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Trends in Health Expenditures for Chronic Disease Management: Hypertension, Diabetes Mellitus, and Dyslipidemia from 2013 to 2020

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Purpose: Chronic diseases such as hypertension (HT), diabetes mellitus (DM), and dyslipidemia (LD) are leading contributors to healthcare expenditures globally, including in South Korea. This study aimed to analyze trends in health expenditures for managing these conditions, focusing on patient demographics, comorbidities, and complications, using real-world data from a tertiary care hospital.

Materials and Methods: This retrospective study utilized clinical data from Severance Hospital's Severance Clinical Research Analysis Portal (SCRAP) system, covering 2013 to 2020. Patients diagnosed with HT, DM, and LD were identified using ICD-10 codes. Generalized linear mixed models were applied to evaluate trends in health expenditures, and a Sankey diagram was used to visualize expenditure flows by patient subgroups and care categories.

Results: Total health expenditures increased nearly threefold, from 157.2 billion KRW in 2013 to 444.8 billion KRW in 2020, driven primarily by rising reimbursable costs (67.1% to 84.1%). Per-patient expenditures decreased initially but stabilized by 2020. Patients with HT+DM incurred the highest per-patient costs, followed by those with HT alone. Complications, particularly cardiovascular and cerebrovascular diseases, significantly elevated costs, with inpatient care accounting for the largest expenditure share.

Conclusion: The economic burden of managing chronic diseases is substantial, particularly for patients with multiple conditions or complications. Strengthening preventive care and integrated management strategies, alongside sustained financial support, is crucial for improving cost-efficiency in chronic disease care.

Key Words: Health expenditures, hypertension, diabetes mellitus, dyslipidemia.

INTRODUCTION

Chronic diseases such as hypertension (HT), diabetes mellitus (DM), and dyslipidemia (LD) represent a significant public health challenge globally, accounting for substantial morbidity, mortality, and economic burden.[1-4] The prevalence and mortality rates of HT, DM, LD have been steadily increasing year by year, a trend that is expected to intensify with the progression of population aging.[3,5-7]

In South Korea, prevalence of major chronic diseases among adults aged 19 years and older has shown distinct trends over the past decade. The prevalence of HT has remained steady at approximately 20%–22%,[8] and that of diabetes has hovered around 10%. In contrast, the prevalence of hypercholesterolemia has steadily increased from 11.9% in 2012 to 22.0% in 2022.[9] In 2023, healthcare expenditures for chronic diseases accounted for 84.5% of total medical spending in South Korea. Specifically, expenditures for HT and cardiovascular/cerebro-

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vascular diseases amounted to 12469278885 thousand KRW, while those for diabetes reached 2480096022 thousand KRW. Compared to 2013, these figures represent increases of 123% and 137%, respectively.[9] Notably, while the prevalence rates of HT and diabetes have remained relatively stable over the past decade, the associated healthcare costs have more than doubled, indicating a growing economic burden.

HT, DM, and LD conditions often coexist and lead to complications, including cardiovascular[10-13] and cerebrovascular diseases,[14-16] further exacerbating their impact on healthcare systems.[17,18] Patients with at least one of HT, DM, or LD are likely to have multiple conditions simultaneously due to the interrelationship among these diseases.[19] Metabolic syndrome is characterized by the simultaneous presence of multiple established cardiovascular risk factors, such as DM, obesity, LD, and HT.[20] As the associations between metabolic syndrome and various health conditions have been increasingly identified,[21-23] the need for societal-level management has also been raised.

This study aims to estimate the cost burden of complications related to HT, DM, and LD, which are the main diseases of metabolic syndrome and causes of cardiovascular and cerebrovascular disease. These diseases are likely to continuously increase financial pressure on both individuals and the healthcare system. Although previous studies have investigated the medical costs of HT, DM, and LD, they are limited in several respects. Most provide cost information for each condition individually, without considering coexisting diseases or complications[24,25]; others lack data on non-reimbursed medical services[26] or are based on single-year datasets.[27] These limitations hinder accurate estimation of the total disease-related expenditures incurred by patients and society.

Therefore, this study aims to address the limitations of previous research by analyzing healthcare expenditures related to chronic diseases—specifically HT, DM, and LD—based on the presence of comorbidities and complications, and by calculating total costs that include both reimbursed and non-reimbursed services. By presenting multi-year trends in medical expenditures, the study seeks to provide more accurate cost information and contribute to a comprehensive understanding of the economic burden associated with these conditions. In doing so, it also aims to offer policy implications through an evaluation of health behaviors that could potentially alleviate the financial burden on both individuals and the healthcare system.

