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Impact of doctor-shopping behavior on patient survival in lung cancer: findings from a 11-year cohort study using Korean claims data

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Abstract

Background This population-based cohort study aimed to explore the impact of doctor-shopping behavior (DSB) on the survival of new patients with lung cancer in Korea to make policy suggestions for the efficient use of medical care for cancer patients.

Methods The cancer cohort data used in this study were obtained from the Korean National Health Insurance Service database, which contains claim records for all cancer patients in Korea between 2009 and 2021. After setting the washout period and exclusion criteria, 280,030 patients were found to be eligible for the analysis. The outcome variables were death within 30 days, 90 days, 1 year, and survival over 5 years after the first diagnosis. DSB, a variable of interest, was defined as the number of visits from the first diagnosis to the first treatment, and was classified into four quartiles. A multiple logistic regression model was used to examine the effects of DSB on the survival of patients with lung cancer.

Results Compared to patients who visited the doctor less than once (Q1), those with 2–9 visits (Q2, Q3) had a lower likelihood of death within 30 days, 90 days, and 1 year, and a higher probability of survival over 5 years. However, patients with more than 10 visits (Q4) had significantly increased odds of death. Moreover, those with excessive doctor shopping had about a 12% decrease in the likelihood of surviving beyond 5 years compared to those with minimal visits (95% CI: 0.85–0.92). Stratified analysis revealed that, especially when patients who are middle class or higher living in metropolitan cities engage in excessive doctor shopping, the likelihood of death within 1 year increases by 14–18%, and the survival rate over 5 years decreases by 12–18%, compared to those who rarely doctor shopped.

Conclusion For patients with lung cancer, moderate doctor shopping can positively affect survival, while excessive visits can increase mortality. This effect was more notable among patients with middle or higher incomes and those living in metropolitan cities. These results highlight the need for policies that regulate the use of medical resources, especially among patients with greater access to medical care, to ensure the efficient utilization of medical care for improved health outcomes.

Keywords Lung cancer, Cancer management, Doctor-shopping behavior, Cancer policy

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Introduction

Cancer remains a critical global public health challenge, with lung cancer as the primary cause of cancer-related mortality. In South Korea, lung cancer is the leading cause of death among all cancer types, necessitating a focused investigation into the factors influencing patient outcomes [1].The incidence of cancer in Korea has been consistently high, and with advancements in diagnostic and treatment technologies, understanding the impact of various health behaviors on patient survival has become a critical area of research [2, 3]. Most notably, the concept of "doctor shopping" or health-seeking behavior has garnered attention within the context of the Korean healthcare system [4].

Doctor shopping refers to a practice in which patients consult multiple healthcare providers to receive multiple medical opinions, prescriptions, or diagnostic tests. This behavior is particularly prevalent in healthcare systems characterized by easy access to multiple specialists, as is the case in Korea [5]. The Korean social insurance system allows for significant medical overuse, which is evident from the comparatively high total healthcare expenses in the country [6]. For cancer patients, the burden is somewhat mitigated by the catastrophic illness policy, which caps the out-of-pocket expenses at 5% of the total medical costs [7]. This policy, while financially protective, may inadvertently encourage the excessive utilization of medical resources, including unnecessary repeated diagnostic tests, such as lung CT scans, reported among lung cancer patients [8].

Despite the awareness of excessive medical usage among cancer patients, comprehensive studies utilizing real-world data to explore these behaviors' impact on lung cancer survival are scarce in Korea [9]. International studies have explored the implications of doctor shopping on patient outcomes, but a nationwide cohort study focusing specifically on lung cancer survival in Korea using claims data has not yet been conducted [10, 11]. This gap in research highlights the need for our study, which aimed to analyze the association between doctor-shopping behaviors (DSB) and survival outcomes in lung cancer patients across Korea [12].

This cohort study used nationwide health insurance claims data to comprehensively assess the impact of DSB among patients with newly diagnosed lung cancer patients [11]. We hypothesized that excessive engagement in DSB, particularly frequent screening and diagnostic procedures, may negatively impact survival rates, contradicting the potential perceived benefits of such practices [8].

