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ORIGINAL REPORT

Job Loss and Re-Employment of Cancer Patients in Korean Employees: A Nationwide Retrospective Cohort Study

Jae-Hyun Park, Eun-Cheol Park, Jong-Hyock Park, Sung-Gyeong Kim, and Sang-Yi Lee

From the Division of Cancer Policy and Management, National Cancer Control Research Institute, National Cancer Center, Gyeonggi-do; and the Department of Preventive Medicine, Cheju University College of Medicine, Cheju, Korea.

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Corresponding author: Eun-Cheol Park, MD, PhD, Division of Cancer Policy and Management, National Cancer Control Research Institute, National Cancer Center, 809 Madu 1-dong, Il sandong-gu, Goyang-si, Gyeonggi-do 410-769, Korea; e-mail: ecpark@ncc.re.kr.

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ABSTRACT

Purpose
The aim of this study was to investigate whether a diagnosis of cancer has an impact on the cancer patients' job loss and re-employment and to identify the factors affecting job loss and re-employment during 6 years of follow-up of Korean employees with cancer.

Patients and Methods
All employees except for the self-employed in Korea who were diagnosed with cancer during the 2001 calendar year (n = 5,396) were identified as the first baseline patients and were followed every 3 months over 6 years to estimate the time taken to job loss. Patients who lost their job within the first year after a diagnosis of cancer (n = 1,398) were identified as the second baseline patients and were followed up over 5 years to estimate the time taken to re-employment using the National Health Insurance claims data. Patient demographic, socioeconomic, and clinical variables were investigated as factors that affected job loss and re-employment.

Results
Among the first baseline cancer patients, 47.0% lost their job, and among the second baseline patients, 30.5% were re-employed over 69 to 72 months of follow-up. Female sex, younger age and older age, company employee, lower income, blood cancer, and brain and CNS, lung, and liver cancer were significant predictors of early job loss or delayed re-employment.

Conclusion
The diagnosis of cancer affects cancer patients' employment status differently according to different factors: sex, age, type of job, income, and cancer site. Efforts should be made to support re-employment and reduce unnecessary work cessation and disparity between different demographic and socioeconomic groups of cancer survivors.

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INTRODUCTION

The 5-year survival rate for all cancers is 60%. Approximately 8 million people have survived after the initial diagnosis of cancer and treatment.[1] As the number of cancer survivors increases, it is important to understand the economic and workplace consequences of cancer. Cancer patients who leave work lose their regular earning and may lose important psychological and social standing as well.[2,3] From a societal point of view, it is important to maintain full employment.[4]

However, in previous studies of cancer and work, there were inconsistent results on the effect of a cancer diagnosis on job loss and re-employment among cancer patients.[5-12] In a systematic review on the return to work of cancer patients, various work-, disease-, and treatment-related factors were noted to be related to the return to work. However, other factors, such as demographic and socioeconomic factors, showed no consistent results in the reported studies. The different study patients, research methods, nature of the social security system, and many other social and cultural factors may have contributed to these variations. Furthermore, the efforts to quantify employment consequences resulting from a cancer diagnosis have been hampered by small sample sizes, lack of longitudinal data, and an inability to account for different cancer sites.[13]

Therefore, the aim of this study was to investigate an entire Korean population to determine whether a cancer diagnosis has an impact on employment status in Korea. We investigated various factors affecting job loss after the diagnosis of cancer and re-employment after job loss separately. This is because these two outcomes (job loss and re-employment) have different socio-economic associations and a different meaning to each cancer patient as well. A unique feature of our study was that we estimated these two outcomes and identified the factors associated with them over 6 years in all Korean cancer patients who were employed at the time they were diagnosed with cancer. This study covers almost all cancer sites. It is a longitudinal design and covers employment status of the entire Korean population. This approach could provide otherwise unobtainable information about job loss and re-employment of cancer patients across different sexes, age groups, socio-economic strata, and cancer sites.

PATIENTS AND METHODS

Patients

All employees except for the self-employed 25 to 55 years of age in Korea who were diagnosed for the first time from April to December in 2001 with one of 21 types of cancer, the most common cancers in Korea defined according to WHO's International Classification of Disease-10, were identified from the National Health Insurance (NHI) claims data. There were 5,396 patients identified (patients at the first baseline). Among them, we selected 1,398 patients who lost their job within 1 year of the cancer diagnosis (second baseline patients) to investigate the time interval to re-employment. During the selection, patients with six cancer sites were excluded because of the small sample size (< 50 patients) at each of these cancer sites, because this could bias the identification of the cancer sites that have potential influence on re-employment. The reason for selecting patients who lost their job within the first year as the second baseline patients was that they account for more than half (55.1%) of the 2,538 patients who lost their job during the 6 years (72 months) of follow-up.

