RESEARCH ARTICLE

Copayment Policy Effects on Healthcare Spending and Utilization by Korean Lung Cancer Patients at End of Life: A Retrospective Cohort Design 2003-2012

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Abstract

Background: In Korea, the National Health Insurance program has initiated various copayment policies over a decade in order to alleviate patient financial burden. This study investigated healthcare spending and utilization in the last 12 months of life among patients who died with lung cancer by various copayment policy windows. Materials and Methods: We performed a retrospective cohort study using nationwide lung cancer health insurance claims data from 2002 to 2012. We used descriptive and multivariate methods to compare spending measured by total costs, payer costs, copayments, and utilization (measured by length of stay or outpatient days). Using 1,4417,380 individual health insurance claims (inpatients: 673,122, outpatients: 744,258), we obtained aggregated healthcare spending and utilization of 155,273 individual patient (131,494 inpatient and 103,855 outpatient) records. Results: National spending and utilization is growing, with a significant portion of inpatient healthcare spending and utilization occurring during the end-of-life period. Specifically, inpatients were more likely to have more spending and utilization as they got close to death. As coverage expanded, copayments decreased, but overall costs increased due to increased utilization. The trends were the same in both inpatient and outpatient services. Multivariate analysis confirmed the associations. Conclusions: We found evidence of the higher end of life healthcare spending and utilizations in lung cancer patients occurring as coverage expanded. The practice pattern within a hospital might be influenced by coverage policies. Health policy makers should consider initiating various health policies since these influence the long-term outcomes of service performance and overall healthcare spending and utilization.

Keywords: Lung cancer - copayment policy - length of stay - costs-sharing - healthcare spending

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Introduction

Cancer is the leading cause of death in Korea since 1983 (Statistics Korea,2012) and is associated with the largest disease burden (Yoon et al., 2007; Kimman et al., 2012). Of cancers, lung cancer has one of the highest fatality rates, and is the leading cause of cancer-related mortality in the South Korea (Shin et al., 2012) and worldwide (Jemal et al., 2011). The latest statistics showed that numbers of incident lung cancer cases were 20,711 (out of 202,053, 71% male), deaths were 15,623 (out of 72,046, 73% male), and prevalent lung cancer cases were 43,564 (out of 960,654, 66% male) during 2010 in Korea (Jung et al., 2013). In Korea for 2010, 72,046 cancer deaths were reported, with lung cancer accounting for 28.2% of all deaths, the highest cancer fatality rate in both male and female. Five-year survival rates for lung cancer are under 20% and average survival is about six months, one of the lowest survival rates, because most patients have advanced-stage lung cancer at their initial diagnosis (Jung et al., 2013).

Healthcare in general and cancer care in particular is very expensive (Meropol and Schulman, 2007). Moreover, advancement of new cancer diagnostics and treatments contributed to rising costs for cancer care as well (Sullivan et al., 2011). Evidence from other countries shows costs rising at a rate outpacing inflation and consuming an increasing share of expenditures at all budgetary levels in almost all countries. Simultaneously there are rising questions of cost-benefit for the proven interventions by individual or society level (Sullivan et al., 2011). It is ideal that more effective and less toxic cares should be initiated , but the price of those innovations are required further costs unfortunately (DiMasi et al., 2003). Furthermore, health

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care utilization is associated with dying, suggesting that a large proportion of expenditures occur in the last few months prior to death (Lubitz and Prihoda, 1984; McCall, 1984; Scitovsky, 1984). In the United States, healthcare spending in the last year of life consumes approximately 27% of the Medicare budget and has done so consistently over the past decades (Lubitz and Riley, 1993).

The Korean government introduced mandatory social health insurance for employees of large corporations in 1977 and achieved universal health insurance program in 1988 (Jeon and Kwon, 2013). However, even with the universal coverage through the mandatory National Health Insurance (NHI), only 58.2% of total health expenditures are associated with the public sector, comparing to 72.2% for OECD countries as of 2010 (OECD, 2012). Korea also faces with health care spending issue that the highest rate of growth, more than twice the OECD average (OECD, 2012). NHI members still need to pay high out-of-pocket payment (copayments) and full payment for uncovered services, to some extent related to fee-for-service reimbursement system that might supplier induces demand and relatively fast adoption of state-of-art technologies (Kwon, 2009).

