

# Research in Brief



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## Trends and Regional Variations in the Cost of Illness<sup>1)</sup>

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The cost of illness, a monetary estimate of costs arising from illness, serves as a useful indicator for assessing the socioeconomic value of health and for analyzing disparities in health outcomes between groups and across subnational regions. The cost of illness has been growing in Korea, with the proportion due to premature death from illness declining and the proportion due to living with illness growing. From a sociodemographic perspective, there is a need for health management policies targeting the population groups with increasing health care utilization, not least those age groups of either sex that remain a major active part of Korea's socioeconomic landscape. Regional variations in the cost of illness have increased in recent years across cities, counties, and districts throughout the country. Policy interventions are required to address disparities in transportation expenditures, which this study finds vary more pronouncedly across regions than the other cost items. Moreover, caregiver costs also demand attention, as their regional variation has shown an increase in recent years.

### Introduction: what is it to measure the cost of illness?

The cost of illness is a measure that quantifies in monetary terms all the costs arising from illness, effectively capturing the socioeconomic impact of health in value terms. Conceptually, the cost of illness includes more than just health care costs arising from illness. It also includes non-medical costs expended for transportation and caregiver services, as well as such factors external to health expenditure as costs arising not in the form of monetary expenses but as the value of time lost resulting

1) This article is a recast of a part of Trends in the Regional Socio-economic Burden of Diseases and the Influencing Factors (2022), authored by Dun-Sol Go et al.

from premature death and the opportunity cost of productivity losses due to illness.

Having a precise estimation of the social burden of diseases provides evidential grounds for decision-making that involves assigning priorities to different health care policies, identifying vulnerable and other groups that need policy intervention, and evaluating the effects of different health policies. Cost-of-illness analysis can apply to the whole population as well as to various cost items, which makes it a standard especially useful for allocating health care resources. The cost of illness is a useful indicator for evaluating local health outcomes and identifying regional health disparities, along with the factors that affect them, allowing for at least an indirect way of measuring healthcare accessibility in regional settings. It can be employed to identify as policy targets cost items, population groups, and diseases for which significant regional cost disparities occur.

There is no nationally agreed-upon basis in Korea for assigning priorities in the allocation of health care resources. Studies on the cost of illness have primarily focused on specific diseases and their risk factors. A couple of studies that measured the cost of illness for all diseases, one examining a single year (2015)<sup>2)</sup> and the other<sup>3)</sup> using a time-series approach. Both studies focus on costs categorized by sex, age group, and disease category.

The literature on subnational health disparities in Korea includes: a study conducted on disparities in disability-adjusted life years and their contributing factors<sup>4)</sup>; another<sup>5)</sup> on subnational disparities in life expectancy and the factors responsible; and yet another<sup>6)</sup> on gaps in the perceived health status of older persons between the capital region and non-capital regions.

Additionally, another study specifically examined illness-related transportation costs and their contributing factors in municipalities (metropolitan cities and provinces)<sup>7)</sup> for the year 2016.

In countries like Canada, the US, and Australia, government agencies are tasked with estimating the cost of illness and publishing the findings to inform policy decision-making. In these countries, having a precise national estimation of the social burden of illness is emphasized as an important basis for reducing between-group health disparities and assigning priorities to different health care policies. The cost of illness in these countries is estimated using international standards, thereby enabling comparisons across different countries. These countries open their cost of illness data to the general public and provide online tools that enable users to readily analyze it.

In Canada, the Public Agency of Canada publishes its estimates of the economic burden of illness, encompassing direct costs, indirect costs, and caregiver costs<sup>8)</sup>. The Agency also keeps track of trends

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2) Lee, Y. R., Cho, B., Jo, M. W., Ock, M., Lee, D., Lee, D., ... Oh, I. H. (2019). Measuring the Economic Burden of Disease and Injury in Korea, 2015. *Journal of Korean Medical Science*, 34(Suppl 1), e80.

3) Hyun, K. R. et al. An Analysis of the Socioeconomic Cost of Major Diseases for the Establishment of Health Policies. National Health Insurance Service.

4) Go, D. S., Kim, Y. E., & Yoon, S. J. (2020). Subnational Burden of Disease According to the Sociodemographic Index in South Korea. *International journal of environmental research and public health*, 17(16), 5788.

5) Kang, Y. H. et al. Developing Indicators for Evaluating and Monitoring the Health Plan 2020 Using the National Health Information Database of the National Health Insurance Service in Korea. National Health Insurance Service.