Employment Status and Data Construction

Employment status of study participants from 2001 to 2006 was obtained from administrative data of the NHI that contains the employment status of

Table 1. General Characteristics of Study Patients

	Patients at First Baseline*						Patients at Second Baseline†					
	Total		Male		Female		Total		Male		Female	
Characteristic	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total	5,296	100.0	3,941	100.0	1,355	100.0	1,398	100.0	973	100.0	425	100.0
Age group, years												
25-29	281	5.3	147	3.7	134	9.9	97	6.9	51	5.2	46	10.8
30-39	1,233	23.3	820	20.8	413	38.5	269	19.2	169	17.4	100	23.5
40-49	2,263	42.7	1,678	42.6	585	43.2	556	39.8	373	38.3	183	43.1
50-55	1,519	28.7	1,296	32.9	223	16.5	476	34.1	380	39.1	96	22.6
Type of job												
Public servant	1,163	22.0	819	20.8	344	25.4	103	7.4	77	7.9	26	6.1
Company employee	4,133	78.0	3,122	79.2	1,011	74.6	1,295	92.6	896	92.1	399	93.9
Equivalent household income quintiles												
I (highest)	1,342	25.3	1,005	25.5	337	24.9	151	10.8	113	11.6	38	8.9
II	1,300	24.6	1,070	27.2	230	17.0	229	16.4	176	18.1	53	12.5
III	1,328	25.1	1,015	25.8	313	23.1	405	29.0	302	31.0	103	24.2
IV (lowest)	1,326	25.0	851	21.6	475	35.1	613	43.9	382	39.3	231	54.4
Cancer site												
Oral cavity and nasopharynx	96	1.8	96	2.4	—	—	27	1.9	27	2.8	—	—
Esophagus	49	0.9	49	1.2	—	—	—	—	—	—	—	—
Stomach	1,312	24.8	1,121	28.4	191	14.1	377	27.0	289	29.7	88	20.7
Colon and rectum	585	11.1	495	12.6	90	6.6	160	11.4	118	12.1	42	9.9
Liver	815	15.4	774	19.6	41	3.0	212	15.2	189	19.4	23	5.4
Gallbladder	81	1.5	81	2.1	—	—	31	2.2	31	3.2	—	—
Pancreas	95	1.8	95	2.4	—	—	23	1.7	23	2.4	—	—
Larynx	55	1.0	55	1.4	—	—	—	—	—	—	—	—
Lung	420	7.9	377	9.6	43	3.2	151	10.8	127	13.1	24	5.7
Breast	411	7.8	—	—	411	30.3	160	11.4	—		160	37.7
Cervix uteri	182	3.4	—	—	182	13.4	—	—	—		—	—
Corpus uteri	25	0.5	—	—	25	1.9	—	—	—		—	—
Ovary	83	1.6	—	—	83	6.1	22	1.6	—		22	5.2
Prostate	37	0.7	37	0.9	—	—	—	—	—		—	—
Testis	37	0.7	37	0.9	—	—	—	—	—		—	—
Kidney	145	2.7	145	3.7	—	—	24	1.7	24	2.5	—	—
Bladder	110	2.1	110	2.8	—	—	21	1.5	21	2.2	—	—
Brain and CNS	154	2.9	127	3.2	27	2.0	38	2.7	38	3.9	—	—
Thyroid gland	350	6.6	135	3.4	215	15.9	87	6.2	21	2.2	66	15.5
Non-Hodgkin's lymphoma	117	2.2	95	2.4	22	1.6	26	1.9	26	2.7	—	—
Leukemia	137	2.6	112	2.8	25	1.9	39	2.8	39	4.0	—	—
Mortality												
Death	1,820	34.4	1,572	39.9	248	18.3	599	42.8	493	50.7	106	24.9
Survival during follow-up	3,476	65.6	2,369	60.1	1,107	81.7	799	57.2	480	49.3	319	75.1

*Patients who were diagnosed with cancer in 2001.
†Patients who lost their job within the first year.

the entire Korean population. NHI claims data and National Death Certificate data were linked using personal identifiers. After linkage, the personal identifiers were deleted. In addition, this study was secondary data analysis. Because of these reasons, this study was not applicable to the review from Human Research Ethics Committee.

Statistical Analyses

The status of employment or re-employment was identified at 3-month intervals from the administrative data of the NHI during the years 2001 through 2006. The employment status was recorded as a dichotomous variable ("employed " or "not employed"). Consideration of the potential factors that influenced job loss and re-employment among the cancer patients included sex, age, type of job, socioeconomic status, and cancer site based on the previous study results. As for the type of job, the administrative data classified all employees into two groups: public servants or company employees. For the economic status, equivalent income taking into account household needs associated with household size was used. In Korea, monthly contribution to the NHI is applied according to the family income for all employees. Therefore, we obtained actual family income using the insurance rate for the NHI for each employee. Equivalent income was obtained by the following methods. Yearly family income was divided by the square root of the number of family members. This formula is widely used when comparing different income levels by the Organization for Economic Cooperation and Development.

