfort	Yes	12.1	62.5	38568.88 (<0.001)	35.3	61.9	17959.68 (<0.001)
	No	87.9	37.5		64.7	38.1	
Self-rated health	Good	54.1	67.2	2837.64 (<0.001)	36.0	72.7	38579.07 (<0.001)
	Bad	45.9	32.8		64.0	27.3	
Comorbidity	Yes	72.4	60	2375.14 (< 0.001)	66.5	50.8	6044.17 (<0.001)
	No	27.6	40		33.5	49.2	
Type of cancer	Gastric cancer	36.7	21.3	5018.47 (<0.001)	2.0	6.4	2016.62 (< 0.001)
	Colon cancer	0.1	12.5	5709.65 (< 0.001)	5.5	5.5	0.003 (0.959)
	Lung cancer	12.8	11.4	71.36 (< 0.001)	2.2	2.2	0.038 (0.845)
	Breast cancer	NA			35.6	26.5	2519.54 (< 0.001)
	Cervical cancer	NA			9.1		(<0.001)
	Thyroid cancer	0.1	9.9	4407.81 (<0.001)	16.6	39.8	13961.77 (<0.001)
	Other cancers	52.3	50.2	64.57 (< 0.001)	33.4	17.5	9987.02 (< 0.001)
<i>Psychological distress</i>							
Depression	Yes	56.9	4.6	122749.20 (<0.001)	35.1	6.1	65090.80 (<0.001)
	No	43.1	95.4		64.9	93.9	
Anxiety	Yes	16.2	4.3	10613.96 (<0.001)	32.9	4.2	79633.67 (<0.001)
	No	83.8	95.7		67.1	95.8	

Note: all percentages were calculated based on weighted samples. Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); NA, not applicable; USD, United States dollar. *Conducted Fisher's exact test as one cell has an expected frequency less than 5.

suicidal ideation increased by 1.47 times (95% CI, 1.44 - 1.50) when they were experiencing pain/discomfort, and by 2.68 times (95% CI, 2.61 - 2.75) when they were depressed. In male cancer patients with anxiety, suicidal ideation increased by 1.39 times (95% CI, 1.33 - 1.45), while in female cancer patients, it increased by 4.25 times (95% CI, 4.14 - 4.37) (Table 3). Therefore, male cancer patients were more likely to have suicidal ideation if they had pain/discomfort or depression, whereas female cancer patients were more likely to exhibit suicidal ideation if they experienced anxiety.

According to χ^2 test results, for males, gastric (36.7% vs. 21.3%), lung (12.8% vs. 11.4%), and other types

(52.3% vs. 50.2%) of cancer patients had higher rates of suicidal ideation compared to those without these cancers (all p-values < 0.001). For females, breast (35.6% vs. 26.5%) and other types of cancer (33.4% vs. 17.4%) were associated with higher rates of suicidal ideation compared to patients without these cancers (all p-values < 0.001).

Discussion

Using nationally representative data, this study provides important insights into considerable sex-specific factors associated with suicidal ideation among cancer patients. In this study, 8.6% of cancer patients reported

Table 3. Sex-Specific Factors Associated with Suicidal Ideation

Variables (Baseline)	Total cancer patients aOR (95 CI)	Male cancer patients aOR (95 CI)	Female cancer patients aOR (95 CI)
Age (ref: < 65 year)			
≥ 65 years	1.16 (1.13, 1.18) **	1.39 (1.35, 1.43) **	0.47 (0.46, 0.48) **
Education level (ref: ≤ elementary school)			
≥ Middle school	0.92 (0.91, 0.94) **	0.59 (0.57, 0.61) **	1.00 (0.97, 1.02)
Marital status (ref: unmarried)			
Married	0.75 (0.74, 0.76) **	0.43 (0.41, 0.44) **	1.06 (1.04, 1.08) **
Employment status (ref: unemployed)			
Employed	0.63 (0.62, 0.64) **	0.13 (0.13, 0.14) **	1.55 (1.52, 1.58) **
Monthly household income (ref: ≥ 1,500 USD)			
< 1,500 USD	1.03 (1.02, 1.05) **	1.21 (1.18, 1.25) **	0.95 (0.93, 0.97) **
Bed-ridden status (ref: no)			
Yes	0.60 (0.59, 0.61) **	1.40 (1.35, 1.44) **	0.52 (0.50, 0.53) **
BMI (ref: normal to obese)			
< underweight	0.97 (0.94, 0.99) *	2.86 (2.63, 3.03) **	0.74 (0.72, 0.76) **
Pain/discomfort (ref: no)			
Yes	2.49 (2.45, 2.53) **	6.49 (6.26, 6.72) **	1.47 (1.44, 1.50) **
Self-rated health (ref: bad)			
Good	0.70 (0.69, 0.71) **	3.02 (2.92, 3.12) **	0.31 (0.31, 0.32) **
Comorbidity (ref: No)			
Yes	1.07 (1.06, 1.09) **	1.15 (1.12, 1.19) **	0.80 (0.79, 0.82) **
Depression (ref: no)			
Yes	5.84 (5.74, 5.95) **	10.94 (10.59, 11.30) **	2.68 (2.61, 2.75) **
Anxiety (ref: no)			
Yes	2.57 (2.52, 2.63) **	1.39 (1.33, 1.45) **	4.25 (4.14, 4.37) **