MATERIALS AND METHODS

Study design and data sources

This retrospective study was conducted using clinical data extracted from the Severance Hospital (Seoul, Korea) Severance Clinical Research Analysis Portal (SCRAP) service, covering the study period from January 2013 to December 2020. SCRAP is a hospital-based clinical data warehouse that integrates electronic medical records (EMRs) across all inpatient, outpatient, and emergency care services. It enables the extraction of structured and anonymized datasets for approved research purposes. The SCRAP database contains comprehensive health information on all patients who visited Severance Hospital, including both reimbursable and non-reimbursable costs, making it a robust source for examining detailed trends in health expenditures for a tertiary care hospital in Korea. Cost data were derived from individual-level billing records and included both reimbursed and non-reimbursed components. Medication cost data were based on prescriptions issued within the hospital and recorded in the EMR. Costs from external community pharmacies were not captured due to the structure of the hospital-based SCRAP system. No annual inflation adjustment or discounting was applied between years, as the objective was to examine actual healthcare expenditures over time rather than conduct a normalized economic evaluation. Each patient's actual cost value was used directly in the analysis, rather than computing averages from aggregate totals. SCRAP has been used in multiple previous studies to generate real-world clinical and economic evidence.[28,29] The EMRs contained no personally identifiable information, and the requirement for informed consent was waived due to the retrospective nature of the study. Patients diagnosed with HT, DM, and LD, either individually or in combination, were identified using ICD-10 codes (I10–I15 for HT, E10–E14 for DM, and E78 for LD), in combination with medication history and healthcare utilization criteria, based on our IRB-approved protocol. Detailed operational definitions, including diagnosis, medication, and visit criteria, are provided in Supplementary Table 1 (only online).

Study variables

The primary variables of interest in this study were total health expenditures and health expenditures per patient per year. Total health expenditures were defined as the sum of all medical costs, including outpatient visits, inpatient admissions, and emergency room visits. More specifically, the cost data included expenses for laboratory tests, anesthesia, radiology tests, medication prescriptions, rehabilitation, and procedures, among others. Health expenditures per patient were calculated by dividing total health expenditures by the number of patients for each year. Secondary variables included demographic factors such as age and sex, and clinical characteristics such as the presence of complications. Age was categorized into the following groups: <20, 20–29, 30–39, 40–49, 50–59, 60–69, 70–79, and ≥80 years. For complications, we focused on the occurrence of cardiovascular diseases and cerebrovascular diseases, categorizing patients into groups: none, single complication (cardiovascular disease or cerebrovascular disease), and combinations (both). Patient types were further categorized based on the type of chronic condition they had, including single conditions (HT, DM, LD) and combinations (HT+DM, HT+LD, DM+LD, HT+DM+LD).

Statistical analysis

Descriptive statistics were used to summarize the characteristics of the study population, and data are presented as mean±standard deviation, or number with percentage. Trends in total and per-patient health expenditures over the study period were evaluated using a generalized linear mixed (GLM) model regression approach, which allowed us to account for repeated measures within subjects over time and handle variations in the data. A GLM was used to examine differences in per-patient medical costs, adjusting for year (reference: 2020), sex, age group, patient types (HT, DM, LD), and presence of complications. For the complications variable, patients with both cardiovascular and cerebrovascular complications were selected as the reference group to evaluate the extent of cost reductions associated with having fewer or no complications. The GLM provided estimates of the association between each independent variable and health expenditures, expressed as regression coefficients with standard errors and *p*-values. Statistical significance was defined as a *p*-value of less than 0.05. We additionally visualized the flow of health expenditures by patient groups as a form of Sankey diagram. It shows the input and output of data (health expenditures) from one node to another. All analyses were performed using SAS software (version 9.4, SAS Institute Inc., Cary, NC, USA), and the Sankey diagram was visualized using STATA (version 17.0, StataCorp., College Station, TX, USA).

Ethics statement

The need for informed consent was waived due to the retrospective nature of the study. The study protocol was reviewed and approved by the Institutional Review Board of Severance Hospital, Yonsei University (approval No. 4-2022-0161).

RESULTS

Participant characteristics

A total of 16560 patients were included in the study in 2013, with the number of participants increasing to a peak of 18113 in 2016 before declining to 11314 by 2020 (Table 1). The cohort