The Kaplan-Meier approach for life-table estimates and the log-rank test was used to evaluate the time taken to job loss after the cancer diagnosis, time taken to re-employment after the job loss, and for identifying the factors that affected the time interval. For the most common cancer sites, median time to job loss and time taken to 25% of re-employment (first quartiles were re-employed) were presented, because in most cancer sites, second baseline study patients could not reach median time to re-employment. We used a multivariate Cox proportional hazards model to identify factors that were significantly

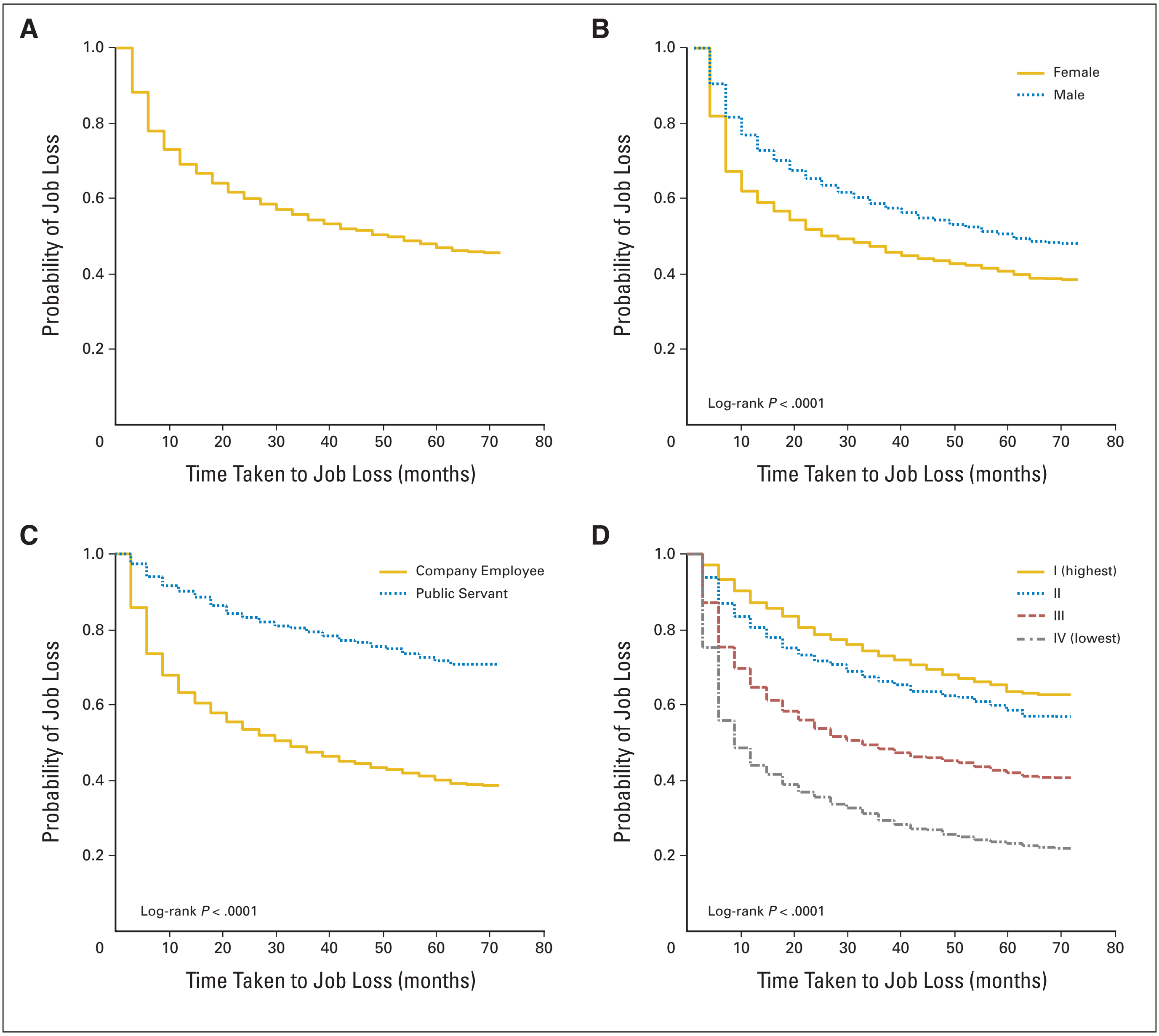

Fig 1. Kaplan-Meier curves: time until job loss of patients from first baseline (n = 5,296). (A) Total patients; (B) comparison according to sex; (C) comparison according to type of job; and (D) comparison according to equivalent household income quintiles.

related to the time taken to job loss after the cancer diagnosis and the time taken to re-employment after the job loss while adjusting for the influence of other factors. We included all of the factors we considered to have an impact on job loss and re-employment, which also showed statistical significance in univariate analysis. As for cancer site, stomach cancer, which was the most prevalent cancer and well distributed across sexes, was chosen as the reference cancer site. For the multivariate Cox proportional hazards model, three different models were used depending on sex, because some cancers are sex specific and some cancers were represented by no more than 50 patients, enough to be entered in the model. In the both sexes model, the cancer sites that were included in both the male model and in the female model simultaneously were included. Deaths that occurred before the loss of a job or before re-employment were coded as censored cases. The level of significance was set at $P < .05$. The SAS statistical package (version 8.1)[14] was used for the analyses.