Since cancer is associated with expensive treatments, drugs, and other diagnostic procedures, NHI initiated various copayment policies over a decade to alleviate patients' financial burden. In January 2004, NHI initiated a copayment policy that limits copayments to 20% for cancer patients in outpatient services where normal copay is 50%. In September 2005, the coverage was expanded to 10% copayments for both inpatient and outpatient services for cancer patients. In December 2009, the coverage was expanded again to 5% copayments for both inpatient and outpatient services. The landmark RAND Health Insurance Experiment conducted in the late 1970s randomized families to different health insurance plans that varied in their cost-sharing. They found that families subjected to higher cost-sharing reduced the use of health services virtually across the board, including fewer physician visits and fewer adult inpatient hospital stays, less preventive and non-preventive care, and less use of both effective and non-effective care (Leibowitz et al., 1985; Lohr et al., 1986; Newhouse, 2004). There are similar findings in a pediatric population (Sen et al., 2012).

The effects of increased cost-sharing on use of health services are well-documented, but the impact of expansion of insurance coverage on healthcare spending and utilizations is less researched (You et al., 2013). In the roughly 10 years since the policy was first implemented, there has been no comprehensive nationwide investigation into the effect of the coverage expansions. This study aims to fill this gap by exploring how expanded national insurance coverage during the past decade impacted health care service spending and utilization at the end of life for lung cancer patients.

Materials and Methods

Data collection and construction

We collected all nationwide lung cancer inpatient and outpatient claims data between 2002 and 2012 to investigate health care spending, utilizations, and associations with copayment policies. Lung cancer patients were defined by ICD-10 (International Classification of Diseases-10) codes C33-C34. This dataset contained health insurance claim details including total inpatient/outpatient costs, patients' copayments, and payer costs. Furthermore, length of stay, outpatient days for each inpatient, and outpatient claims were included. Other variables include admission/outpatient visit date, date of death, age, sex, ICU days and days on ventilator during hospitalization.

To measure the severity of disease, we calculated the progression of lung cancer using the dataset. With the inpatient and outpatient records of 2003, we searched 2002 claims. If a patient has any utilization record in 2002, we assumed that the patient was diagnosed with cancer in 2002. If a patient has no records in 2002, we assumed that the patient was newly diagnosed in the year 2003. Likewise, using all records in 2004, we searched all claim records of year 2002 and 2003. If a patient has any records in 2002 or 2003, we assumed the patient was diagnosed in 2002 or 2003. If a patient has no record in 2002 and 2003 then we assumed the patient was newly diagnosed in 2004. Using the method above, we calculated all patients' year of diagnosis.

Since the dataset is health insurance claim data, we included only patients who died with lung cancer and transposed the dataset to a retrospective cohort design with the baseline as death of each patient. To investigate secular trends and factors influencing health care utilization and spending of lung cancer patients, we aggregated each patient's spending and utilization by three month intervals up to 12 months before death [3 months before death, 3-6 months before death, 6-9 months before death, and 9-12 months before death]. We selected the span of 12 months before death to see pure end-of-life lung cancer spending and utilization.

In Korea, the fee for services (FFS) catalogue is negotiated by the government, providers, and other stakeholders every year. We discounted all inpatient and outpatient costs to 2002 levels using each year's negotiated FFS catalogue. To investigate the copayments policy impact, we created dummy variable such that each patient's aggregated health care spending and utilization information fell within specific policy periods. The yearly mean of the FX rate was 1USD=1251.20 KRW in year 2002 (cf. The yearly mean of FX rate of year 2012 1 USD=1126.88 KRW).

Since year 2002 is baseline point of measuring each patient's cancer progression, we deleted the year 2002 dataset. Furthermore, we excluded patients diagnosed with lung cancer more than five years prior, assuming those patients did not have severe lung cancer. Finally we excluded patients with inpatient total costs less than 300,000 KRW and outpatient costs less than 100,000 KRW, assuming those hospitalization and outpatient visits were occasional. Using 1,4417,380 individual health insurance claims (inpatients: 673,122, outpatients: 744,258), we obtained aggregated healthcare spending and utilization of total 155,273 patients' (131,494 inpatient and 103,855 outpatients) records.