Table 1. Characteristics of Participants

	2013 (n=16560)	2014 (n=17399)	2015 (n=17598)	2016 (n=18113)	2017 (n=17502)	2018 (n=17743)	2019 (n=15956)	2020 (n=11314)
Sex								
Male	8947 (54.0)	9358 (53.8)	9581 (54.4)	9886 (54.6)	9804 (56.0)	10097 (56.9)	9034 (56.6)	6568 (58.1)
Female	7613 (46.0)	8041 (46.2)	8017 (45.6)	8227 (45.4)	7698 (44.0)	7646 (43.1)	6922 (43.4)	4746 (41.9)
Age								
<20 years	380 (2.3)	471 (2.7)	518 (2.9)	524 (2.9)	505 (2.9)	551 (3.1)	529 (3.3)	233 (2.1)
20–29 years	355 (2.1)	391 (2.2)	375 (2.1)	394 (2.2)	444 (2.5)	423 (2.4)	344 (2.2)	224 (2.0)
30–39 years	974 (5.9)	991 (5.7)	967 (5.5)	968 (5.3)	916 (5.2)	961 (5.4)	802 (5.0)	497 (4.4)
40–49 years	2014 (12.2)	2023 (11.6)	2017 (11.5)	1998 (11.0)	1918 (11.0)	1895 (10.7)	1610 (10.1)	1072 (9.5)
50–59 years	4238 (25.6)	4299 (24.7)	4114 (23.4)	4127 (22.8)	3919 (22.4)	3804 (21.4)	3252 (20.4)	2228 (19.7)
60–69 years	4352 (26.3)	4727 (27.2)	4870 (27.7)	5041 (27.8)	4965 (28.4)	5105 (28.8)	4741 (29.7)	3476 (30.7)
70–79 years	3334 (20.1)	3472 (20.0)	3611 (20.5)	3825 (21.1)	3604 (20.6)	3752 (21.1)	3394 (21.3)	2486 (22.0)
≥80 years	913 (5.5)	1025 (5.9)	1126 (6.4)	1236 (6.8)	1231 (7.0)	1252 (7.1)	1284 (8.0)	1098 (9.7)
Mean±SD	58.7±15.6	58.8±16.0	59.1±16.2	59.5±16.3	59.4±16.3	59.5±16.5	60.0±16.6	61.6±15.6
Patient types								
HT	5751 (34.7)	5784 (33.2)	6023 (34.2)	6212 (34.3)	6057 (34.6)	6024 (34.0)	5483 (34.4)	3974 (35.1)
DM	2105 (12.7)	2243 (12.9)	2322 (13.2)	2506 (13.8)	2486 (14.2)	2914 (16.4)	2727 (17.1)	2120 (18.7)
LD	2221 (13.4)	2639 (15.2)	2424 (13.8)	2433 (13.4)	2297 (13.1)	2282 (12.9)	2084 (13.1)	1374 (12.1)
HT+DM	2097 (12.7)	1943 (11.2)	2126 (12.1)	2231 (12.3)	2076 (11.9)	2117 (11.9)	1800 (11.3)	1307 (11.6)
HT+LD	2130 (12.9)	2254 (13.0)	2166 (12.3)	2258 (12.5)	2229 (12.7)	2057 (11.6)	1960 (12.3)	1351 (11.9)
DM+LD	701 (4.2)	824 (4.7)	836 (4.8)	830 (4.6)	811 (4.6)	834 (4.7)	704 (4.4)	421 (3.7)
HT+DM+LD	1555 (9.4)	1712 (9.8)	1701 (9.7)	1643 (9.1)	1546 (8.8)	1515 (8.5)	1198 (7.5)	767 (6.8)
Complications								
None	11511 (69.5)	12160 (69.9)	12470 (70.9)	12805 (70.7)	12361 (70.6)	12611 (71.1)	11592 (72.6)	8388 (74.1)
Cardiovascular	2160 (13.0)	2300 (13.2)	2335 (13.3)	2462 (13.6)	2466 (14.1)	2615 (14.7)	2176 (13.6)	1565 (13.8)
Cerebrovascular	2190 (13.2)	2282 (13.1)	2215 (12.6)	2328 (12.9)	2245 (12.8)	2089 (11.8)	1887 (11.8)	1157 (10.2)
Both	699 (4.2)	657 (3.8)	578 (3.3)	518 (2.9)	430 (2.5)	428 (2.4)	301 (1.9)	204 (1.8)

HT, hypertension; DM, diabetes mellitus; LD, dyslipidemia.
Data are presented as mean±standard deviation or n (%).

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consistently comprised a slightly higher proportion of male patients throughout the study period, with males accounting for 54.0% in 2013 and 58.1% by 2020. The mean age of the study population increased from 58.7 years (±15.6) in 2013 to 61.6 years (±15.6) in 2020, indicating an aging cohort. The distribution of chronic conditions also evolved over time; the proportion of patients with HT alone and LD alone remained stable, while the prevalence of patients with DM alone showed a gradual increase. Specifically, the percentage of patients with DM rose from 12.7% in 2013 to 18.7% in 2020. The presence of complications, such as cardiovascular and cerebrovascular diseases, varied over the years, with the percentage of patients having no complications increasing from 69.5% in 2013 to 74.1% in 2020, suggesting improvements in disease management or earlier intervention strategies.