Methods

Data and study population

This population-based cohort study used data obtained from the Korean National Health Insurance Service (NHIS) database. Following the introduction of universal health coverage in 1989, all South Korean residents are required to be part of the NHIS, leading to enrollment of approximately 98% of the total population. The NHIS database encompasses information on Korean medical usage, medication prescriptions, sociodemographic details, healthcare provisions, and diagnostic codes based on the International Classification of Disease 10th revision (ICD-10), as determined by clinical standards [13]. The study protocol was reviewed and approved by the Institutional Review Board of Yonsei University Health System and aligned with the principles of the Declaration of Helsinki (IRB Number: 4–2022–1599). Owing to the absence of personally identifiable information in the NHIS database (NHIS-2023–1–456), the requirement for informed consent was waived.

The NHIS cancer cohort data used in this study were obtained from the NHIS database, which contains health insurance claim records for all cancer patients in Korea between 2009 and 2021. Among the 3,992,245 registered cancer patients during the study period, we targeted only new patients diagnosed with primary lung cancer (ICD-10 code: C34) between 2011 and 2021. The initial two years (2009–2010) were designated as the washout period because of the possibility that diagnoses made during this period stemming from pre-existing conditions [14]. In addition, after excluding patients who did not receive any surgery, radiation therapy, or chemotherapy, and those who were under 19 years of age or had missing values, 280,030 patients were finally eligible for analysis (Fig. 1).

Variables

The outcome variable was the survival of patients with lung cancer, which was determined using the following binary variables: mortality within 30 days, mortality within 90 days, mortality within 1 year, and survival over 5 years after the initial cancer treatment (such as surgery, radiation therapy, or chemotherapy). The main variable of interest was set as doctor-shopping behaviors (DSBs) to identify the medical overuse behavior of patients with new-onset lung cancer. We operationally defined DSB as the number of visits to a general hospital or a higher-level medical facility from the first diagnosis of lung cancer until the first treatment (surgery, radiation therapy, or chemotherapy). Specifically, the number of doctor-shopping among all study participants was classified into 4 quartiles as follows: Q1: 0–1 times, Q2: 2–4 times, Q3: 5–9 times, Q4: 10 or more times.

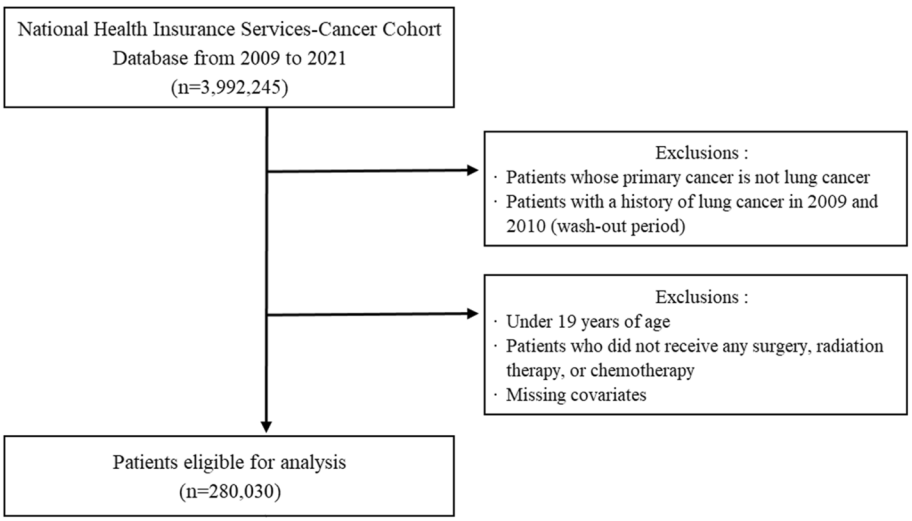

Fig. 1 Flow chart of sample selection

As covariates, we adjusted for sociodemographic factors, health-status-related variables, and diagnosis and treatment history. Socio-demographic factors included sex (men and women), age (range: 19–29, 30–39, 40–49, 50–59, 60–69, and ≥ 70), type of medical insurance (workplace-insured, self-insured, and medical aid), region (metropolitan cities and small cities and rural areas). As health status-related variables, we included disability status (yes or no), and Charlson comorbidity index (CCI) (range: 0 and ≥ 1) that calculated scores for comorbidities other than lung cancer [15, 16]. In addition, the analysis accounted for the patients' first cancer treatment method (surgery, radiation therapy, or chemotherapy), the number of medical uses in the year before the first cancer diagnosis (< median, and ≥ median), and the year of first cancer diagnosis (2011–2021).