Statistical Analysis

We first examined characteristics of nationwide lung cancer patients at their time of death by inpatient and outpatient status. Then we examined trends of health care spending and utilizations by three month intervals up 12 months before death, by their inclusion in various copayment policy windows. Student's t-test and analysis of variance were used to compare mean spending and utilization. After adjusting for patient demographics and other potential confounders, we used multivariate analysis to investigate the effect of copayment policy on health care spending and utilizations. We used generalized linear models for each patient's three month intervals before death. SAS 9.2 (SAS Institute, Cary, NC) was used for all calculations and analyses. All statistical tests were two-tailed, and we rejected null hypotheses of no difference if p-values were less than .05, or, equivalently, if the 95% CIs of risk point estimates excluded 1.

Table 1. Characteristics of Korean Lung Cancer Patients at Their Time of Death

	Total		Inpatients		Outpatients	
	N	%	N	%	N	%
No. of Patients	155,273	100%	131,494	100%	103,855	100%
Sex						
Male	114,864	74.00%	98,833	75.20%	78,448	75.50%
Female	40,409	26.00%	32,661	24.80%	25,407	24.50%
Years of Cancer Progression at Death						
0	84,140	54.20%	68,399	52.00%	47,456	45.70%
1	45,948	29.60%	41,124	31.30%	35,054	33.80%
2	14,063	9.10%	12,802	9.70%	11,765	11.30%
3	5,459	3.50%	4,972	3.80%	4,728	4.60%
4	2,525	1.60%	2,385	1.80%	2,293	2.20%
5	3,138	2.00%	1,812	1.40%	2,559	2.50%
Age*	69.08	10.9	68.93	10.66	67.5	10.53

* Mean, SD; ** = Death at diagnosed year

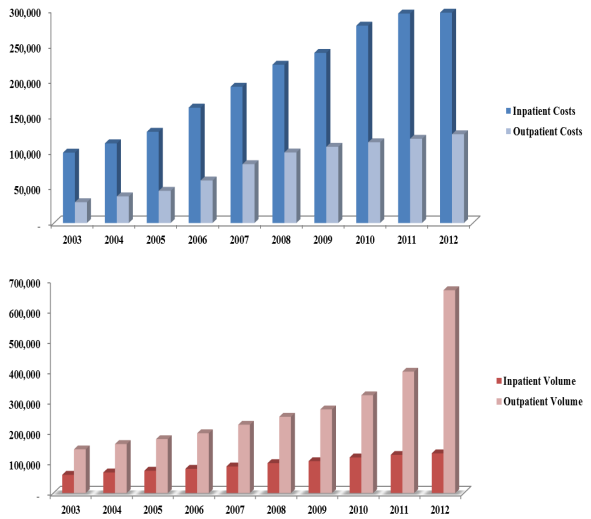

Figure 1. Discounted Healthcare Spending and Utilization among Nationwide Lung Cancer Patients

Results

An overall trend of healthcare spending and utilization by lung cancer patients is presented in Figure 1. Both discounted spending and utilization gradually increased over the past decade.

Table 1 shows baseline characteristics of lung cancer patients nationwide. Since our study investigates spending and utilization retrospectively from time at death, 155,273 patients met our cohort definition. This included 131,494 inpatients and 103,885 outpatients. Most patients were male and mean age was about 70. More than 80% of patients died during their diagnosis year (progression =0, 54.2%) or in the following year (progression =1, 29.6%).

Table 2 depicts overall lung cancer episode spending and utilization, and three month intervals until 12 months before death by both inpatient and outpatient services. A significant portion of inpatient healthcare spending and utilization occurs during the end of life. Most patients were hospitalized (105,121 out of 131,494) in the three months before death. This end-of-life period spending and utilization were higher than other periods. The likelihood of inpatient hospitalization gradually increases as patients get close to death. However, the trend in outpatient cost is completely different from the inpatient. Although the number of patients increased close to death, outpatient spending and utilization decreased with approaching death. All differences were statistically significant.

The results of bivariate analysis of each outcome variable by specific copayment policy periods are presented in Table 3. As noted, inpatient costs increased as patients get close to their death and utilization (defined as length of stay) also increased. In contrast, outpatient spending and utilizations gradually decreased until close to death. Especially for policy impact, both inpatient and outpatient copayments significantly decreased as national health insurance coverage expanded, while the total costs and payer burden significantly increased.