Note: all percentages were calculated based on weighted samples; Abbreviations: aOR, adjusted odds ratio; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); CI, confidence interval; USD, United States dollar; ref, references for each group of independent variables. *p < 0.05, ** p < 0.0001

suicidal ideation, with female cancer patients being slightly more susceptible to suicidal ideation than male cancer patients. Factors associated with suicidal ideation varied by sex. Male cancer patients' suicidal ideation was associated with worse financial status (for example, lower education, unemployment, and being unmarried) and conditions that adversely affected financial status (for example, being bedridden, underweight, and having comorbidities). Suicidal ideation was more likely to occur in younger female cancer patients, those with a higher body mass index (BMI), worse self-rated health, and increasing social burdens (for example, being employed and married). Although pain/discomfort and depression were more strongly linked to male cancer patients' suicidal ideation, while anxiety had a stronger association with female cancer patients' suicidal ideation, these factors were related to suicidal ideation in both sexes. The following discussion highlights the significance and unique findings regarding sex-specific differences in suicidal ideation among patients with cancer, presenting supportive and/or comparative evidence from previous studies.

According to a prior systematic review, the prevalence rate of suicidal ideation ranged from 0.7% to 45.5% in

patients with cancer across a number of studies with varying types of cancer, ages, methods of assessment, and research timelines [8]. In the present study, the prevalence of suicidal ideation in patients with cancer (8.6%) was not higher than this range. However, given that the rate of suicidal ideation in the general Korean population was 5.4% in 2020, the year in which the data for this study were collected [25], these findings suggest that patients with cancer are at an increased risk of experiencing suicidal ideation. Therefore, this study's findings reinforce the importance of enhancing suicide screening and assessment among patients with cancer, which is consistent with previous studies [8, 26]. This can be done by incorporating basic screening questions about suicidality into regular care and by asking all patients with cancer about suicidal risk and psychological distress, regardless of whether they show warning signs of suicidality [26].

This study reinforces prior research by highlighting the sex-based disparity in suicidal ideation among patients with cancer [4, 8], showing that suicidal ideation has a slightly higher prevalence in females than in males. Although evidence of the reasons for the differing prevalence rates of suicidal ideation between males and females is still lacking, one possible explanation for

these consistent findings is the difference in emotional expression [27] and coping mechanisms [28] between males and females, which may contribute to the prevalence of suicidal ideation. For example, females are more likely to express their emotions in response to psychological distress, whereas males are more likely to suppress it [27]. This may explain the observed differences in the reporting rates of suicidal ideation between females and males. Additionally, compared to males, females are more prone to ruminating and dwelling on negative thoughts regarding their cancer-related experiences, leading to heightened suicidal ideation [28]. Considering the lack of understanding of the mechanisms underlying sex-specific differences, differences in suicidal ideation between males and females should be explored further in future studies. This will contribute to a more comprehensive understanding of the complexities involved in disparities in suicidal ideation by sex.

The most intriguing finding of this study was the differentiation of factors associated with suicidal ideation in patients with cancer based on sex. However, this aspect has received limited attention in previous studies. These sex-specific factors for suicidal ideation among males were low income, unemployment, lower educational levels, being bedridden, underweight, and being unmarried. Considering that financial hardship is related to lower education, unemployment, lower income, unmarried status, and being bedridden and underweight can have adverse effects on financial status, as they inhibit economic activities [13]. These findings suggest that financial responsibility might strongly affect suicidal ideation in male cancer patients than in female cancer patients. This is because taking financial responsibility as the head of a household has been traditionally considered as a man's role rather than a woman's [17], and job-security problems induce more depression and suicidal ideation in male patients with cancer compared to their female counterparts [14, 15]. As societal norms regarding "masculinity" force males to preserve being manly and to avoid becoming a burden on others [14, 17], deviating from the sex-specific expectations of financial responsibility might lead to suicidal ideation among male cancer patients [17]. However, to obtain clear evidence to support this hypothesis, further studies are required.