RESULTS

General Characteristics of the Study Patients

Table 1 shows the general characteristics of the study patients at the first baseline, who were diagnosed with cancer for the first time in 2001, and patients at the second baseline, who lost their job within the first year. The total number of patients at the first baseline was 5,396. Among them, 1,398 patients lost their jobs within the first year of the cancer diagnosis.

Time Until Job Loss and Affecting Factors

Among the 5,396 patients who were employed at the baseline, 2,538 patients (47.0%) lost their job over 72 months of follow-up, and 1,398 patients (25.9%) lost their job within the first year. This accounted for 55.1% of the total 2,538 patients who lost their job. The mean time to job loss was 41.4 months (SE = 0.4; Fig 1). The log-rank test showed a different likelihood of job loss according to sex, type of job, and income level. As for different cancer sites, leukemia patients had shortest median time until job loss (Fig 2).

The Cox proportional analysis, after adjusting for age, type of job, income level, and cancer site, demonstrated that the risk of job loss owing to a cancer diagnosis was more common among the younger (younger than 30 years) and older age (older than 50 years) groups, company employees, the lower income group in male, female, and both sexes model (Table 2). For the both sexes model, female patients were more likely to lose their jobs than male patients. Regarding cancer site, lung, brain, and CNS cancer sites and leukemia for male patients and brain and CNS cancer site for female patients, in addition to lung, brain, and CNS cancer site and leukemia in patients of both sexes, had a higher risk of job loss compared with patients with stomach cancer. A lower risk of job loss was associated with larynx and kidney cancer in males patients, leukemia and ovarian cancer in female patients, and thyroid gland cancer in both sexes as compared with stomach cancer.

Time Until Re-Employment and Affecting Factors

Among 1,398 patients who lost their job within the first year (study patients at second baseline), 426 patients (30.5%) were re-employed during the 69 months of follow-up. The mean time to job loss was 45.7 months (SE = 0.7; Fig 3). The log-rank test showed a different likelihood of re-employment based on sex and type of job. Regarding different cancer sites, patients with thyroid cancer had shortest time until 25% of patients were re-employed (Fig 4).

The Cox proportional analysis showed cancer patients of older age (older than 50 years) were less likely to be re-employed. However, the type of job and income level had no significant affect on re-employment in the male model, female model, and both sexes model (Table 2). For the both sexes model, female patients were less likely to be re-employed than male patients. Regarding cancer site, leukemia patients were less likely to be re-employed than were patients with stomach cancer in the male model. For the female model, cancer site was not associated with re-employment. For the both sexes model, patients with liver cancer were less likely to be re-employed, whereas patients with thyroid cancer were more likely to be re-employed compared with patients with stomach cancer.

DISCUSSION

We estimated the effect of the diagnosis of cancer on the employment status in the Korean population. Among all of the study patients who were employed and diagnosed with cancer, 47.0% of patients lost their job during the 72 months of follow-up, and 25.9% of patients lost their job within the first year of the cancer diagnosis. This rate is lower than that reported by Choi et al,[15] which was limited to small sample size and three cancer sites and was conducted only in one cancer center in Korea and is higher than the rate reported in a study from the United States.[16] The reason for these differences is assumed to be different study populations, sample size, and research methods, as well as the different national and social security systems. In the study reported by Short et al[16] conducted in the United States, the study patients were limited to one state in the United States. In a society that does not have a national health insurance system, like the