Statistical analysis

We performed a chi-square test to examine the baseline characteristics and compare the distribution of the study population. Descriptive statistics for all variables included in the analysis are presented as frequencies (*N*) and percentages (%). Subsequently, a multiple logistic regression model was applied to explore the factors associated with the survival of patients with lung cancer, especially the impact of DSB on patient survival. As the key results, we estimated the adjusted odds ratios (aORs) and 95% confidence intervals (CIs). For all statistical analyses, SAS software (version 9.4; SAS Institute Inc., Cary, NC, USA) was used, with the significance threshold set at $P < 0.05$.

Ethics statement

The study protocol was reviewed and approved by the Institutional Review Board of Yonsei University's Health System and adhered to the principles of the Declaration of Helsinki (IRB Number: 4–2022–1599). Due to the absence of personally identifiable details in the NHIS database (NHIS–2023–1–456), the requirement for informed consent was waived.

Results

Table 1 presents the baseline characteristics of the study population in the year of first lung cancer diagnosis. Of the 280,030 individuals eligible for analysis, the largest percentage consisted of men (66.9%), those aged ≥ 70 years (39.5%), those with high income (43.0%), workplace-insured people (64.0%), residents of metropolitan cities (87.0%), people without disabilities (87.3%), those without comorbidities other than lung cancer (80.3%), and those who underwent surgery as their first treatment (51.7%). In addition, there was a significant difference in DSB between all general characteristics ($p < 0.0001$).

Table 2 depicts the distribution of the study population according to the outcome variables. Among new-onset lung cancer patients during the study period, 2.8% died within 30 days, 10.7% died within 90 days, 27.5% died within 1 year, and 54.4% survived for more than 5 years. Particularly, a high mortality rate was observed in patients who engaged in extensive doctor shopping between their first diagnosis of lung cancer and their first treatment.

Table 1 Baseline characteristics of the study population

Characteristics	Doctor-shopping behavior (quartile, times)										*p*-value
	Total		Q1 (0—1)		Q2 (2—4)		Q3 (5—9)		Q4 (10 +)		
	n	%	n	%	n	%	n	%	n	%	
Sex											< .0001
Men	187,408	66.9	48,804	26.0	41,466	22.1	49,768	26.6	47,370	25.3	
Women	92,622	33.1	30,176	32.6	21,928	23.7	21,762	23.5	18,756	20.3	
Age (years)											< .0001
19—29	588	0.2	238	40.5	132	22.4	98	16.7	120	20.4	
30—39	3,098	1.1	1,024	33.1	720	23.2	590	19.0	764	24.7	
40—49	14,700	5.2	4,718	32.1	3,526	24.0	3,050	20.7	3,406	23.2	
50—59	53,600	19.1	16,160	30.1	13,076	24.4	12,264	22.9	12,100	22.6	
60—69	97,392	34.8	27,560	28.3	22,028	22.6	25,052	25.7	22,752	23.4	
≥ 70	110,652	39.5	29,280	26.5	23,912	21.6	30,476	27.5	26,984	24.4	
Income level											< .0001
Low	80,888	28.9	23,008	28.4	17,848	22.1	20,340	25.1	19,692	24.3	
Middle	78,750	28.1	22,150	28.1	17,782	22.6	19,652	25.0	19,166	24.3	
High	120,392	43.0	33,822	28.1	27,764	23.1	31,538	26.2	27,268	22.6	
Type of Medical Insurance											< .0001
Workplace-insured	179,100	64.0	50,330	28.1	41,276	23.0	46,066	25.7	41,428	23.1	
Self-insured	87,284	31.2	24,558	28.1	19,408	22.2	22,104	25.3	21,214	24.3	
Medical Aid	13,646	4.9	4,092	30.0	2,710	19.9	3,360	24.6	3,484	25.5	
Region											< .0001
Metropolitan cities	243,676	87.0	69,484	28.5	55,046	22.6	61,914	25.4	57,232	23.5	
Small cities and rural areas	36,354	13.0	9,496	26.1	8,348	23.0	9,616	26.5	8,894	24.5	
Disability											< .0001
Yes	35,582	12.7	9,670	27.2	7,650	21.5	9,360	26.3	8,902	25.0	
No	244,448	87.3	69,310	28.4	55,744	22.8	62,170	25.4	57,224	23.4	
Charlson Comorbidity Index											< .0001
0	224,954	80.3	57,720	25.7	53,642	23.8	61,136	27.2	52,456	23.3	
≥ 1	55,076	19.7	21,260	38.6	9,752	17.7	10,394	18.9	13,670	24.8	
First treatment method											< .0001
Surgery	144,728	51.7	52,682	36.4	36,392	25.1	40,376	27.9	15,278	10.6	
Radiation therapy	135,206	48.3	26,268	19.4	26,978	20.0	31,144	23.0	50,816	37.6	
Chemotherapy	96	0.0	30	31.3	24	25.0	10	10.4	32	33.3	
Medical uses in the year before cancer diagnosis											< .0001
< median	135,378	48.3	37,168	27.5	32,624	24.1	34,690	25.6	30,896	22.8	
≥ median	144,652	51.7	41,812	28.9	30,770	21.3	36,840	25.5	35,230	24.4	
Year of first cancer diagnosis											< .0001
2011	28,810	10.3	7,596	26.4	8,016	27.8	4,300	14.9	8,898	30.9	
2012	20,196	7.2	6,470	32.0	4,710	23.3	4,044	20.0	4,972	24.6	
2013	20,904	7.5	6,590	31.5	4,898	23.4	4,414	21.1	5,002	23.9	
2014	22,296	8.0	6,598	29.6	5,322	23.9	5,210	23.4	5,166	23.2	
2015	22,890	8.2	6,004	26.2	5,666	24.8	5,852	25.6	5,368	23.5	
2016	25,282	9.0	6,492	25.7	6,140	24.3	6,814	27.0	5,836	23.1	
2017	26,780	9.6	6,494	24.2	6,244	23.3	7,600	28.4	6,442	24.1	
2018	28,256	10.1	6,838	24.2	6,162	21.8	8,324	29.5	6,932	24.5	
2019	29,330	10.5	7,826	26.7	5,842	19.9	8,496	29.0	7,166	24.4	
2020	28,616	10.2	9,012	31.5	5,384	18.8	7,982	27.9	6,238	21.8	
2021	26,670	9.5	9,060	34.0	5,010	18.8	8,494	31.8	4,106	15.4	
Total	280,030	100.0	78,980	28.2	63,394	22.6	71,530	25.5	66,126	23.6	