The results of the multivariate generalized linear model analysis are presented in Table 4. Inpatient model results show that total costs and payer costs increased

Table 2. Healthcare Spending and Utilization by Lung Cancer Patients in Their Last Year of Life by Three Month Intervals Before Death

		N	Total Costs [KRW]		P	Copayments [KRW]		P	Payer Costs [KRW]		P	LOS [Days]		P
			Mean	SD		Mean	SD		Mean	SD		Mean	SD	
Inpatients	3 Month Before Death	105,121	5,843,475	5,614,031	<.0001	644,051	586,430	<.0001	5,199,425	5,161,958	<.0001	29.11	21.55	<.0001
	3-6 Months Before Death	53,559	4,876,716	4,677,016		558,727	544,558		4,317,989	4,250,238		23.68	23.44	
	6-9 Months Before Death	36,194	4,444,676	4,004,029		512,461	479,444		3,932,214	3,638,342		19.71	20.21	
	9-12 Months Before Death	26,417	4,405,837	3,875,803		513,324	469,750		3,892,513	3,519,237		18.57	19.25	
Outpatients	3 Month Before Death	66,215	1,049,578	1,361,799	<.0001	121,419	176,617	<.0001	928,160	1,253,435	<.0001	4.66	5.47	<.0001
	3-6 Months Before Death	57,323	1,538,014	1,913,413		175,371	250,673		1,362,643	1,759,557		5.92	6.63	
	6-9 Months Before Death	44,547	1,636,352	2,045,174		188,645	269,921		1,447,707	1,880,674		5.96	6.75	
	9-12 Months Before Death	34,982	1,708,667	2,153,421		200,710	291,513		1,507,958	1,974,868		6.09	6.94	
Inpatient Episode		131,494	11,634,031	12,226,039		1,346,122	1,380,773		10,287,909	11,071,139		53.6	61.5	
Outpatient Episode		103,855	4,902,526	8,161,963		599,036	949,589		4,303,490	7,435,208		18.8	23.8	

Table 3. Healthcare Spending and Utilization by Copayment Policies and three Month Intervals before Death for Both Inpatients, Outpatients