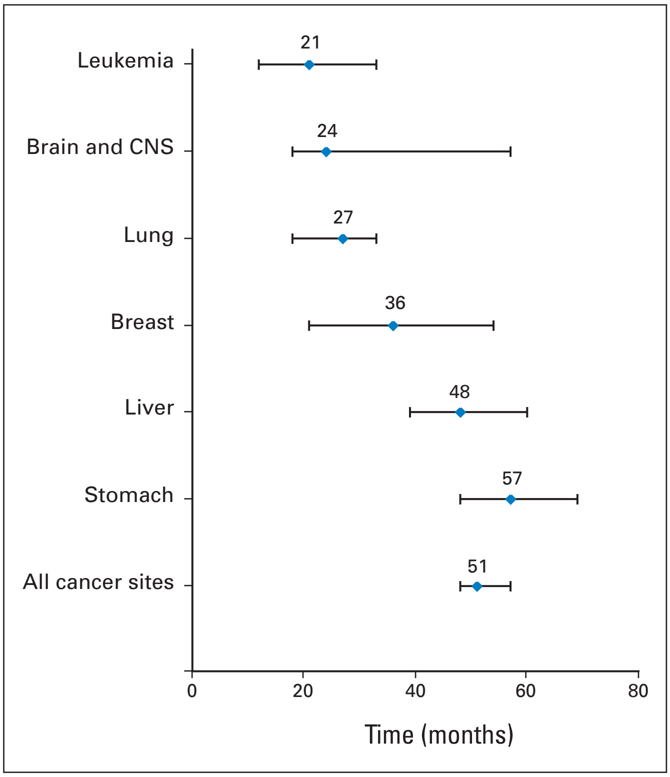

Fig 2. Median time to job loss and 95% CIs according to different cancer sites.

Table 2. Cox Proportional Hazard Analysis According to Demographic and Socioeconomic Characteristics of Patients With Cancer

	Time Until Job Loss of Patients From First Baseline						Time Until Re-Employment of Patients From Second Baseline					
	Male		Female		Both Sexes		Male		Female		Both Sexes	
Characteristic	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Sex												
Male					1.00						1.00	
Female					1.59	1.40 to 1.80					0.56	0.41 to 0.75
Age, years												
25-29	1.00		1.00		1.00		1.00		1.00		1.00	
30-39	0.58	0.45 to 0.74	0.57	0.44 to 0.72	0.68	0.56 to 0.84	0.79	0.49 to 1.27	0.76	0.48 to 1.21	0.83	0.53 to 1.31
40-49	0.65	0.52 to 0.83	0.63	0.50 to 0.80	0.73	0.60 to 0.89	0.72	0.46 to 1.13	0.76	0.49 to 1.18	0.81	0.53 to 1.25
50-55	1.18	0.93 to 1.50	1.13	0.90 to 1.42	1.23	1.01 to 1.50	0.47	0.29 to 0.75	0.51	0.32 to 0.81	0.54	0.34 to 0.56
Type of job												
Public servant	1.00		1.00		1.00		1.00		1.00		1.00	
Company employee	1.43	1.32 to 1.54	1.41	1.31 to 1.52	1.49	1.38 to 1.60	1.18	0.88 to 1.58	1.24	0.93 to 1.65	1.26	0.95 to 1.67
Equivalent household income quintiles												
I (highest)	1.00				1.00		1.00		1.00		1.00	
II	1.33	1.15 to 1.55	1.34	1.15 to 1.56	1.32	1.14 to 1.54	0.76	0.49 to 1.20	0.80	0.51 to 1.25	0.61	0.40 to 0.95
III	2.04	1.77 to 2.36	2.06	1.78 to 2.37	1.95	1.69 to 2.25	1.09	0.74 to 1.61	1.15	0.78 to 1.69	0.91	0.63 to 1.33
IV (lowest)	2.85	2.47 to 3.29	2.89	2.50 to 3.33	2.76	2.40 to 3.18	0.97	0.66 to 1.44	1.00	0.68 to 1.47	0.73	0.50 to 1.06
Cancer site												
Stomach	1.00		1.00		1.00		1.00		1.00		1.00	
Oral cavity and nasopharynx	0.99	0.73 to 1.34					0.66	0.32 to 1.35				
Esophagus	1.18	0.77 to 1.81										
Gallbladder	1.32	0.95 to 1.84					0.91	0.42 to 1.97				
Pancreas	1.23	0.89 to 1.70					0.96	0.45 to 2.08				
Larynx	0.65	0.43 to 0.99										
Prostate	0.59	0.35 to 1.00										
Testis	0.73	0.42 to 1.27										
Kidney	0.66	0.50 to 0.88					1.08	0.56 to 2.07				
Bladder	0.76	0.56 to 1.03					1.02	0.53 to 1.97				
Colon and rectum	1.03	0.88 to 1.20	0.98	0.73 to 1.33	1.04	0.91 to 1.20	0.94	0.66 to 1.35	0.72	0.35 to 1.47	0.96	0.70 to 1.32
Liver	1.11	0.96 to 1.29	1.18	0.77 to 1.80	1.11	0.97 to 1.27	0.68	0.45 to 1.01	1.04	0.74 to 1.46	0.66	0.45 to 0.97
Lung	1.33	1.23 to 1.58	1.03	0.89 to 1.19	1.31	1.12 to 1.53	0.74	0.49 to 1.12	0.74	0.50 to 1.08	0.79	0.55 to 1.16
Brain and CNS	1.35	1.04 to 1.77	1.33	1.13 to 1.56	1.32	1.04 to 1.66	0.54	0.26 to 1.11				
Thyroid gland	0.81	0.61 to 1.07	0.59	0.35 to 1.00	0.72	0.60 to 0.87	1.49	0.86 to 2.57	0.81	0.54 to 1.20	1.50	1.03 to 2.20
Non-Hodgkin's lymphoma	0.97	0.70 to 1.34	0.72	0.42 to 1.25	0.95	0.71 to 1.26	0.76	0.39 to 1.46				
Leukemia	1.50	1.12 to 2.01	0.66	0.50 to 0.87	1.58	1.23 to 2.03	0.25	0.10 to 0.62				
Breast			1.11	0.97 to 1.27					0.99	0.46 to 2.12		
Cervix uteri			1.32	0.95 to 1.82								
Corpus uteri			1.22	0.89 to 1.68								
Ovary			0.65	0.43 to 0.98					1.07	0.50 to 2.29		

