



Gender differences in employment disruption and return to work among cancer survivors in South Korea

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Abstract

Purpose This study analyzes gender differences in unemployment and return-to-work experiences among all patients with cancer in a nationwide cohort.

Methods Using data from the Korean National Health Insurance Service (NHIS), we analyzed 20,835 employed individuals (aged 15–59) newly diagnosed with cancer in 2010. These individuals were followed annually for 6 years (2010–2016) to assess unemployment after diagnosis. Of the total, 5,524 patients experienced unemployment during the follow-up period. Kaplan–Meier survival curves and Cox proportional hazards models were used to evaluate unemployment risk and its association with gender.

Results The hazard ratio (HR) for unemployment following cancer diagnosis is 1.98 (95% CI, 1.85 to 2.11), indicating that women have a higher rate of job loss compared to men. Additionally, women were approximately 26% less likely to return to work after losing their jobs, highlighting significant gender disparities in employment outcomes among cancer survivors.

Conclusion Employment is important for cancer survivors, but women are more vulnerable to job loss after a cancer diagnosis and less likely to return to work after losing their jobs, particularly those in lower-income groups.

Keywords Cancer survivor · Employment disruption · Return to work · Gender · Cohort study

Introduction

As the age of cancer onset decreases, younger patients with cancer are becoming more common, and their survival rates are improving [1, 2]. Consequently, job loss and the challenge of returning to work have become critical issues for cancer survivors [3–5]. It is important to recognize that even patients with the same cancer type and stage may experience different life trajectories following a diagnosis, particularly in terms of job retention, job loss, and return to work [6–8]. When diagnosed with cancer, patients may

initially take a leave of absence from work to focus on treatment, with the intention of returning afterward [4, 9, 10]. However, if they lack sufficient sick leave, they may be forced to leave their job either due to treatment needs or health complications [11, 12]. This situation can lead to a financial burden, as individuals face high healthcare costs while also losing their income, creating a "double hardship" [11, 13–16].

Women are generally considered a vulnerable group in the labor market [17, 18]. According to Statistics Korea, women's average income is approximately 65% of men's [19]. Women are also overrepresented in insecure jobs, including part-time, temporary, and platform-based work, which further increases their vulnerability [20–24]. Existing studies have shown that women, in particular, are at greater risk of job loss after an illness, including cancer, compared to the general population [24–27]. For example, a study in the Netherlands of patients diagnosed with stroke found that young women had a 2–3 times higher risk of job loss than controls [27]. Similarly, breast cancer patients, especially women, face higher unemployment rates than the general population [28].

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In South Korea, where the labor market is dualized [18, 29], women in particular face a high risk of job loss after illness. International studies also report higher job loss among female cancer survivors compared to males [28, 30]. There is a significant gap between regular, secure jobs and precarious, temporary employment. While South Korea's universal health insurance system reduces the financial burden of medical expenses for cancer patients, employment protection policies such as sick leave primarily benefit those in stable, regular jobs. Women, who are often employed in temporary or insecure jobs, tend to lack sufficient support, making it difficult for them to continue working or return to work after treatment [20–22, 31]. Therefore, it is crucial to focus on the specific challenges faced by women following a cancer diagnosis, including how the healthcare and employment systems interact to either support or hinder their ability to return to work [4, 5, 31–33].

Previous studies on job loss among cancer patients have often focused on descriptive data, showing a higher risk of job loss among certain cancer survivors, particularly women with cancers like breast cancer [28, 34–39]. These studies also suggest that women's return-to-work outcomes are influenced not only by medical factors but also by workplace accommodations and employment policies [40]. Workplaces offering flexible schedules and modifications facilitate smoother transitions back into the workforce, whereas women in temporary or unstable jobs face greater barriers. These barriers are compounded by the gender disparities in income and job security, making women cancer survivors especially vulnerable to job loss and delayed reentry [34, 41].

This research aims to fill this gap by focusing specifically on the impact of gender on job loss and return to work among cancer survivors in South Korea. By analyzing a large cohort of cancer patients over a 7-year follow-up period, we seek to provide valuable insights into the unique challenges faced by women cancer survivors in the labor market.