		After 2009. 12.		2005.09. - 2009. 11.		2004. 01. - 2005. 08.		Before 2003. 12.		P
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Inpatients Total Costs [KRW]	3 Month Before Death	6,960,077	6,366,614	5,956,633	5,488,786	3,858,734	3,660,987	3,514,449	3,353,130	<.0001
	3-6 Months Before Death	5,542,900	5,098,022	5,025,741	4,735,171	3,518,234	3,355,568	3,446,606	3,394,279	<.0001
	6-9 Months Before Death	5,087,229	4,463,832	4,542,220	3,993,057	3,314,046	2,940,541	3,271,446	2,825,347	<.0001
	9-12 Months Before Death	5,081,499	4,401,401	4,500,512	3,845,115	3,367,891	2,768,522	3,268,510	2,866,174	<.0001
Inpatients Copayments [KRW]	3 Month Before Death	500,123	406,383	685,464	599,643	829,931	765,607	747,120	689,195	<.0001
	3-6 Months Before Death	414,119	376,593	580,688	537,992	764,260	702,401	736,783	698,319	<.0001
	6-9 Months Before Death	370,041	341,402	519,533	457,377	721,813	618,058	697,334	585,043	<.0001
	9-12 Months Before Death	363,894	333,278	511,105	440,950	729,428	582,098	695,585	592,732	<.0001
Inpatients Payer Costs [KRW]	3 Month Before Death	6,459,954	6,010,075	5,271,169	4,918,101	3,028,803	2,899,081	2,767,329	2,666,184	<.0001
	3-6 Months Before Death	5,128,782	4,772,407	4,445,054	4,223,482	2,753,974	2,657,558	2,709,823	2,698,401	<.0001
	6-9 Months Before Death	4,717,189	4,172,069	4,022,687	3,560,389	2,592,232	2,327,974	2,574,112	2,242,894	<.0001
	9-12 Months Before Death	4,717,604	4,116,269	3,989,407	3,424,547	2,638,463	2,191,692	2,572,925	2,276,029	<.0001
Inpatients LOS [Days]	3 Month Before Death	31.25	22.33	29.89	21.58	24.46	19.55	22.9	18.55	<.0001
	3-6 Months Before Death	25.06	24.53	24.29	23.69	20.29	20.38	20.21	21.04	<.0001
	6-9 Months Before Death	21.21	22	19.97	20.15	16.88	16.77	17.15	17.41	<.0001
	9-12 Months Before Death	20.13	21.18	18.71	19.19	16.18	15.93	16.31	16.68	<.0001
Outpatients Total Costs [KRW]	3 Month Before Death	1,189,124	1,490,691	1,124,376	1,405,830	717,231	956,189	539,338	704,514	<.0001
	3-6 Months Before Death	1,706,583	2,037,338	1,677,607	2,011,024	1,063,957	1,379,169	776,698	1,018,943	<.0001
	6-9 Months Before Death	1,817,868	2,198,977	1,786,471	2,145,523	1,121,813	1,426,424	853,784	1,112,699	<.0001
	9-12 Months Before Death	1,903,930	2,314,689	1,870,635	2,260,108	1,171,675	1,522,983	894,975	1,220,866	<.0001
Outpatients Copayments [KRW]	3 Month Before Death	66,668	85,505	121,762	146,032	180,297	215,486	275,426	367,533	<.0001
	3-6 Months Before Death	91,465	109,565	176,588	203,471	267,425	302,232	400,032	528,075	<.0001
	6-9 Months Before Death	96,953	117,336	187,157	217,683	285,429	308,285	440,421	577,531	<.0001
	9-12 Months Before Death	101,640	122,952	197,228	231,326	300,725	328,683	460,421	629,728	<.0001
Outpatients Payer Costs [KRW]	3 Month Before Death	1,122,457	1,420,404	1,002,614	1,269,212	536,934	748,282	263,912	340,329	<.0001
	3-6 Months Before Death	1,615,118	1,940,663	1,501,019	1,815,941	796,532	1,083,251	376,665	493,184	<.0001
	6-9 Months Before Death	1,720,915	2,094,858	1,599,315	1,936,369	836,384	1,124,459	413,362	537,758	<.0001
	9-12 Months Before Death	1,802,290	2,204,466	1,673,407	2,038,104	870,949	1,201,706	434,554	593,801	<.0001
Outpatients Days [Days]	3 Month Before Death	4.19	5.04	5.02	5.67	4.76	5.66	4.64	5.73	<.0001
	3-6 Months Before Death	5.38	6.14	6.35	6.74	6.02	7.05	5.78	7.21	<.0001
	6-9 Months Before Death	5.49	6.28	6.31	6.78	5.97	7.12	5.99	7.67	<.0001
	9-12 Months Before Death	5.66	6.63	6.45	6.98	6.1	7.24	5.81	7.35	<.0001

Table 4. Multivariate Analysis to Investigate Impact of Copayment Policies on Healthcare Spending and Utilization for Lung Cancer Patients at end of Life