Abbreviations: *DSB* doctor-shopping behavior

Table 2 Distribution of study population on outcome variables

Variables	Total		30-day mortality				90-day mortality				1-year mortality				5-year survival			
			Yes		No		Yes		No		Yes		No		Yes		No	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
DSB (quartile, times)																		
Q1 (0—1)	78,980	28.2	2,120	2.7	76,860	97.3	7,868	10.0	71,112	90.0	18,764	23.8	60,216	76.2	47,988	60.8	30,992	39.2
Q2 (2—4)	63,394	22.6	1,516	2.4	61,878	97.6	5,234	8.3	58,160	91.7	14,408	22.7	48,986	77.3	37,320	58.9	26,074	41.1
Q3 (5—9)	71,530	25.5	1,158	1.6	70,372	98.4	4,552	6.4	66,978	93.6	13,574	19.0	57,956	81.0	44,326	62.0	27,204	38.0
Q4 (10+)	66,126	23.6	3,174	4.8	62,952	95.2	12,408	18.8	53,718	81.2	30,392	46.0	35,734	54.0	22,646	34.2	43,480	65.8
Total	280,030	100.0	7,968	2.8	272,062	97.2	30,062	10.7	249,968	89.3	77,138	27.5	202,892	72.5	152,280	54.4	127,750	45.6

The results of each analysis of the impact of DSB on mortality and survival of lung cancer patients are shown in Tables 3 and 4. Compared to patients who visited the doctor less than once (Q1), patients who had 2–9 visits (Q2, Q3) showed a notably lower likelihood of death within 30 days, 90 days, and 1 year, while also exhibiting a higher probability of survival over 5 years. Meanwhile, it was verified that probability of death increased significantly for patients who made more than 10 visits to the doctor (Q4) between their first diagnosis and first treatment (30-day mortality, aOR: 1.05, 95% CI: 0.97–1.15; 90-day mortality, aOR: 1.06, 95% CI: 1.01–1.12; 1-year mortality, aOR: 1.13, 95% CI: 1.09–1.18). Moreover, it was estimated that patients engaging in excessive doctor visits, in contrast to those with minimal visits, encountered approximately a 12% decrease in the likelihood of surviving beyond 5 years (aOR: 0.88, 95% CI: 0.85–0.92).