Materials and methods

Study design and population

In this study, we used the National Health Insurance Service's national population database in Korea. These data are highly reliable as they are generated from the actual billing of medical services provided to patients by medical institutions to insurers. In addition, because it covers the entire population, it is possible to identify the total number of patients with cancer in Korea by using ICD-10 diagnosis codes, compensating for the limitations of overestimation or underestimation that may occur when analyzing

panel or sample data. Because the National Health Insurance Service collects and manages employment status, income, and administrative information to determine health insurance premiums for its members, it provides real-time information on job changes, new employment, and unemployment, making it a highly appropriate data source for this study [42, 43]. The following variables were used in this study: gender, age, income quintile, workplace type, and cancer type. The data provided by the National Health Insurance Service were anonymized and followed the STROBE guidelines for epidemiology.

In this study, we analyzed the unemployment and reemployment experiences of working-age people after a cancer diagnosis, as well as the influencing factors by gender. The study was conducted in two stages: (1) analyzing unemployment after cancer diagnosis; and (2) analyzing return to work after unemployment. For these analyses, we constructed two separate cohorts: cohort 1 consisted of cancer survivors followed for unemployment after diagnosis, and cohort 2 included those who experienced unemployment and were followed for return to work.

A total of two cohorts were constructed to perform each analysis. Cohort 1 was defined as "young patients newly diagnosed with cancer who had been employed in the previous 3 years" from the total population. To identify patients with cancer, we used International Classification of Diseases-10 (ICD-10) diagnostic codes [44] and selected patients with a primary or secondary illness in the range of C00–C97. For cohort 2, from cohort 1, we selected only those subjects who had experienced unemployment during the follow-up period.

To identify newly diagnosed patients as of 2010, we used the 3 years before 2010 as a wash-out period and excluded those with cancer-related disease codes during this period. In addition, to restrict the working-age group to those actively engaged in employment during the study period, we included individuals who maintained their health insurance employment status from 19 to 50 years of age. In South Korea, individuals typically begin their professional careers after the age of 19, with the statutory retirement age set at 60. However, to accommodate the follow-up period for tracking post-diagnosis employment outcomes, the upper age limit at the time of cancer diagnosis was set lower. Furthermore, to ensure baseline employment stability, we included only individuals who had been continuously enrolled as workplace members of the NHIS for at least 3 years prior to cancer diagnosis. This criterion indirectly reflects job security, although exact measures of employment tenure or total work history were unavailable.

Cohorts 1 and 2 were monitored for changes in labor status from 2010 to 2016. The final selection process is shown in Fig. 1.