NOTE. All variables are adjusted for sex, age, type of job, equivalent household income quintiles, and cancer sites.
Abbreviation: HR, hazard ratio.

United States, the fear of loss of health insurance may be an important consideration in the decision to discontinue working if cancer treatment is expensive and the potential for medical expense is great.[9,17,18] This may have a significant influence on the continuation of work to maintain health coverage. However, that is not the case in Korea, which has a national health insurance system. The return to work after job loss was shown to widely vary in a prior report (30% to 93%). This is also likely due to a high degree of heterogeneity with regard to the patient characteristics, including age range, cancer sites, and treatment modalities.[13]

As for factors affecting the time taken to job loss and time taken to re-employment, the results of this study and a previous study showed some similarities but mostly inconsistencies. This study found that women are more likely to lose their jobs and are less likely to be re-employed than are men. Only one prior study[16] investigated and identified sex disparity in terms of job loss. However, in most previous studies conducted in Western countries, sex was not found to influence the return to work.[13] These findings should be considered with differences of culture between Asian countries and Western countries or differences between newly developed countries and highly developed countries. The presence of women in the labor force has been increasing with industrialization and sex disparities are now vanishing even in conventional Asian countries, but nonetheless, these cultural factors may influence sex disparity. In addition, we found that patients in the older age group (older than 50 years) were more likely to lose their job earlier and were less likely to be re-employed compared with patients in the middle age group (age 30 to 49 years). These results are similar to those reported by Choi et al[15] and Lima et al.[19] However,