We anticipated that income level and residential region would have a potential impact on DSB and survival of patients with lung cancer. Therefore, we conducted a stratified analysis based on income level and region (Table 5). A noticeable gap in outcomes according to DSB was observed between patients with high incomes and those living in metropolitan cities. When patients who are middle class or higher or living in metropolitan cities engage in excessive doctor shopping, the likelihood of death within 1 year increases by 14–18% (middle-income, aOR: 1.18, 95% CI: 1.10–1.27; high-income, aOR: 1.14, 95% CI: 1.07–1.21; residents of metropolitan cities, aOR: 1.16, 95% CI: 1.11–1.21) and the survival rate over 5 years decreases by 12–18% (middle-income, aOR: 0.82, 95% CI:: 0.76–0.88; high-income, aOR: 0.87, 95% CI: 0.82–0.93; residents of metropolitan cities, aOR: 0.88, 95% CI: 0.84–0.91), compared to those who rarely doctor shopped (Q1).

Discussion

In Korea, the growing challenges of an aging population and increasing number of cancer cases are placing an increasing social burden. In response, the Korean government has implemented a robust health insurance system that requires cancer patients to pay only 5% of their total medical expenses, aiming to alleviate their financial burden [17]. However, this initiative has led to the overuse of medical care by cancer patients, which in turn is straining the national health insurance financially. Against this background, this cohort study aimed to investigate the impact of DSB on the survival of patients with new-onset lung cancer with the objective of providing evidence-based policy suggestions.

The key findings of this study are outlined as follows. First, we found that patients with lung cancer patients engaging in an appropriate amount of doctor-shopping tend to show improved survival rates. This study suggests that visiting the hospital less than 9 times before receiving the first treatment, for purposes such as checkups and consultations, is indicative of proactive health-seeking behavior among patients with lung cancer. Second, this study confirmed that patients who excessively sought multiple doctors before initiating their first treatment, specifically those who visited hospitals more than 10 times, had a notably higher risk of mortality. Consequently, it is anticipated that excessive DSB will not only adversely affect patients' health outcomes by potentially delaying timely initial treatment but will also contribute to an increase in unnecessary medical expenses. Third, an association between excessive DSB and higher mortality was observed in patients who are middle class or higher or living in metropolitan cities. For patients with ample access to medical services or willingness to cover substantial medical costs, doctor shopping is relatively easier and less burdensome. However, their medical utilization behavior primarily led to the unnecessary consumption of medical resources without significantly improving their health outcomes.

This study demonstrated several important commonalities and distinctions compared with previous research on similar topics. For example, earlier studies have highlighted the negative impact of doctor shopping on patient outcomes [18, 19]; however, our research provides