Trends in health expenditures

Total health expenditures for managing HT, DM, and LD increased significantly from 2013 to 2020 (Fig. 1). In 2013, the total expenditures were estimated at 157.2 billion KRW, rising to 444.8 billion KRW by 2020, reflecting nearly a threefold increase over the study period. Notably, the proportion of reimbursable costs also saw a marked rise, increasing from 67.1% in 2013 to 84.1% in 2020. This shift indicates not only the growing economic burden associated with chronic disease management in a tertiary care hospital setting but also a significant increase in national-level financial support. Fig. 2 describes the annual health expenditures per patient, showing that the per-patient health expenditures decreased from 842268 KRW in 2013 to 742369 KRW in 2016, stabilizing around 733512 KRW by 2020. This trend suggests that while total expenditures have risen, efforts to control costs on a per-patient basis may have been effective, particularly through improved disease management strategies and increased reimbursement support. Fig. 3 provides a more granular view, showing per-patient expenditures by specific patient subgroups across four dimensions. In Fig. 3A, male patients consistently incurred higher per-patient healthcare expenditures than female patients throughout the study period. Fig. 3B shows that patients aged ≥65 years generally had higher per-patient costs than younger patients until 2016, but the difference narrowed over time and eventually reversed. As presented in Fig. 3C, patients with both HT and DM consistently showed the highest per-patient expenditures, starting at 992108 KRW in 2013 and declining to 872763 KRW in 2020. This decline may reflect improved management or more efficient use of healthcare resources for patients with multiple metabolic conditions. Patients with HT alone also had high expenditures, which decreased from 968555 KRW to 793787 KRW over the same period. Fig. 3D illustrates per-patient expenditures by complication type. By complications, patients with cardiovascular disease incurred the highest annual costs, particularly from 2015 onward. In contrast, patients with cerebrovascular disease showed a decline in total and reimbursed costs, while non-reimbursed costs increased steadily over time.

Factors affecting in health expenditures

GLM model regression (Table 2) identified several significant factors influencing health expenditures. Male patients incurred higher costs than female patients (p<0.001), and patients aged <65 years incurred higher per-patient medical costs than those aged ≥65 years, with an estimated difference of 32689 KRW (p<0.001). This may reflect the tendency for younger patients to receive more intensive treatments or advanced diagnostics, which may lead to higher per-patient costs despite

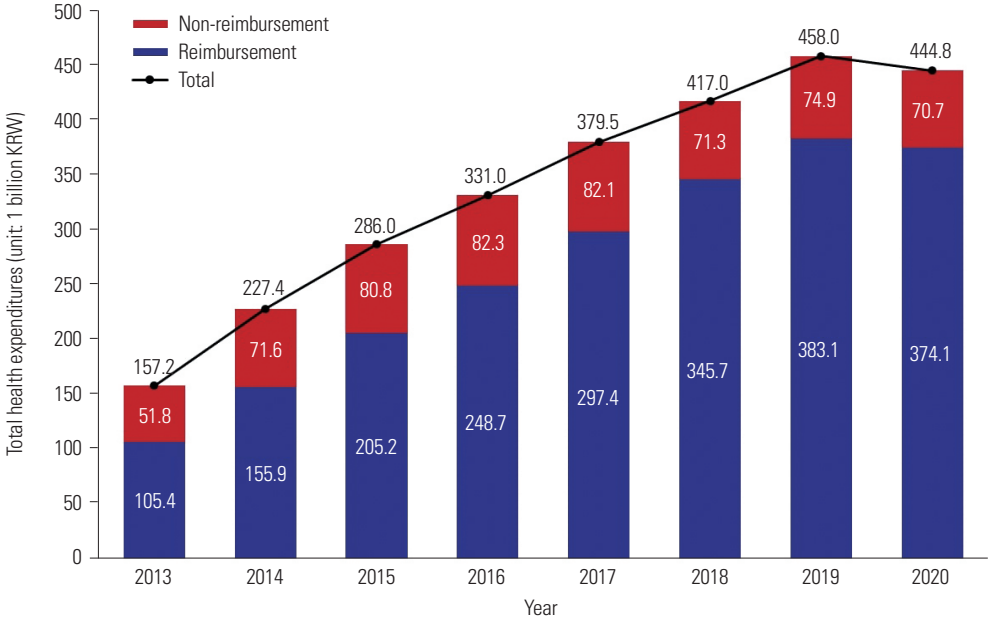

Fig. 1. Total health expenditures from 2013 to 2020.

lower disease burden overall. Patient type was a major determinant, with the highest expenditures observed in patients with both HT and DM, followed by those with HT alone. In contrast, patients with LD alone had significantly lower expenditures (p<0.001). Complications further amplified costs, particularly cardiovascular diseases, which were associated with the larg-