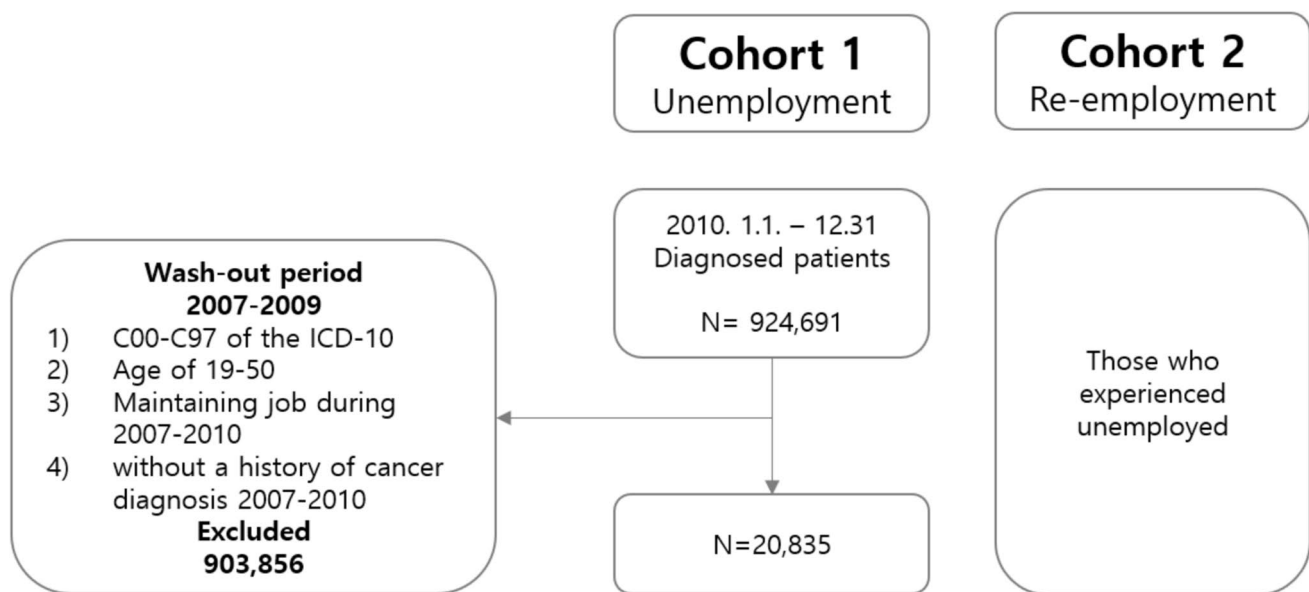


Fig. 1 Study population selection process

Measures

Diagnosis of cancer

Cancer diagnosis was defined as a C00-C97 code indicating cancer as the primary and secondary diagnoses in the medical history from January 1, 2010, to December 31, 2010. It is an international standard and a reliable method for research and statistical analysis to confirm a cancer diagnosis using ICD-10 codes C00-C97. The National Cancer Data Centre in South Korea applies this standard to produce cancer statistics [45].

In addition, extracting based on primary and secondary diagnosis minimizes unnecessary errors and ensures that only cases where cancer is actually confirmed as the primary condition are included. We coded 1 if cancer was diagnosed and 0 otherwise. A total of 15 cancer types were categorized according to the ICD-10 classification [44].

Unemployment and reemployment

Unemployment and reemployment were defined as follows. In South Korea, all citizens are compulsorily enrolled in the National Health Insurance Program, with three main types of enrollees: “employed,” “local,” and “medical benefit” enrollees. Workplace enrollees are “employed,” earn income, and pay a fixed premium of approximately 6% based on their income, which is split 50/50 between the employer and employee. “Local” enrollees are not engaged in income-earning activities and pay premiums based on the amount of property they own, with 100% of the premiums

paid out of pocket. Approximately 3% of the population is covered by “medical benefits,” and the government pays the premiums for those in need. To calculate and collect insurance premiums, the National Health Insurance Service collects information on the income and assets of all citizens, as well as real-time information on those who retire from active employment. In this study, we collected information on job change based on the system’s characteristics and coded it as 1 if the member was a worker at the end of the year and 0 otherwise. If the enrollees’ status changed from “employed” to “local,” it was defined as “unemployment,” and if it changed from “local” to “employed,” it was defined as “reemployment.”

Sociodemographic characteristics, workplace type, and income quintile

The administrative data in the Korea Health Insurance Corporation database include gender, age, residence, income, disability type, diagnosis (ICD-10), workplace type, death status, medical treatment history, and medical treatment date. This study included gender, age, income quintile, workplace type, and cancer type.

Statistical analyses

All analyses performed in this study were conducted according to the guidelines of the Korean National Health Insurance Service (KNHIS) [46]. The KNHIS allows data analysis only in designated locations to protect sensitive personal information. For this study, SAS version 9.4 (SAS Institute,

Cary, NC, USA) was used to analyze the data from January 13 to May 28, 2021, at a location designated by the KNHIS. For the analysis of unemployment and reemployment after a cancer diagnosis, the Kaplan–Meier survival curve was used for the follow-up period from January 1, 2010, to December 31, 2016, with annual updates of employment status. The Cox proportional hazard model was then applied to compare differences by gender and income level, controlling for gender, age, income quintile, workplace type, and cancer type. Statistical significance was based on $p < 0.05$. The 6-year horizon was chosen to capture both short-term effects and the clinically meaningful 5-year survival benchmark. Additionally, employment status was updated annually throughout the follow-up.