Table 3 Results of factors associated with mortality of lung cancer patients

Variables	30-day mortality				90-day mortality				1-year mortality			
	aOR	95% CI			aOR	95% CI			aOR	95% CI		
DSB (quartile, times)												
Q1 (0—1)	1.00				1.00				1.00			
Q2 (2—4)	0.80*	(0.72	-	0.88)	0.68*	(0.65	-	0.72)	0.70*	(0.67	-	0.73)
Q3 (5—9)	0.54*	(0.48	-	0.60)	0.51*	(0.48	-	0.54)	0.53*	(0.51	-	0.56)
Q4 (10 +)	1.05	(0.97	-	1.15)	1.06*	(1.01	-	1.12)	1.13*	(1.09	-	1.18)
Sex												
Men	1.00				1.00				1.00			
Women	0.65*	(0.60	-	0.71)	0.64*	(0.62	-	0.67)	0.59*	(0.57	-	0.61)
Age												
19—29	1.00				1.00				1.00			
30—39	1.33	(0.40	-	4.38)	1.02	(0.58	-	1.78)	1.20	(0.80	-	1.80)
40—49	1.16	(0.37	-	3.66)	0.97	(0.57	-	1.64)	1.07	(0.73	-	1.57)
50—59	1.32	(0.42	-	4.10)	0.98	(0.58	-	1.66)	1.22	(0.84	-	1.79)
60—69	1.73	(0.56	-	5.39)	1.35	(0.80	-	2.28)	1.54*	(1.05	-	2.25)
≥ 70	2.63	(0.84	-	8.18)	2.05*	(1.22	-	3.47)	2.43*	(1.66	-	3.54)
Income level												
Low	1.13*	(1.04	-	1.22)	1.15*	(1.09	-	1.20)	1.18*	(1.14	-	1.23)
Middle	1.15*	(1.06	-	1.24)	1.06*	(1.01	-	1.11)	1.10*	(1.06	-	1.14)
High	1.00				1.00				1.00			
Type of Medical Insurance												
Workplace-insured	1.00				1.00				1.00			
Self-insured	1.06	(0.99	-	1.14)	1.06*	(1.02	-	1.10)	1.05*	(1.02	-	1.08)
Medical Aid	1.06	(0.91	-	1.23)	1.12*	(1.03	-	1.22)	1.21*	(1.13	-	1.30)
Region												
Metropolitan cities	1.00				1.00				1.00			
Small cities and rural areas	0.99	(0.90	-	1.08)	0.98	(0.93	-	1.03)	1.01	(0.97	-	1.05)
Disability												
Yes	1.05	(0.96	-	1.15)	1.03	(0.98	-	1.08)	1.06*	(1.01	-	1.10)
No	1.00				1.00				1.00			
Charlson Comorbidity Index												
0	1.00				1.00				1.00			
≥ 1	1.36*	(1.27	-	1.46)	1.40*	(1.34	-	1.46)	1.43*	(1.38	-	1.48)
First treatment method												
Surgery	1.00				1.00				1.00			
Radiation therapy	6.00*	(5.42	-	6.64)	9.67*	(9.11	-	10.26)	13.92*	(13.41	-	14.45)
Chemotherapy	11.49*	(4.80	-	27.53)	15.71*	(8.64	-	28.57)	9.44*	(5.26	-	16.94)
Medical uses in the year before cancer diagnosis												
< median	1.00				1.00				1.00			
≥ median	1.03	(0.96	-	1.10)	1.02	(0.98	-	1.06)	1.03*	(1.00	-	1.06)
Year of first cancer diagnosis												
2011	1.00				1.00				1.00			
2012	0.87	(0.76	-	1.00)	0.92*	(0.85	-	0.99)	0.93*	(0.87	-	0.99)
2013	0.92	(0.80	-	1.05)	0.93	(0.87	-	1.01)	0.88*	(0.83	-	0.94)
2014	0.85*	(0.75	-	0.97)	0.91*	(0.84	-	0.98)	0.86*	(0.81	-	0.92)
2015	0.78*	(0.68	-	0.89)	0.79*	(0.73	-	0.86)	0.78*	(0.73	-	0.83)
2016	0.76*	(0.67	-	0.87)	0.77*	(0.72	-	0.84)	0.73*	(0.69	-	0.78)
2017	0.68*	(0.59	-	0.78)	0.70*	(0.64	-	0.75)	0.64*	(0.60	-	0.68)
2018	0.64*	(0.56	-	0.73)	0.66*	(0.61	-	0.71)	0.57*	(0.54	-	0.61)
2019	0.57*	(0.50	-	0.65)	0.59*	(0.55	-	0.64)	0.51*	(0.48	-	0.54)
2020	0.57*	(0.50	-	0.66)	0.57*	(0.52	-	0.61)	0.46*	(0.44	-	0.49)
2021	0.45*	(0.38	-	0.53)	0.43*	(0.40	-	0.48)	0.18*	(0.17	-	0.20)

Abbreviations: *DSB* doctor-shopping behavior, *aOR* adjusted odds ratio, *CI* confidence interval