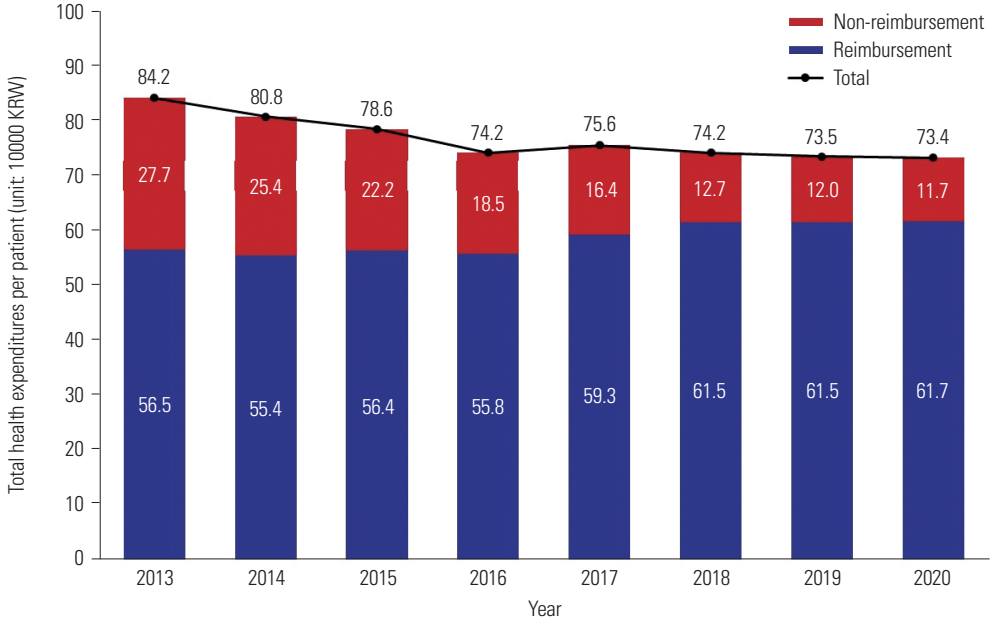

Fig. 2. Total health expenditures per patient from 2013 to 2020.