6) Lee, Y. J. *The Journal of the Korea Contents Association* 15(11):347–358

7) Jang, S. Y., Seon, J. Y., & Oh, I. H. (2020). Influencing Factors of Transportation Costs Regarding Healthcare Service Utilization in Korea. *Journal of Korean medical science*, 35(35), e290.

8) Public Health Agency of Canada. (2018). *Economic Burden of Illness in Canada, 2010*. Public Health Agency of Canada. Ottawa: Public Health Agency of Canada.

in the cost of illness by population group and by disease subgroup, although on an irregular basis<sup>9)</sup>. In Australia, the Australian Institute of Health and Welfare estimates the burden of illness not in monetary value but in terms of disability-adjusted life years (DALYs)<sup>10)</sup> and identifies risk factors and diseases responsible for the burden and the extent of their contribution to it, specific to men, women, regions, age groups, and socioeconomic groups<sup>11)</sup>. In the US, the cost of illness is estimated and the resulting estimates are published through public-academic collaboration<sup>12)</sup>. Although these estimates are not presented as unified indicators, they are based on information collected on population group-specific disease burden and published so as to enable interstate and regional comparisons. Korea needs to quantify the cost of illness into indicators, monitor and analyze their trends and regional disparities, and utilize the findings as a foundation for assigning priorities in health care resource allocation. This study attempts to analyze trends and regional variations in the cost of illness in Korea and identify priority policy targets.



## Estimation method

Here the cost of illness is measured from a societal perspective, which comprises, on top of healthcare and non-healthcare costs, morbidity-related productivity losses and the potential economic losses due to premature death from illness. The societal perspective is recommended by guidelines, both national and international, as an approach to disease burden evaluation and health economic analysis, as it takes into account the whole of the costs and effects of illness that occur in society.

The present analysis concerns the 10-year period between 2011 and 2020. In cases where data was unavailable at the municipal units on which this study focuses, we obtained information instead from relevant metropolitan cities and provinces or from other sources that are considered to adequately reflect the characteristics of the targeted municipalities.

The sources of data and the demographic and municipal units for which data were available are as listed in Table 1.

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9) Government of Canada. (2022). Economic Burden of illness in Canada. <https://cost-illness.canada.ca/custom-personnalise/national.php>

10) Australian Institute of Health and Welfare. (2021). Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018. Canberra: AIHW.

11) Australian Institute of Health and Welfare. (2022. 12. 12.). Burden of disease. <https://www.aihw.gov.au/reports-data/healthconditions-disability-deaths/burden-of-disease/overview>

12) CMS. (2021. 12. 1.). Chronic Conditions Overview. CMS. <https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Chronic-Conditions>; The Dartmouth Institute for Health Policy & Clinical Practice. (2022). Dartmouth Atlas Project. <https://www.dartmouthatlas.org/interactive-apps/end-of-life-care>

**[Table 1] Sources and availability of data by cost item**

Cost item		Variable	Data source (agency)	Availability			
				Sex/age	Municipality		Non-metropolitan cities/counties/districts
					Metropolitan cities/provinces		
Direct costs	Healthcare costs	Reimbursable	Health care costs	National Health Insurance claims data (National Health Insurance Service)	○	○	○
		Non-reimbursable	Health care costs	Health Expenditure Survey (National Health Insurance Service)	×	×	×
	Non-healthcare costs	Transportation	Transportation costs	Korea Health Panel Survey (KIHASA)	○	○	×
			Number of outpatient days	National Health Insurance claims data (National Health Insurance Service)	○	○	○
		Caregiver costs	Caregiver costs	Korea Health Panel Survey (KIHASA)	○	○	×
			Number of inpatient days	National Health Insurance claims data (National Health Insurance Service)	○	○	○
Indirect costs	Productivity loss resulting from morbidity	Mean wage		Survey of Labor Conditions (Ministry of Employment and Labor)	○	○	×
				Regional Employment Survey (Statistics Korea)			
		Employment rate	Regional Employment Survey (Statistics Korea)	○	○	×	
		Number of outpatient days	National Health Insurance claims data (National Health Insurance Service)	○	○	○	
	Productivity loss resulting from premature death due to illness	Mean wage		Survey of Labor Conditions (Ministry of Employment and Labor)	○	○	×
				Regional Employment Survey (Statistics Korea)			
		Employment rate	Regional Employment Survey (Statistics Korea)	○	○	×	
		Years of life lost	Cause-of-death data (Statistics Korea)	○	○	○	

Note: 1) Transportation costs for a specific year are calculated by multiplying the standard inpatient and outpatient transportation costs by region and by disease group of that year by the transportation price index number with 2015 as the base year; values missing from the categories of medical conditions observed at city and province levels were substituted with the mean values for the corresponding conditions for the municipality concerned.