Results

Characteristics of the study population

In the KNHIS's health information database, a total of 924,691 people were diagnosed with cancer (C00–C97) as primary and secondary diagnoses in 2010. After extracting those who met the conditions of this study, a total of 20,835 subjects who were employed and aged 19–50 years as of 2010 from the KNHIS's national citizen database and were newly diagnosed with cancer between January 1, 2010, and December 31, 2010, constituted cohort 1. Cohort 1 comprised 56.1% males and 43.9% females, with 7.0% aged 19–29 years, 33.8% aged 30–39 years, and 59.2% aged 40–50 years. The age distribution of the study population correlated with an increasing incidence of cancer with age. Regarding workplace type, 16.0% were government employees, 3.4% were private school employees, 0.1% were military personnel, and 80.6% were private sector workers. The distribution of income quintiles was 31.1% in the lowest income quintile, 15.3% in the second quintile, 28.8% in the third quintile, 20.1% in the fourth quintile, and 4.7% in the highest quintile.

A total of 5,524 patients with cancer who had experienced unemployment during the study's 6-year follow-up period were included in cohort 2. The number of participants in cohort 2 according to gender, age, workplace type, income group, and cancer type is summarized in Table 1.

Unemployment and reemployment after cancer diagnosis

To determine whether there were differences in job loss rates by gender, we compared cohort 1 using Kaplan–Meier curves. The results showed that women had a significantly higher risk of job loss than men at all follow-up periods and at the end of follow-up. We then compared cohort 2 by

gender using a Kaplan–Meier curve, with the aim to establish differences in the return to work among people who had lost their jobs. We found that women had a significantly lower return to work rate than men. The Kaplan–Meier curve results for these job losses and returns are shown in Fig. 2.

Based on these results, Cox proportional hazard analysis was performed to derive accurate hazard ratios. The analysis was adjusted for age, income level, workplace type, and cancer type. Regarding gender, compared to males, the hazard ratio for females was 1.98, indicating a significantly higher risk of job loss among females (95% CI, 1.85 to 2.11, $p < 0.001$). We then performed Cox proportional hazards analyses on reemployment in cohort 2. Women were approximately 26% less likely to return to work than men (95% CI, 0.66 to 0.83, $p < 0.001$). The Cox proportional hazard ratio analysis results for job losses and returns by gender are shown in Table 2.

Discussion

In this study, we analyzed the impact of gender on unemployment and return to work following a cancer diagnosis using the Korean National Health Insurance Database. Our findings indicate that female survivors of cancer are at a higher risk of job loss after a cancer diagnosis than men, highlighting a gender disparity in the unemployment rates among cancer patients. While a cancer diagnosis alone is a significant risk factor for job loss, women face an even greater likelihood of unemployment within this population [24, 25, 30, 47]. These disparities emerged early—within the first 3 years after diagnosis—and persisted throughout the 6-year follow-up period, underscoring their robustness over both short- and long-term horizons.

We then explored the return-to-work experiences of individuals who had lost their jobs after a cancer diagnosis. The results showed that women were less likely to return to work than men. This suggests that, apart from health-related factors, female survivors of cancer face additional barriers when attempting to re-enter the workforce, such as workplace discrimination and challenges in accessing adequate support systems. These barriers contribute to the slower return-to-work rates observed among women compared to men.

The decision to stay or leave an existing job when at risk of illness is strongly related to the availability of institutionalized sick and job security [48, 49]. However, South Korea is the only OECD country without a legally guaranteed sick leave system [50]. Apart from South Korea and the United States, 32 OECD countries offer some form of paid sick leave, and the United States requires unpaid sick leave to prevent dismissal due to illness [51–53]. In Korea, there is no legally prescribed social security system related