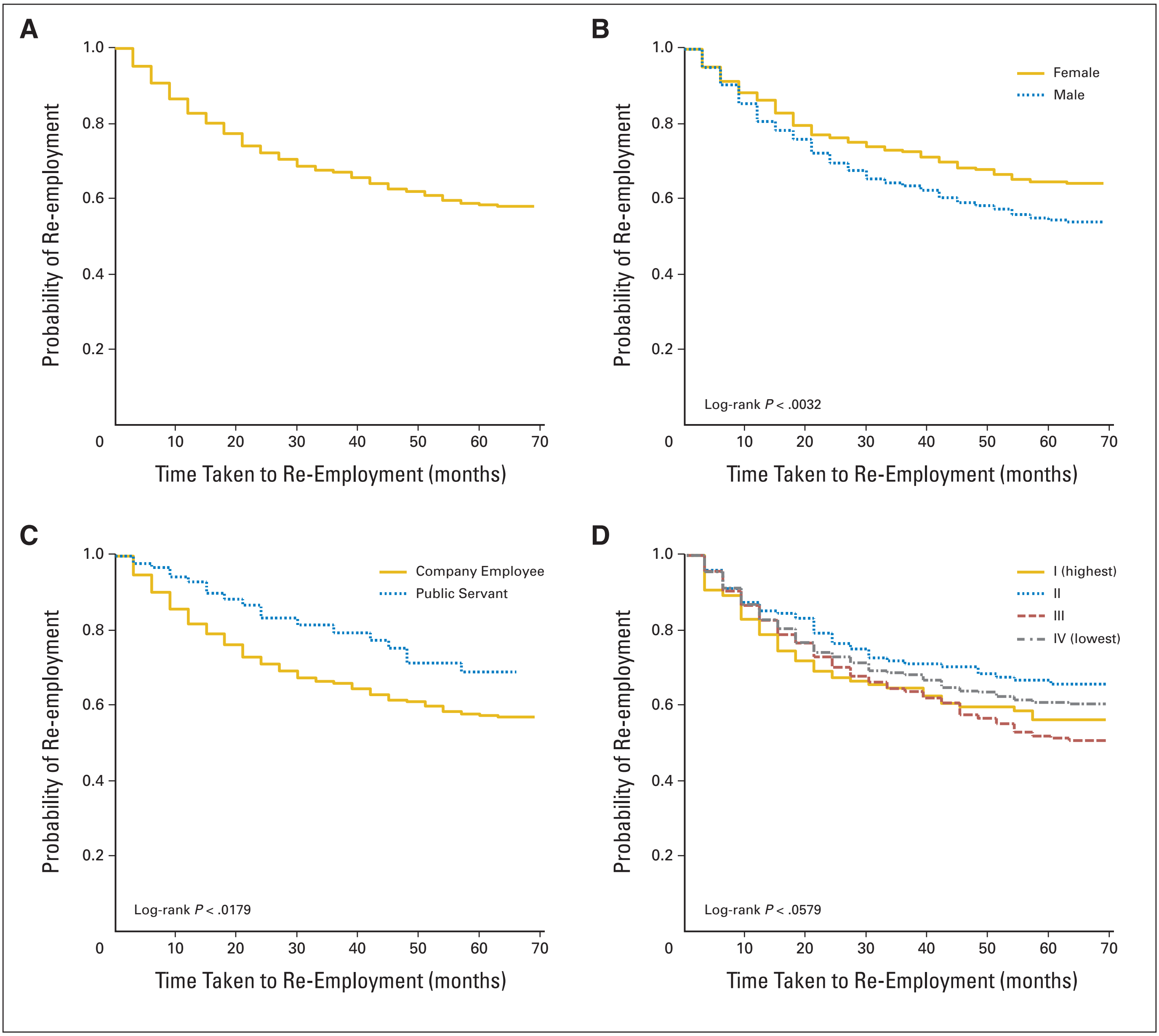

Fig 3. Kaplan-Meier curves: time until re-employment of patients from second baseline (n = 1,358). (A) Total patients; (B) comparison according to sex; (C) comparison according to type of job; and (D) comparison according to equivalent household income quintiles.

other studies found no relationship between age and employment.[11,15] We found that company employees were more likely to lose their jobs earlier than were public servants. This result is consistent with previous studies.[11,15] Prior reports showed that manual workers were more likely to lose their jobs than were sedentary workers[15] and that women who did not belong to a union or who had blue-collar or service industry jobs were most likely to be without a job.[12] It is assumed that company employees are more likely to be subject to the labor market forces than are public servants like manual workers, those who have blue-collar or service industry jobs in other studies. However, one study did not support these findings.[16] We also found that a low-income level was a predictor of early job loss. The same findings were observed in a previous study conducted in Korea.[15] However, interestingly, the income level had no relationship with the time taken for reemployment in this study, and these findings have been frequently reported in previous studies.[13] We found that the higher income groups were more protected than the lower income groups from job loss (eg, availability of sick leave) in Korea. However, the cumulated income or assets of the higher income group might be associated with a longer leave from work, whereas the lower income group might need to return to work to provide income.

In this study, some cancer sites had a statistically significant effect on job loss and re-employment among the cancer patients. Previous studies reported some variation in job loss among different cancer sites and have some similarities with our study results. We found that cancer sites including the lung, brain, and CNS cancer as well as leukemia had a statistically significant effect on early job loss compared with other cancers, which is consistent with the results of