2) Personal caregiver costs are calculated by multiplying the standard caregiver costs for 2015 by the caregiver price index.

3) Local wage estimates are calculated by multiplying the national figures by the ratio of national to local wage levels.



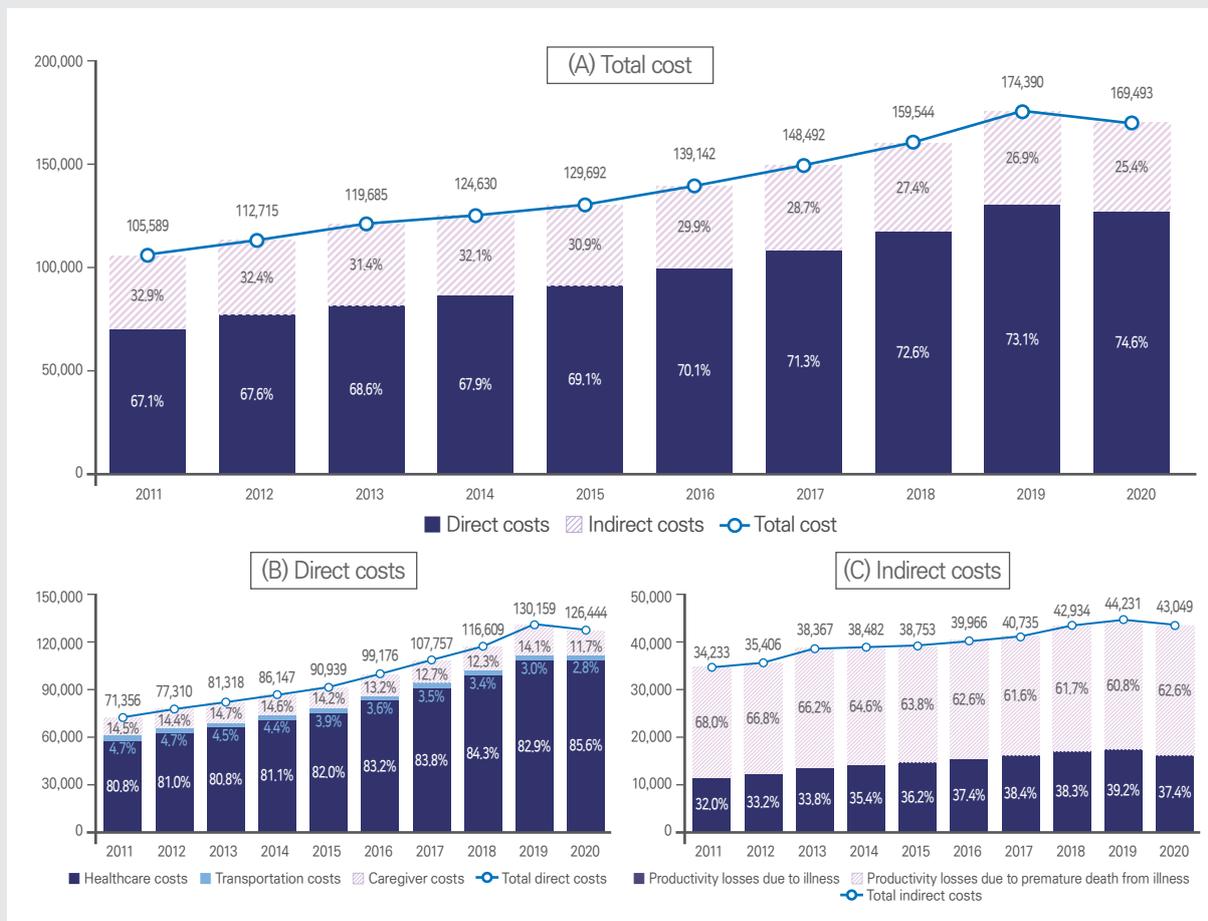
## Trends in the cost of illness in Korea

The overall cost of illness in 2020 amounted to KRW 169.493 trillion, of which 74.6 percent was direct cost attributed to healthcare use and the rest—25.4 percent—was indirect cost due to productivity loss. Compared to 2011, the overall cost of illness increased by an average of 4.8 percent each year until 2020. Over the 10-year period, direct costs increased by an average of 5.9 percent and indirect costs increased by 2.3 percent. The share of the former (direct costs due to morbidity) grew, while that of the latter (indirect costs due to deaths) declined. Healthcare costs as a part of direct costs increased by an average of 6.5 percent yearly, while transportation costs and caregiver costs increased by 0.4 percent and 3.6 percent, respectively. In the category of direct costs, the costs of productivity losses attributed to morbidity increased by a yearly average of 3.9 percent and the costs of productivity losses due to premature deaths by 1.6 percent on average.