Table 1 Characteristics of the study population

Characteristic		Cohort 1		Cohort 2	
		<i>n</i> = 20,835	%	<i>n</i> = 5524	%
Gender	Male	11,696	56.1	2287	41.4
	Female	9139	43.9	3237	58.6
Age (years)	19–29	1459	7.0	616	11.2
	30–39	7047	33.8	1814	32.8
	40–50	12,329	59.2	3094	56.0
Working type	Public worker	3306	16.0	202	3.7
	Private school worker	697	3.4	99	1.8
	military personnel	17	0.1	6	0.1
	Private sector worker	16,679	80.6	5113	94.3
Income quintile	1 (lowest)	6486	31.1	2632	47.7
	2	3196	15.3	1011	18.3
	3	5998	28.8	1080	19.6
	4	4186	20.1	633	11.5
	5 (highest)	969	4.7	168	3.0
Cancer type	Lip, oral cavity, and pharynx (C00–C14)	264	1.3	80	1.5
	Digestive organs (C15–C26)	6,708	32.2	1565	28.3
	Respiratory and intrathoracic organs (C30–C39)	961	4.6	207	3.8
	Bone and articular cartilage (C40–C41)	109	0.5	30	0.5
	Skin (C43–C44)	202	1.0	44	0.8
	Mesothelial and soft tissue (C45–C49)	155	0.7	58	1.1
	Breast (C50)	1640	7.9	654	11.8
	Female genital organs (C51–C58)	1105	5.3	413	7.5
	Male genital organs (C60–C63)	610	2.9	107	1.9
	Urinary tract (C64–C68)	715	3.4	179	3.2
	Eye, brain, and other parts of the central nervous system (C69–C72)	387	1.9	125	2.3
	Thyroid and other endocrine glands (C73–C75)	6923	33.2	1753	31.7
	Ill-defined secondary and unspecified sites (C76–C80)	318	1.5	70	1.3
	Stated or presumed to be primary of lymphoid, hematopoietic, and related tissues (C81–C96)	738	3.5	239	4.3
	Independent (primary) multiple sites (C97)	-	-	-	-

Cohort 1 includes all patients who were employed before being diagnosed with cancer. Cohort 2 is a subset of Cohort 1 and includes only those who experienced job loss after their cancer diagnosis

to sick leave, nor is there institutional responsibility for sick leave by employers. Sick leave benefits are only available voluntarily, often in the case of government employees or full-time employees of large corporations with high job security [18]. Consequently, workers without stable jobs and guaranteed sick leave are more likely to experience financial hardship when sick [11, 28]. This gap in benefits can widen depending on the stability of the worker's job and the quality of the available benefits.

The policy implications of these findings are significant, particularly for return-to-work outcomes. Targeted interventions are needed to address the gender disparity in return-to-work rates, as women face additional barriers, such as workplace discrimination and health-related challenges. Furthermore, it is essential to provide economic safety nets

and workplace accommodations for cancer patients, ensuring they are not forced to return to work prematurely due to financial pressure. Adequate sick leave, rehabilitation support, and other resources are crucial for enabling a healthier and more sustainable reemployment process for cancer survivors. Our findings of elevated unemployment risk persisting up to 6 years post-diagnosis align with prior research showing sustained long-term effects of cancer on employment (Chen et al., 2021; Brink et al., 2024). These patterns reflect ongoing treatment demands, recurrence surveillance, and late sequelae.

At the same time, adequate state support is necessary to ease the burden on employers [23, 53]. This study reaffirms that women, in particular, are vulnerable and require intervention to remain in the labor market [54–56]. A deeper