In contrast to male cancer patients, suicidal ideation among female cancer patients was associated with worse self-rated health, employment status, and status of married and living with a spouse. These results suggest that different factors contribute to suicidal ideation based on sex. Although limited research explains the mechanism of these disparities, These findings are supported by the fact that females have traditionally shouldered familial and household responsibilities [13, 29]. Additionally, prior research has shown that taking on job responsibilities and family issues increases distress more in females than in males [15, 29]. Accordingly, These results suggest that female cancer patients' suicidal ideation may be increased by social burdens such as occupational and household demands.

Importantly, a significant claim of this study is the possibility of gendered roles, such as financial

responsibilities for males and familial responsibilities for females, which are rooted in sociocultural factors and seem to influence distinct experiences of cancer and subsequent suicidal ideation processes for both sex groups. However, these observations were speculative and inconclusive. Thus, further research is needed to elucidate the relationship between gender roles and suicidal ideation among patients with cancer and its mechanism through deeper exploration, such as qualitative studies and structural equation modeling (SEM), to gain a comprehensive understanding. These investigations could pave the way for the development of interventions tailored to the unique vulnerabilities of at-risk patients with cancer based on their sex.

This study found that the prevalence of suicidal ideation was higher among younger female cancer patients compared to older female cancer patients. This finding contrasts with that of previous research, which found that suicidal ideation is more common among older adults [8]. The discrepancy between present study's findings and those of previous studies may be explained by the fact that breast and thyroid cancers are more commonly diagnosed in younger Korean females, including 55-64 years old [30].

In this study, the common risk factors shared by both sex groups were pain/discomfort, depression, and anxiety. These results are in line with those of previous studies suggesting that patients with cancer with high levels of pain, depression, and anxiety are likely to suicide [8, 13, 18]. In the present study, pain and depression were more strongly associated with suicidal ideation in male cancer patients, whereas anxiety was more strongly associated with suicidal ideation in female cancer patients. This finding is understandable given that anxiety is more common in female cancer patients than in male cancer patients [31, 32], and distress induced by loss of identity and worthlessness of living is more common in male patients with cancer than in female patients [15]. Considering the findings of the current study alongside prior research, These results underscore the importance of healthcare providers being especially vigilant for signs of suicidal ideation among patients with cancer grappling with pain/discomfort, depression, or anxiety.

Study limitation

This study has several limitations. First, the data employed in the study were adapted from sources in South Korea, warranting caution regarding generalization to other ethnicities and countries owing to potential socio-cultural variations. Second, the cross-sectional nature of this study restricted causal explanations. Third, suicidal ideation was assessed using a single questionnaire and dichotomized, potentially inadequately capturing the full spectrum of suicidal ideation, including its level and severity. Fourth, while the study variables were informed by prior research, certain external factors influencing suicidal ideation in patients with cancer were not comprehensively addressed. Given the intricate nature of suicidal ideation, future research would benefit from more robust designs, such as longitudinal studies featuring changes in suicidal ideation according to cancer trajectories, using larger and diverse samples.

In conclusion, using nationally representative data, this study found that 8.6% of patients with cancer harbored suicidal ideation, with a slightly higher prevalence in females than in males. Factors associated with suicidal ideation differed by sex. In male cancer patients, suicidal ideation was more prevalent with lower socioeconomic status (older age, lower education, unemployed, unmarried, bedridden, underweight). For female cancer patients, suicidal ideation was associated with poor self-rated health and higher social burden (employed and married). While pain, depression, and anxiety affected both sexes, pain and depression were stronger association for male cancer patients' suicidal ideation, while anxiety was more impactful for female cancer patients. This research highlights the need for sex-specific assessments of suicide risk in patients with cancer, especially those with pain, depression, or anxiety. Further research is needed to better understand the underlying biological, psychological, and social mechanisms that lead to sex differences.

Author Contribution Statement

Conceptualization, data curation, formal analysis, methodology, writing original draft and editing: Sun-Young Park.

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Availability of Data

Data used in this study are available in the Korea Health Panel Survey repository upon request (<https://www.khp.re.kr/>).

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Ethical Approval

The Institutional Review Board of Daegu Catholic University classified this study as exempt research from obtaining participant consent as all the data were de-identified from the 2020 Korea Health Panel Survey (CU-IRB-2023-E012; approval date: 5 September 2023).

Conflicts of Interest

The author has no conflict of interest to disclose.

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