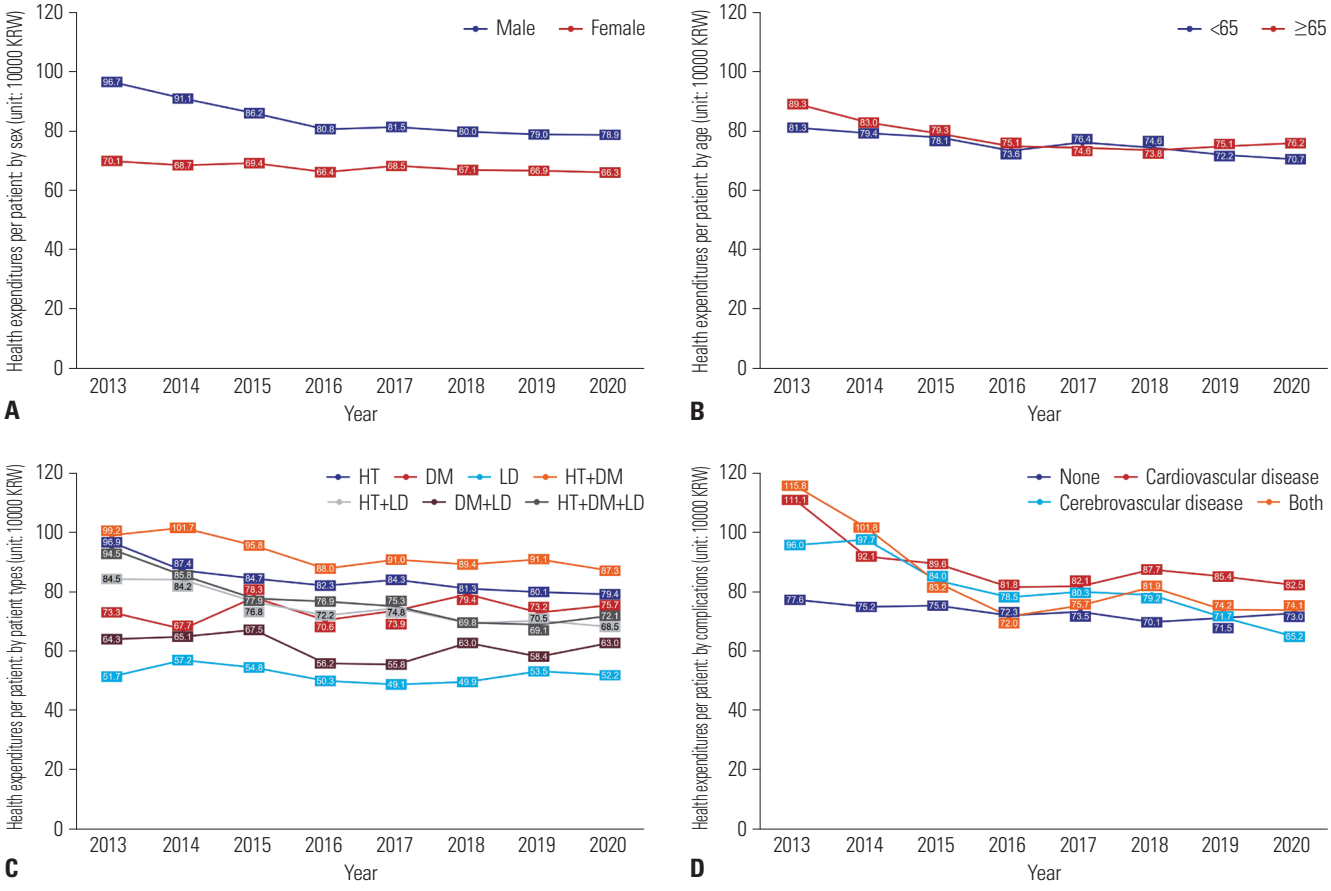

Fig. 3. Trends in health expenditures per patient from 2013 to 2020. (A) By sex. (B) By age group. (C) By patient types (HT, DM, LD combinations). (D) By complications (cardiovascular, cerebrovascular, both). HT, hypertension; DM, diabetes mellitus; LD, dyslipidemia.

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est increases in both total (p<0.001) and reimbursable costs (p<0.001).

The Sankey diagram (Fig. 4) visualized the distribution of expenditures in 2020, emphasizing the costs associated with multiple chronic conditions and complications. Supplementary Figs. 1-7 (only online) represent that of 2013–2019. Patients with HT accounted for a significant share of total and reimbursable costs, driven by higher utilization of inpatient care. Those with severe complications, particularly both cardiovascular and cerebrovascular diseases, represented a smaller subgroup. However, it is interpreted as contributing to the resource-intensive management of these patients, as evidenced by the per-patient cost.

DISCUSSION

This study provides meaningful insights into the financial dynamics of managing chronic metabolic diseases, specifically HT, DM, and LD, in a tertiary care setting in South Korea. By analyzing trends in total and per-patient healthcare expenditures over eight years, this research highlights the economic burden these diseases place on healthcare systems, as well as the influence of demographic factors, comorbidities, and complications on healthcare costs. The study demonstrated a significant increase in total healthcare expenditures for HT, DM, and LD from 2013 to 2020, nearly tripling during the study period. This rise reflects the growing prevalence of these conditions, advancements in treatment, and increased utilization of healthcare services. The increasing proportion of reimbursable costs further indicates a strengthened national-level financial support system for chronic disease management. These results

Table 2. Generalized Linear Model Results for Per-Patient Medical Costs by Year, Sex, Age Group, Disease Type, and Complications (Reference Year: 2020)

Parameter	Total			Reimbursement			Non-reimbursement		
	Estimate	SE	*p*	Estimate	SE	*p*	Estimate	SE	*p*
Intercept	671350	18032	<0.0001	584356	15001	<0.0001	86994	6033	<0.0001
Year									
2013	115852	15301	<0.0001	-45601	12729	<0.0001	161453	5120	<0.0001
2014	81540	13180	<0.0001	-57232	10965	<0.0001	138772	4410	<0.0001
2015	55822	12111	<0.0001	-50309	10075	<0.0001	106131	4052	<0.0001
2016	10864	11391	0.340	-57791	9476	<0.0001	68655	3811	<0.0001
2017	22507	11017	0.041	-24832	9166	0.007	47339	3686	<0.0001
2018	7543	10687	0.480	-2769	8890	0.756	10312	3576	0.004
2019	1301	10409	0.855	-2001	8659	0.817	3902	3483	0.263
2020	ref			ref			ref		
Sex									
Male	120590	6205	<0.0001	89291	5162	<0.0001	31299	2076	<0.0001
Female	ref			ref			ref		
Age									
<65 years	32689	6361	<0.0001	29216	5292	<0.0001	3474	2128	0.103
≥65 years	ref			ref			ref		
Patient types									
HT	124317	10344	<0.0001	85981	8605	<0.0001	39336	3461	<0.0001
DM	43158	12564	0.001	5384	10452	0.607	37774	4204	<0.0001
LD	-187995	12376	<0.0001	-183495	10296	<0.0001	-4501	4141	0.277
HT+DM	194403	12250	<0.0001	136280	10191	<0.0001	58123	4099	<0.0001
HT+LD	-5910	11857	0.618	-12673	9864	0.112	9763	3967	0.014
DM+LD	-111251	15829	<0.0001	-103896	13168	<0.0001	-7355	5296	0.165
HT+DM+LD	ref			ref			ref		
Complications									
None	-93210	15766	<0.0001	-70874	13116	<0.0001	-2236	5275	<0.0001
Cardiovascular	62640	17188	0.000	64531	14299	<0.0001	-1891	5751	0.742
Cerebrovascular	-35164	17368	0.043	-48490	14449	0.001	13326	5811	0.022
Both	ref			ref			ref		