The socioeconomic costs of illness were higher for men than for women (53.2 percent vs. 46.8 percent). The difference can be attributed to women having lower economic participation rates and wage levels. However, the socioeconomic costs of illness for women have been increasing more rapidly since 2011, with an average yearly growth rate of 5.8 percent, compared to 4.1 percent for men.

During the same period, the proportion of socioeconomic costs accounted for by those aged 50 and older increased, while the share attributed to those younger declined. People in their 50s accounted for the largest share (20.4 percent) of the overall cost of illness, followed by those in their 60s and 40s with 19.9 percent and 14.2 percent, respectively. In the category of direct costs due to healthcare use, the largest share was accounted for by those in their 60s. In the category of indirect costs, which factor in productivity losses due to illness, those in their 50s accounted for the largest share, followed by those in their 40s and 60s.

[Figure 1] Trends in the cost of illness in billion won



## Regional variations in the cost of illness

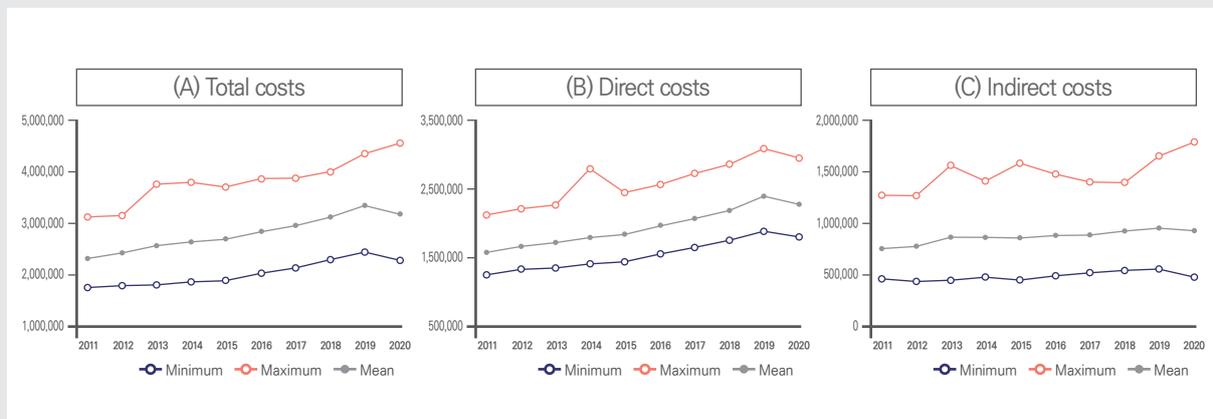
In this study, we measured regional variations in the cost of illness using the external quotient and the coefficient of variation. The external quotient represents the ratio of the lowest value to the highest value. The coefficient of variation is calculated as the ratio of the standard deviation to the mean of the observed values. We assumed that higher ratios correspond to greater variations. We estimated the per capita cost of illness for the 10-year period between 2011 and 2020 in non-metropolitan cities, counties, and districts. These estimates were then standardized against the 2015 national population by sex and age.

The per capita cost of illness for the regions examined increased on a yearly average by 3.59 percent, from KRW2,321,573 in 2011 to KRW3,188,212 in 2020, with direct costs increasing at an average rate of 4.10 percent compared to indirect costs increasing at 2.42 percent. Within the category of direct costs, health care costs increased at a yearly average of 4.85 percent. Within the category of indirect costs, the

costs of productivity losses due to illness grew the most, at a rate of 3.22 percent.

The regional variations in the per capita cost of illness trended downward between 2013 and 2018 and then increased in 2019 and 2020. In the years 2013 and 2019, the difference in the per capita cost of illness between the region with the highest amount and that with the lowest amount increased year on year, due to the increase in indirect costs in the former. The regional variations in the amount of direct costs showed only negligible changes over the period examined, trending downward in general. The regional variations in the amount of indirect costs, greater than those in the amount of direct costs, have trended upward in recent years. Within direct costs, transportation and caregiver costs varied considerably across regions. Variations in caregiver costs, in particular, showed an upward trend.