			Total Costs		Copayments		Payer Costs		LOS/Outpatient days	
			Est. [KRW]	P	Est. [KRW]	P	Est. [KRW]	P	Est. [Days]	P
Inpatient	3 Month Before Death	After 2009. 12.	993,758	<.0001	-684,118	<.0001	1,677,876	<.0001	2.45	<.0001
		2005.09. - 2009. 11.	946,705	<.0001	-326,423	<.0001	1,273,128	<.0001	2.78	<.0001
		2004. 01. - 2005. 08.	-12,774	0.827	6,389	0.323	-19,162	0.721	0.19	0.479
		Before 2003. 12.								
	3-6 Months Before Death	After 2009. 12.	1,464,197	<.0001	-532,992	<.0001	1,997,189	<.0001	4.66	<.0001
		2005.09. - 2009. 11.	1,233,171	<.0001	-274,767	<.0001	1,507,939	<.0001	3.56	<.0001
		2004. 01. - 2005. 08.	113,641	0.135	6,551	0.463	107,090	0.119	0.13	0.76
		Before 2003. 12.								
	6-9 Months Before Death	After 2009. 12.	1,030,289	<.0001	-522,297	<.0001	1,552,586	<.0001	1.81	0.034
		2005.09. - 2009. 11.	833,465	<.0001	-288,461	<.0001	1,121,926	<.0001	1.36	0.017
		2004. 01. - 2005. 08.	55,123	0.486	5,955	0.534	49,168	0.49	-0.37	0.406
		Before 2003. 12.								
	9-12 Months Before Death	After 2009. 12.	743,463	<.0001	-547,043	<.0001	1,290,506	<.0001	2.07	0.033
		2005.09. - 2009. 11.	640,257	<.0001	-306,763	<.0001	947,020	<.0001	1.32	0.039
		2004. 01. - 2005. 08.	62,382	0.48	10,426	0.333	51,957	0.513	-0.07	0.883
		Before 2003. 12.								
Outpatient	3 Month Before Death	After 2009. 12.	265,423	<.0001	-235,586	<.0001	501,009	<.0001	2.19	<.0001
		2005.09. - 2009. 11.	434,482	<.0001	-163,069	<.0001	597,551	<.0001	2.05	<.0001
		2004. 01. - 2005. 08.	113,662	<.0001	-98,619	<.0001	212,282	<.0001	0.56	<.0001
		Before 2003. 12.								
	3-6 Months Before Death	After 2009. 12.	657,593	<.0001	-329,169	<.0001	986,762	<.0001	3.63	<.0001
		2005.09. - 2009. 11.	853,518	<.0001	-225,690	<.0001	1,079,208	<.0001	3.21	<.0001
		2004. 01. - 2005. 08.	233,566	<.0001	-135,484	<.0001	369,049	<.0001	0.92	<.0001
		Before 2003. 12.								
	6-9 Months Before Death	After 2009. 12.	489,635	<.0001	-383,432	<.0001	873,067	<.0001	2.45	<.0001
		2005.09. - 2009. 11.	772,803	<.0001	-265,974	<.0001	1,038,777	<.0001	2.43	<.0001
		2004. 01. - 2005. 08.	192,842	<.0001	-160,037	<.0001	352,879	<.0001	0.62	<.0001
		Before 2003. 12.								
	9-12 Months Before Death	After 2009. 12.	343,838	<.0001	-415,644	<.0001	759,482	<.0001	2.51	<.0001
		2005.09. - 2009. 11.	670,247	<.0001	-288,142	<.0001	958,389	<.0001	2.49	<.0001
		2004. 01. - 2005. 08.	141,017	0.003	-169,862	<.0001	310,879	<.0001	0.85	<.0001
		Before 2003. 12.								

as inpatient coverage expanded. Of course, copayments significantly decreased by three-month intervals. Policy periods including outpatient coverage expansion only (2004.01.-2005.08.), however, did not affect inpatient costs. Since inpatient coverage was expanded, length of stay significantly increased in all three month intervals. Copayment reduction was greatest in patients hospitalized during the three months before death. Outpatient model results are presented that demonstrate increases in total costs and payer costs as coverage expanded and the copayments significantly decreased. More coverage expansion was associated with greater copayment reductions. Likewise, inpatient length of stay, outpatient days increased as coverage expanded. In both inpatient and outpatient, three to six month intervals were associated with the highest costs and length of stay, and of outpatient days as well.

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Discussion

In this study, we examined the association of cancer coverage expansion policies on individual patient overall healthcare spending, copayments, payer costs, and utilizations measured by inpatient length of stay and outpatient days. The nationwide dataset over the decade used for the study included all lung cancer patients within the national health insurance program. The different health insurance coverage expansion policy initiatives were used to compare health care spending and utilization with three month intervals up to a year before death.

Most patients were hospitalized in their end-of-life period, especially in last three months before death. Most inpatient spending occurred in that period as well. Regarding the impact of insurance coverage expansion policies, patients were more likely to use inpatient and outpatient services as coverage expanded, hence overall healthcare spending increased due to higher utilization in lung cancer patients (You et al., 2013). In Korea, there are no restrictions on using primary, secondary, and tertiary medical institutions, and no penalties for repeated care. Without referrals for inpatient services, more services might be induced to both patients and providers (Park and Jang, 2012).