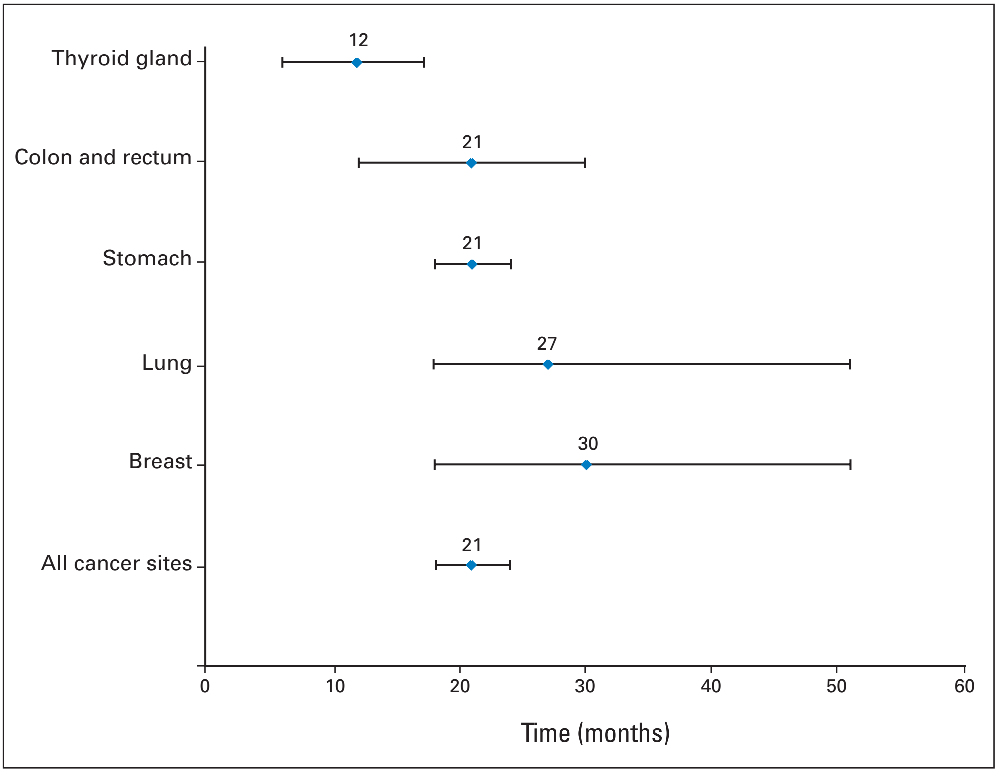

Fig 4. Time taken to 25% of re-employment and 95% CIs according to different cancer sites.

previous studies.[8,13,16,20] Presumably these findings result from cancer-related disease severity, impairment of physical function, and lower survival rates.[21] In particular, patients with nervous system cancer are likely to have problems with perception, cognition, and movement, which are critical functions in most jobs.[8,13] Our results showed that patients with leukemia were more likely to lose their jobs and were less likely to be re-employed than other cancer patients. The treatment for blood cancers or lymphomas generally requires systemic treatment that involves radiation, chemotherapy, and stem-cell transplantation, which may be related with prolonged physical debilitation compared with the localized treatment of early-stage solid tumors.[16] The intensive and long-term treatment courses of patients with leukemia can explain this finding. The relative earlier job loss of patients with lung cancer can be explained by a variety of cancer-related symptoms, lower quality of life,[22] and higher severity, reflected by worst survival rates.[21,22] Similar results were also found in a Finnish study.[20] We also found that patients with liver cancer were less likely to be re-employed than were other cancer patients; this has not been reported in other studies. Liver cancer is one of the most common cancers in Korea because of the high infection rate with the hepatitis B virus.[23] Liver cancer develops relatively early compared with other cancers.[23] This unique epidemiologic situation may explain the delayed employment among this group compared with other cancers. In terms of influence of the cancer site on re-employment, this study and previous studies showed inconsistent results, except for thyroid cancer.[16] The early re-employment of patients with thyroid cancer compared with patients with other cancer sites is presumably due to its less severe clinical course and high survival rate[21] in Korea.

This study has some limitations: First, we could not include other factors, such as cancer stage, treatment modalities, marital status, work-related factors (eg, positive attitude of coworkers), and patient symptoms (eg, fatigue), which were found to be predictors of job loss and re-employment.[13,15] Especially, cancer stage was reported to have inconsistent effects on employment status in each cancer site.[13] Therefore, different cancer stages in each cancer site may have confounding effects on the study results. But the study patients have representative cancer stage distribution and because it is not sampled data, there is no bias owing to unrepresentative cancer stage distribution. In the future, more studies need to be conducted aiming to investigate employment consequences resulting from different cancer sites and stages and their relations. Second, we could not identify the reasons for job loss because of limited data available. There are possibilities that patients with cancer quit their job because of their preference. However, the age range of study patients was 25 to 55 years, which is most prominent working age. Although we could not ask cancer patients the reason for job loss (eg, underlying disease, preference, employer, or social security factors) directly, we could identify potential influencing factors (patients' clinical factors, demographic, socio-economic status, type of job) that have association with the main reason for job loss and re-employment instead. In the future, more studies using different methodology (eg, survey, qualitative study) aiming to investigate the reason for job loss and re-employment in further detail need to be conducted.

Although this study has several limitations, the results provide important information on the work environment of patients with cancer. Disparities according to patients' demographic characteristics and socioeconomic status and inconsistent results of previous studies can be explained by different social security systems and other cultural factors. This means that the disparity of employment can be minimized through establishing social security systems and favorable cultures for cancer patients. Previous studies reveal that most cancer patients received little guidance from their physicians about work.[24] Monitoring of the employment status of cancer patients and greater efforts should be made to reduce unnecessary work cessation, increase the rate of re-employment of cancer survivors, and reduce the disparity between different demographic and socioeconomic groups.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

The author(s) indicated no potential conflicts of interest.

AUTHOR CONTRIBUTIONS

Conception and design: Jae-Hyun Park, Eun-Cheol Park, Sang-Yi Lee
Financial support: Eun-Cheol Park
Administrative support: Eun-Cheol Park, Sang-Yi Lee
Provision of study materials or patients: Sang-Yi Lee
Collection and assembly of data: Jong-Hyock Park, Sung-Gyeong Kim, Sang-Yi Lee
Data analysis and interpretation: Jae-Hyun Park
Manuscript writing: Jae-Hyun Park, Jong-Hyock Park, Sung-Gyeong Kim
Final approval of manuscript: Eun-Cheol Park

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