* *p*-value < 0.05

Table 4 Results of factors associated with survival of lung cancer patients

Variables	5-year survival			
	aOR	95% CI		
DSB (quartile, times)				
Q1 (0—1)	1.00			
Q2 (2—4)	1.31*	(1.26	-	1.36)
Q3 (5—9)	1.39*	(1.34	-	1.45)
Q4 (10 +)	0.88*	(0.85	-	0.92)
Sex				
Men	1.00			
Women	1.97*	(1.91	-	2.03)
Age				
19—29	1.00			
30—39	0.66*	(0.47	-	0.94)
40—49	0.73	(0.52	-	1.01)
50—59	0.72*	(0.52	-	0.99)
60—69	0.54*	(0.39	-	0.75)
≥ 70	0.31*	(0.23	-	0.43)
Income level				
Low	0.84*	(0.81	-	0.87)
Middle	0.89*	(0.86	-	0.92)
High	1.00			
Type of Medical Insurance				
Workplace-insured	1.00			
Self-insured	0.95*	(0.92	-	0.97)
Medical Aid	0.73*	(0.68	-	0.79)
Region				
Metropolitan cities	1.00			
Small cities and rural areas	0.93*	(0.89	-	0.97)
Disability				
Yes	0.80*	(0.77	-	0.84)
No	1.00			
Charlson Comorbidity Index				
0	1.00			
≥ 1	0.65*	(0.63	-	0.67)
First treatment method				
Surgery	1.00			
Radiation therapy	0.07*	(0.07	-	0.07)
Chemotherapy	0.17*	(0.08	-	0.36)
Medical uses in the year before cancer diagnosis				
< median	1.00			
≥ median	0.95*	(0.93	-	0.98)
Year of first cancer diagnosis				
2011	1.00			
2012	1.11*	(1.04	-	1.19)
2013	1.10*	(1.03	-	1.17)
2014	1.18*	(1.11	-	1.26)
2015	1.31*	(1.23	-	1.40)
2016	1.48*	(1.39	-	1.58)
2017	1.91*	(1.80	-	2.03)
2018	2.94*	(2.76	-	3.12)
2019	4.55*	(4.27	-	4.84)
2020	4.71*	(4.16	-	5.28)
2021	5.65*	(5.16	-	6.29)

Abbreviations: *DSB* doctor-shopping behavior, *aOR* adjusted odds ratio, *CI* confidence interval

* *p*-value < 0.05

stronger evidence through a nationwide data-based analysis [20]. While other studies focused on small samples or specific regions, our study enhances the generalizability of the results by using a broader demographic dataset [21, 22]. A unique distinguishing feature of our research is the detailed, segmented analysis of the frequency of doctor shopping and its specific impact on survival rates. This provides more granular data for policymakers for making informed adjustments [23].

Our findings revealed that excessive doctor shopping can negatively affect the survival rates of patients with lung cancer. Particularly in countries like Korea, where aging is rapidly progressing, the prevalence of such behaviors could lead to an escalation in medical costs and exacerbate the financial strain on health insurance systems [24, 25]. Therefore, it is crucial for policymakers to implement public health policies aimed at reducing DSB, such as policies that improve medical accessibility and encourage efficient use of medical resources [26, 27]. In addition, it is necessary to enhance the quality of medical services and conduct educational and awareness campaigns to prevent patients from unnecessarily visiting multiple doctors. Our results may be generalizable to countries with similar demographic structures and single-insurer system, such as Korea.

This study had certain limitations. First, the NHIS claims data we obtained were primarily constructed for administrative purposes; therefore, there were several limitations to employing them in academic research. The ICD-10 codes documented for health insurance claims may lack intricate clinical details regarding patient conditions. In addition, the possibility of incomplete coding exists, potentially resulting in the misclassification of variables, which is a notable concern. Second, although cancer stage greatly influences the survival of patients with lung cancer, this crucial information was not included in our analysis, which makes it difficult to determine the severity; we instead adjusted for the first treatment method, CCI score, and medical utilization behavior before cancer diagnosis. Follow-up studies should be conducted based on national cancer big data,