Although this study found evidence that the financial burdens significantly decreased as coverage expanded, utilization and spending increased. To prevent escalating health service use, we recommend considering policy changes for government agencies to maintain budget viability for the national health insurance program. First, a copayment flat rate might be the most attractive incentive for patients who make unnecessary outpatient visits and/or inpatient hospitalizations. This is also a great incentive to providers who are providing excessive unnecessary, expensive, and advanced tech services. The lessons from other studies show that increased cost-sharing decreases health care utilization (Leibowitz et al., 1985; Lohr et al., 1986; Newhouse, 2004). Different rate of copayments could be applied depending on types of cancer, years of cancer treatment period, cancer stage at diagnosis and costs of various health services. This strategy could help controlling the moral hazard of both patient and providers as well.

Escalating healthcare costs caused by unnecessary utilization might be controlled by fixing reimbursement of annual copayments dependent on severity of cancer progression. Since payment is based on FFS in Korea, patients and providers lack incentives to reduce utilization. Government agencies alone can act to gauge national spending levels based on patient's severity, types, and patterns of care, then set reasonable episode copayments limitations.

Demand for private health insurance plans by NHI members, which broadly cover medical expenses caused by catastrophic illness and accidents, is driven by the limited coverage and weak financial protection from the NHI benefit package (Shin, 2012). Private health insurance plans are both supplementary and complementary to the NHI plan by paying a lump-sum disbursement upon diagnosis of critical illness irrespective of actual medical bills and the receipt of care, or by providing itemized medical expenses compensation upon service use (Shin, 2012). Since economically vulnerable populations are less likely to have private health insurance to cover their cancer treatment costs, different levels of coverage rate should be implemented based on socio-economic status, especially depending on possession of private insurance among NHI members.

Government agencies also need to focus on more on prevention, not just expanding coverage. Since the landmark reports showing that smoking causes lung cancer over a half century ago (Doll and Hill, 1954; U.S. Department of Health Education and Welfare, 1964), expansion of smoking cessation programs should be first implemented. Furthermore, as our study confirmed, a large portion of healthcare spending occurs in the very end-of-life, so attention should be paid to palliative care, and development and expansion of facilities such as hospices that specialize in end of life care.

This study has several limitations worth noting, and caution must be taken when interpreting the study's results or attempting to generalize its findings. Although we analyzed nationwide all inpatient and outpatient insurance claims for lung cancer during a defined period, South Korea's unique health care delivery and insurance system may significantly limit generalizability of the results of this study. Costs of care or rates of copayments are likely to depend upon the type of health insurance system in place and the ability of health care providers to negotiate the price of medical services.

Furthermore, we investigated only lung cancer patients. Therefore, our results will differ from spending

and utilizations of other cancer patients, and this could weaken the reliability of our findings. A lack of data with which to analyze important aspects of patient care quality was another limitation of our study. Our study also suffered because it lacked non-insurance covered services information, one of the most important cost factors. Given the nature of claims dataset, this study artificially calculated the progression of cancer. Further research using cohort datasets should be performed to inform the association examined in this study controlling for proper severity. Lastly, advances in level of treatment and medical technology for lung cancer might increase utilization and spending. Further studies are needed to examine the associations among treatments, technology advancement and patient outcome.

Although several limitations are presented, to the best of our knowledge, this is the one of few evaluations of the impact of copayment policies on healthcare spending and utilization measures in South Korea. We believe our findings will prove useful to health policy makers, especially those residing in countries with national health insurance programs based on fee-for-service payments. Our findings add to mounting evidence of the need to develop a national cancer management strategy.

In conclusions, our retrospective cohort design study showed that cancer copayments policies over a decade in South Korea reduced patient burdens for both inpatient and outpatient health care services, although more burden was shifted to the NHI and overall healthcare costs. As coverage for cancer expanded, utilization measured by inpatient LOS and outpatient days also increased, suggesting that moral hazard might have been important in lung cancer patients. Furthermore, significant cost increases suggest that more expensive, technologically advanced treatments or diagnosis services were offered as coverage expanded. Lastly, this study suggests that the practice pattern within a hospital might be influenced by coverage policy. Health policy makers should consider initiating health policies to influence long-term outcomes of services performance and overall healthcare spending and utilization.

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