[Figure 2] Trends in the regional per capita cost of illness (in won)



**[Table 2] Regional variations in the per capita cost of illness (in won)**

Year	Min	Max	Mean	SD	Coefficient of variation	
					EQ	CV (%)
<b>Total costs</b>						
2011	1,749,749	3,115,393	2,321,573	247,604	1.78	10.67
2012	1,787,377	3,142,928	2,433,896	263,822	1.76	10.84
2013	1,802,684	3,752,199	2,571,545	334,546	2.08	13.01
2014	1,867,299	3,782,632	2,643,879	348,774	2.03	13.19
2015	1,891,225	3,699,004	2,694,394	351,377	1.96	13.04
2016	2,025,150	3,855,022	2,835,843	350,800	1.90	12.37
2017	2,143,241	3,861,602	2,957,482	345,181	1.80	11.67
2018	2,288,243	3,987,457	3,112,776	346,675	1.74	11.14
2019	2,443,508	4,336,444	3,343,228	360,379	1.77	10.78
2020	2,275,979	4,532,465	3,188,212	365,501	1.99	11.46
<b>Direct costs</b>						
2011	1,246,660	2,116,722	1,577,172	168,894	1.70	10.71
2012	1,327,866	2,202,209	1,667,903	181,780	1.66	10.90
2013	1,330,669	2,263,807	1,716,035	194,939	1.70	11.36
2014	1,397,809	2,782,054	1,786,600	214,250	1.99	11.99
2015	1,434,516	2,443,995	1,836,533	211,688	1.70	11.53
2016	1,544,152	2,554,895	1,958,604	216,372	1.65	11.05
2017	1,635,446	2,725,552	2,077,532	221,815	1.67	10.68
2018	1,738,902	2,859,203	2,196,892	224,708	1.64	10.23
2019	1,880,278	3,075,928	2,399,467	237,964	1.64	9.92
2020	1,794,620	2,947,013	2,265,163	228,664	1.64	10.09
<b>Indirect costs</b>						
2011	456,987	1,266,228	744,401	131,349	2.77	17.64
2012	426,825	1,258,842	765,993	135,024	2.95	17.63
2013	433,527	1,547,978	855,510	179,927	3.57	21.03
2014	465,627	1,402,423	857,278	180,329	3.01	21.04
2015	442,154	1,571,570	857,861	188,551	3.55	21.98
2016	480,998	1,464,728	877,238	183,307	3.05	20.90
2017	507,795	1,393,955	879,950	172,839	2.75	19.64
2018	529,242	1,388,495	915,884	174,888	2.62	19.10
2019	544,996	1,648,248	943,760	182,234	3.02	19.31
2020	466,951	1,786,703	923,049	202,129	3.83	21.90

Note: Figures are standardized against the 2015 population by sex and age group.



## Concluding remarks

The cost of illness is increasing in Korea. The proportion of costs due to illness-caused premature death is declining, while the proportion due to living with illness is growing. The per capita cost of illness is rising, with its regional variations increasing after a period of decline. Based on my analysis of trends and regional variations in the cost of illness, I recommend the following policy suggestions. From a sociodemographic perspective, there is a need for policy efforts to reduce gaps, especially for cost categories where regional variations have been on the rise. Preventive policies can be effective for not only the old-age population, whose use of health care is a source of significant economic burden, but also for those in their 40s and 50s, who are not that far from old age but who still remain a main socioeconomic driver. The health management projects, currently targeted primarily at older people, need to be expanded to include a wider range of socioeconomic groups. There is a need to strengthen health management policies to prevent disease and premature death among men, who tend to incur higher socioeconomic costs of death and have lower adherence than women to overall healthy lifestyle behaviors across all age groups.

Efforts should be made to narrow gaps between regions in cost items where regional variation is rising. The regional variation of direct costs tied to health care use has trended downward. However, ways need to be sought to address regional gaps in transportation and caregiver costs, where regional variation has been found to remain greater than in other cost items. In addition, the factors that contribute to regional variations in the cost of illness need to be further examined and dealt with accordingly, as regional variations are on the rise in indirect costs arising from productivity loss due to premature death and morbidity. The fact that indirect costs as a share of the total cost of illness declined while their regional variations increased and remained wider than variations in direct healthcare costs suggests that regional disparities have been widening in healthcare use and in such socioeconomic indicators as average wages and employment rates. Thus, with the aim of reducing regional variations in the cost of illness, policymakers could consider implementing a social safety net as a comprehensive and effective policy measure to address illness and regional disparities in healthcare access, especially for socioeconomically vulnerable groups.

Identification of between-group disparities in the cost of illness should be followed by a process of addressing the question of what factors contribute, and to what extent, to these differences. The regional disparities observed in health outcomes, in particular, are a consequence of complex interactions involving individuals' socioeconomic status, health risk factors, local health care resources, community social support, and cultural factors.