SE, standard error; HT, hypertension; DM, diabetes mellitus; LD, dyslipidemia.
Adjusted for year (ref: 2020), sex, age group, patient types (HT, DM, LD), and complication status.

are consistent with the previous research indicating a trend of expanding public health expenditures.[30,31]

However, the stabilization and slight decrease in per-patient expenditures suggest that efforts to improve cost-efficiency, particularly through better disease management and early intervention strategies, have been somewhat successful. Patients with multiple chronic conditions, particularly those with both HT and DM, consistently exhibited the highest per-patient expenditures. Park, et al.[32] pointed out that from 2010 to 2019, per capita healthcare spending in Korea increased by 52.9% while per capita disability-adjusted life years decreased by 233.4%, suggesting that the country's healthcare spending delivered relatively good value. This underscores the complexity and resource-intensive nature of managing patients with chronic conditions, highlighting the need for integrated care strategies. Similarly, patients with cardiovascular complications incurred the highest costs, emphasizing the economic and clinical importance of preventing complications through early detection and effective management. In the case of cerebrovascular disease, although total and reimbursed expenditures decreased, the rise in non-reimbursed costs may reflect increasing use of services such as rehabilitation, assistive devices, or follow-up procedures that are not fully covered by the national insurance system.

The findings of this study have significant implications for healthcare policy and practice. First, the rising total expenditures underscore the importance of developing sustainable financing mechanisms to address the economic burden of chronic diseases. Expanding preventive programs and enhancing public awareness of lifestyle modifications could help mitigate the growing prevalence and costs associated with metabolic diseases. Second, tailored strategies for managing patients with multiple conditions or complications are critical for reducing resource utilization and improving patient outcomes. Lastly, the observed trends in reimbursable costs highlight the importance of aligning healthcare financing policies with patient needs, particularly in the context of an aging population.

Despite its strengths, this study has several limitations. First, the analysis is based on data from a single tertiary care hospital, which may not fully represent the broader healthcare landscape in South Korea. Differences in cost structures, patient demographics, and treatment practices across smaller clinics and regional hospitals may affect the generalizability of our findings. Nevertheless, this limitation is partially offset by the unique strength of our dataset, which includes both reimbursed and non-reimbursed medical expenditures. Unlike claims-based datasets, which typically exclude non-reimbursed services, our data allows for a more comprehensive and realistic estimation