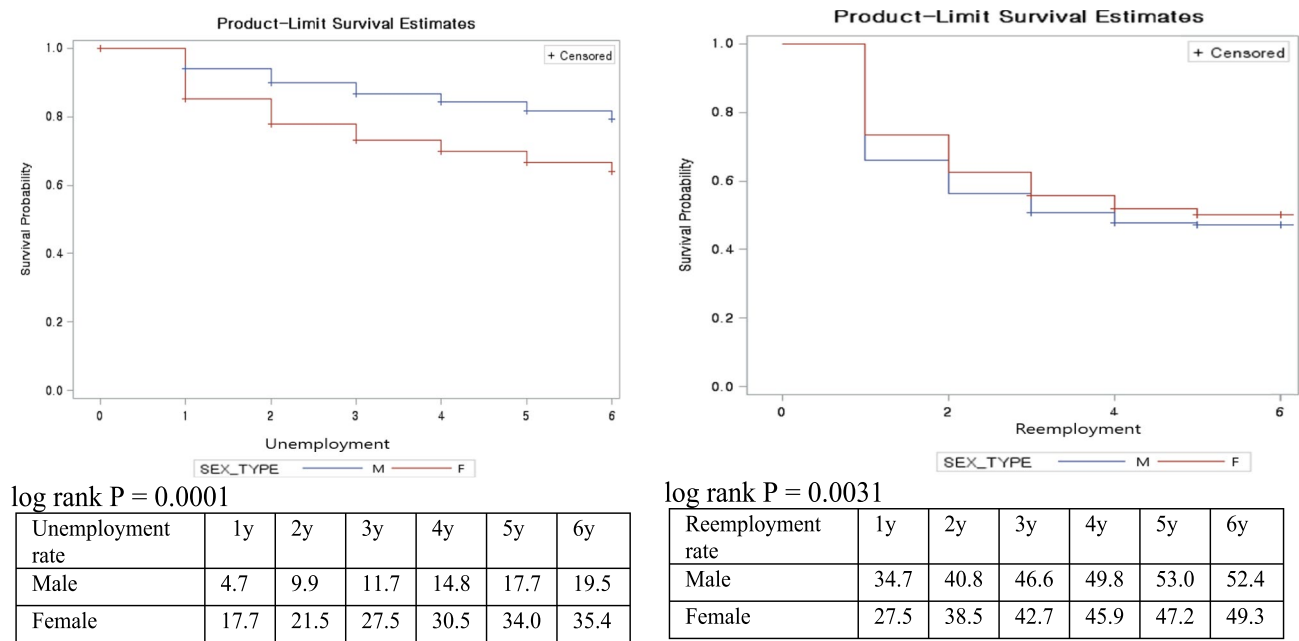


Fig. 2 Kaplan–Meier estimates of survival curves of unemployment and re-employment by gender

Table 2 Adjusted HRs for unemployment and re-employment

		Unemployment (cohort 1)			Reemployment (cohort 2)		
		HR	95% CI	p	HR	95% CI	p
Gender	Male (ref)						
	Female	1.98	1.85 2.11	<0.001	0.74	0.66 0.83	<0.001

Models were adjusted for gender, age, income quintile, workplace type, and cancer type

understanding of this vulnerable population's lives is essential to better support them and facilitate their inclusion in the workforce.

Despite the valuable insights provided by this study, there are some limitations to consider. This study used administrative health insurance eligibility data to identify individuals employed for 3 years prior to their cancer diagnosis. However, temporary and non-regular workers in Korea may not be fully covered by health insurance, potentially leading to an underestimation of job loss and return-to-work rates among this vulnerable group. Additionally, the dataset did not include information on education levels, preventing adjustment for this important confounding variable. Although we analyzed reemployment following unemployment, we did not investigate the specific reasons why individuals in Cohort 2 did not return to work after job loss. Furthermore, the possibility that some individuals transitioned to self-employment after leaving their jobs was not accounted for in this study.

Our dataset did not contain explicit variables on employment contract type (e.g., permanent vs. temporary). Instead, we adjusted for income quintile and workplace type, which

partly proxy job stability. This limitation likely makes our estimates conservative. Future studies should explore both total and direct effects of gender using detailed contract-type data.

Lastly, the absence of cancer stage data in the dataset prevented us from analyzing the impact of cancer severity on unemployment and return-to-work outcomes. Future research should include analyses stratified by cancer type and incorporate additional socioeconomic variables, such as education and reemployment barriers, for a more comprehensive understanding of these issues.

Individuals who are disadvantaged in the existing job market may face significantly more difficulties than those with greater job security when they fall ill. As this study shows, women are more likely to hold jobs with lower wages, fewer benefits, and less job security. When diagnosed with conditions requiring intensive treatment, such as cancer, the state must provide support to ensure that these individuals can seek treatment without the fear of losing their jobs and income. Although this may create short-term financial burdens, from a societal perspective, it will prevent

these individuals from falling into extreme poverty and ultimately avoid higher long-term welfare expenditures.

Author contributions Yoonjoo Choi: conceptualization, data curation, formal analysis, investigation, methodology, writing; Ji Won Han: conceptualization, data curation, formal analysis; Weon-Young Lee: conceptualization, supervision.

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Data availability The datasets are not publicly available due to privacy laws restricting access to data obtained through the Korean National Health Insurance Service. If you have any questions about the data or materials in this study, please contact Yoonjoo Choi or the corresponding author.

Declarations

Ethics approval and consent to participate This study performed an analysis of secondary administrative data, and the submission of informed consent forms by individual participants was waived. This study was approved by the Institutional Review Board of Chung-Ang University (1041078–202011-BRHR-332–01).

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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