Table 5 Results of stratified analysis by income level and region

Variables	DSB (quartile, times)			
	30-day mortality (aOR, 95% CI)			
	Q1 (0—1)	Q2 (2—4)	Q3 (5—9)	Q4 (10 +)
Income level				
Low	1.00	0.79 (0.66–0.94)	0.53 (0.44–0.65)	1.10 (0.95–1.27)
Middle	1.00	0.83 (0.69–0.99)	0.54 (0.45–0.66)	1.04 (0.89–1.21)
High	1.00	0.79 (0.67–0.92)	0.54 (0.45–0.64)	1.03 (0.90–1.18)
Region				
Metropolitan cities	1.00	0.82 (0.74–0.92)	0.55 (0.49–0.62)	1.04 (0.95–1.14)
Small cities and rural areas	1.00	0.66 (0.51–0.85)	0.48 (0.36–0.64)	1.14 (0.92–1.48)
Variables	**90-day mortality (aOR, 95% CI)**			
	Q1 (0—1)	**Q2 (2—4)**	**Q3 (5—9)**	**Q4 (10 +)**
Income level				
Low	1.00	0.67 (0.60–0.73)	0.50 (0.45–0.56)	1.07 (0.98–1.16)
Middle	1.00	0.72 (0.65–0.80)	0.54 (0.48–0.60)	1.08 (0.99–1.19)
High	1.00	0.68 (0.62–0.74)	0.49 (0.45–0.54)	1.05 (0.97–1.14)
Region				
Metropolitan cities	1.00	0.69 (0.65–0.73)	0.51 (0.48–0.54)	1.07 (1.02–1.13)
Small cities and rural areas	1.00	0.65 (0.56–0.75)	0.48 (0.41–0.56)	1.01 (0.89–1.14)
Variables	**1-year mortality (aOR, 95% CI)**			
	Q1 (0—1)	**Q2 (2—4)**	**Q3 (5—9)**	**Q4 (10 +)**
Income level				
Low	1.00	0.70 (1.65–0.75)	0.52 (0.48–0.56)	1.09 (1.02–1.17)
Middle	1.00	0.73 (0.67–0.79)	0.53 (0.49–0.58)	1.18 (1.10–1.27)
High	1.00	0.69 (0.64–0.73)	0.54 (0.51–0.58)	1.14 (1.07–1.21)
Region				
Metropolitan cities	1.00	0.70 (0.67–0.73)	0.54 (0.51–0.56)	1.16 (1.11–1.21)
Small cities and rural areas	1.00	0.69 (0.62–0.77)	0.50 (0.45–0.56)	0.96 (0.89–1.09)
Variables	**5-year survival (aOR, 95% CI)**			
	Q1 (0—1)	**Q2 (2—4)**	**Q3 (5—9)**	**Q4 (10 +)**
Income level				
Low	1.00	1.34 (1.24–1.44)	1.55 (1.44–1.66)	0.96 (0.89–1.03)
Middle	1.00	1.27 (1.18–1.37)	1.41 (1.30–1.52)	0.82 (0.76–0.88)
High	1.00	1.30 (1.23–1.39)	1.29 (1.21–1.37)	0.87 (0.82–0.93)
Region				
Metropolitan cities	1.00	1.29 (1.24–1.35)	1.39 (1.33–1.45)	0.88 (0.84–0.91)
Small cities and rural areas	1.00	1.39 (1.25–1.56)	1.45 (1.30–1.61)	0.92 (0.82–1.03)

in which all medical use information, including specific stages, treatment methods, and non-covered prescriptions, is added to the health insurance claim data. Third, although we made efforts to account for potential factors that could influence the outcome, it is important to acknowledge that this study could not entirely eliminate the possibility of residual confounding effects stemming from variables that were not measured. Finally, the DSB in patients with lung cancer explored in this study is expected to be due to the uniqueness of the Korean medical system, and there may be limitations in generalizing our findings to other countries.

Conclusion

Our findings identified that appropriate doctor shopping among patients with lung cancer in Korea may have a positive effect on their survival; however, excessive visits actually increase mortality. The association between

excessive DSBs and higher mortality was particularly pronounced among patients with middle or higher incomes and those living in metropolitan cities. These results underscore the issue of medical overuse among patients with better access to medical care and suggest the necessity of policies to ensure the efficient utilization of medical resources for improved health outcomes.

Abbreviations

DSB	Doctor-shopping behavior
NHIS	National Health Insurance Service
ICD-10	International Classification of Disease 10th revision
CCI	Charlson comorbidity index
OR	Odds ratio
CI	Confidence interval

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Authors' contributions
Conceptualization: Hong M, Yun I. Data curation: Yun I. Formal analysis: Yun I. Funding acquisition: Moon JY. Investigation: Hong M. Methodology: Hong M, Yun I. Software: Yun I, Validation: Moon JY. Visualization: Yun I. Writing—original draft: Hong M, Yun I. Writing—review & editing: Hong M, Yun I, Moon JY.

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Data availability
The data that support the findings of this study are available from the Korean National Health Insurance System (NHIS) but restrictions apply to availability of these data, which were used under permission for the current study, and so are not publicly available.

Declarations

Ethics approval and consent to participate
The study protocol was reviewed and approved by the Institutional Review Board of Yonsei University Health System and aligned with the principles of the Declaration of Helsinki (IRB Number: 4–2022-1599). Owing to the absence of personally identifiable information in the NHIS database (NHIS-2023–1-456), the requirement for informed consent was waived.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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