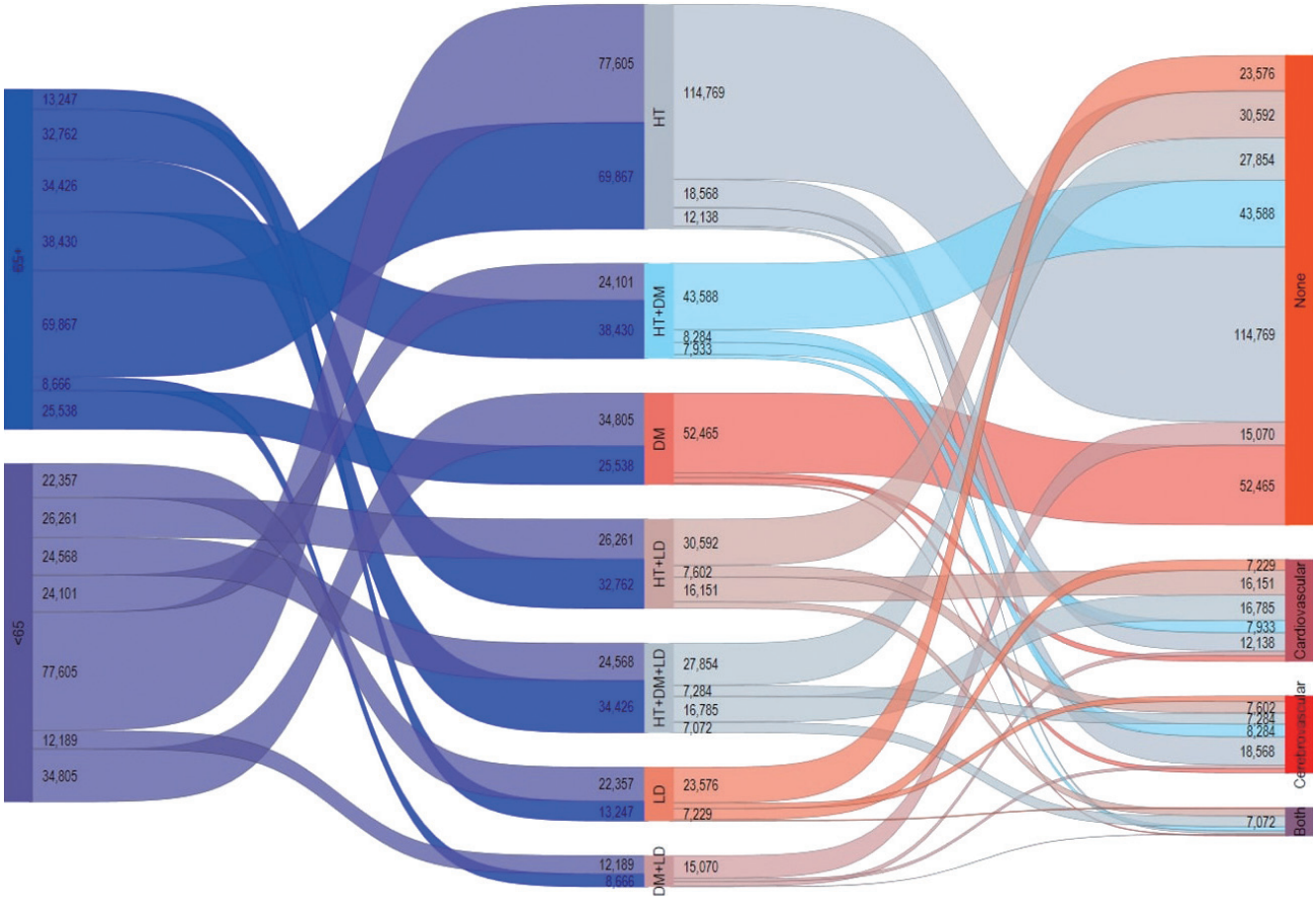

Fig. 4. Sankey diagram for health expenditures in 2020.

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of actual healthcare costs. Given that non-reimbursed services represent a significant portion of out-of-pocket spending in the Korean healthcare system, this level of detail enhances the internal validity and real-world applicability of our findings. Second, the absence of data on socioeconomic factors such as income, education, and employment status limits the ability to assess the broader determinants of healthcare utilization and expenditures. Third, while the study categorizes patients by disease type and complications, it does not account for longitudinal transitions between categories, such as patients progressing from a single condition to multiple conditions. Fourth, the study focused on active patients during the study period, excluding those who may have exited the system due to mortality or other reasons, which could lead to an underestimation of the long-term economic burden of chronic diseases. Fifth, this study did not account for the presence of chronic conditions beyond the three target diseases, such as cancer or chronic respiratory disease. Multimorbidity is known to substantially increase healthcare utilization and costs, and its omission may have led to underestimation of the total economic burden. Future research should incorporate broader comorbidity profiles to enhance the accuracy and generalizability of cost assessments. In addition, this study did not perform detailed subgroup analyses by age, as the primary objective was to examine the overall flow and trends of healthcare expenditures related to chronic metabolic diseases. However, the multivariable model included age as a covariate, comparing individuals aged under 65 years with those aged 65 years and older. Future studies should explore age-specific cost patterns, particularly given the increasing prevalence of these conditions among younger populations. In particular, the observed cost difference by age group may be partially explained by the right-skewed nature of healthcare cost data, where a small proportion of younger patients may account for disproportionately high expenditures due to intensive interventions. Although we used a classical linear regression model to compare costs, we acknowledge that healthcare expenditure data are typically right-skewed. Additionally, although mean and standard deviation were used as descriptive statistics, we recognize that such measures may be limited in skewed distributions. Future studies may consider reporting median and interquartile ranges or visualizing cost distributions to better represent the data. Thus, residuals may not fully satisfy the normality assumption. Future studies may consider using generalized linear models with gamma distribution and log link for more appropriate modeling of skewed cost data. Although cost components included inpatient, outpatient, and emergency services, this study did not disaggregate expenditures by visit type. Future studies should explore these dimensions to better understand cost drivers by care setting.

In conclusion, this study highlights the growing economic burden of metabolic diseases in South Korea and underscores the importance of preventive measures, integrated care strategies, and sustainable healthcare financing to address this challenge. By providing detailed information on healthcare expenditures incurred by patients based on their specific conditions and complications, this study also contributes to helping patients make informed decisions and develop economic plans to manage their medical expenses more effectively. Future research should aim to incorporate broader datasets, including data from various healthcare settings and socioeconomic indicators, to provide a more comprehensive understanding of chronic disease management. By addressing these limitations, policymakers and healthcare providers can better allocate resources, design effective interventions, and ultimately reduce the burden of chronic diseases on patients and the healthcare system.

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AUTHOR CONTRIBUTIONS

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