Utilization Trends and Concentration Ratio of Korean Medicine: Based on the National Health Insurance Data

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Objectives: Although Korean Medicine (KM) subsidized by the National Health Insurance (NHI) has been used for a long time, there has been no active analysis using claims data. Therefore, the purpose of this study was to examine the NHI KM utilization trend using NHI statistics and to measure the level of market concentration by year.

Methods: By restructuring the contents of NHI Statistics for Pharmaceuticals for 2010-2019, the claim cases, costs, and annual growth rates of KM were demonstrated by year, sex, age group, region, therapeutic group, and KM treatment. The proportion of highly used k treatments in cost was calculated as the concentration ratio (CR) k and its trend by year was investigated.

Results: In 2019, the NHI cost on KM amounted to ₩38.2 billion KRW, increasing by 11.6% per year on average in 2010-2019. Notably, KM was used more frequently among women and patients aged ≥ 65 years, and the mixed formulation accounted for 95% of the total cost of KM. The CR of the simple formulation increased rapidly, whereas that of the mixed formulation remained constant. In 2019, three simple formulation treatments—peony, licorice, and ginseng—accounted for 93.8% of the total cost for KM (CR3 = 93.8%).

Conclusion: NHI KM is rapidly increasing. Investigating the CR of KM confirmed that KM prescriptions have been concentrated in small numbers over the past 10 years.

Keywords: korean medicine, herbal preparation, national health insurance, concentration ratio, utilization trend

INTRODUCTION

Herbal preparations are defined as “dried, cut, or refined herbal substances, mainly collected from animals, plants, or minerals” under the Pharmaceutical Law, wherein certain herbal preparations are covered by health insurance services [1]. As of 2020, there were 1,327 herbal preparations in total available on the health insurance service, comprising 682 single herbal preparations, 645 mixed herbal preparations, and 56 standard prescriptions [2].

Recently, Korean medical care has become health insurance-oriented and the overall market for its health insurance has also been steadily increasing. However, there has been no change in

the type of medicine that can be covered by health insurance services, and thus the usage of herbal preparations is low, accounting for a low percentage of total medical expenses. Currently, 56 herbal preparations are covered by health insurance, which have been maintained since 1990 following its expansion from 36 in 1988 due to the recognition of 26 mixed prescriptions in 1987 [3].

Herbal preparations are relatively safe since they are based on traditionally used prescriptions; however, they can cause synergies or drug interactions when administered in combination with other medications. Studies that show this have included interactions with certain drugs or diseases such as antiplatelet drugs and osteoarthritis, reporting that a combination

of herbal preparations and medicines is relatively safe [4, 5].

Previous studies have also shown that drug costs in standard prescriptions were concentrated on a small number of drugs, with 10 herbal preparations accounting for more than half of the claims and the top 20 diseases accounting for 90% of the total claims [6]. Although there have been suggestions—such as adding new prescriptions or improving manufacturing methods—instead of deleting those with low frequency of use, many prescriptions remain concentrated on this small number of drugs [7].

Despite this situation, the current use of herbal preparations using health insurance claims data remains unreported. With the government's policy to strengthen guarantees, Korean medicine (KM) is also being promoted, and it is therefore necessary to investigate the changes in how herbal preparations are used. To that end, there have been studies that have analyzed major diseases and standard prescriptions using health insurance data [6], studies on doctors' drug administration [8], and studies that investigated doctors' recognition and satisfaction [9].

In this study, we examined how the status of herbal preparations has changed over the past decade. Since prior research has reported the concentration of their use in a small number of herbal preparations, the study is intended to analyze the use of herbal preparations and interpret their policy implications by applying the concept of market concentration to quantitatively represent them. The results of this study will provide basic data on the research and policies related to herbal preparations by suggesting how they should be used nationwide.

MATERIALS AND METHODS

1. Source of data

This study used data from one of the statistics using health insurance claims, referred to as “medicine statistics covered by insurance.” [10] The contents of the herbal preparations in this study were extracted and reconstructed from the Health Insurance Review and Assessment Service (hereinafter referred to as HIRA), which publishes medicine statistics every year. The herbal preparations presented in this study were based on single herbal and mixed herbal preparations listed in the “A health insurance list of herbal preparations and upper limit amount,” which included health insurance claims other than medical benefits. The analysis period starts in 2010, when herbal medicine statistics started being produced, and continues until the

most recent data, 2019.

2. Variables

The status of herbal preparation use was presented as the number of claims, the expense of claims, and the rate of their increase. Specifically, the number of claims for each year refers to the number of medical statements prescribed by herbal preparations, whereas the expense claimed is the sum of insurance benefit costs and the patients' own charges multiplied by the unit price and the cost of use for each herbal preparation. To quantify the change in claims for 2010-2019, the growth rate period was calculated as the compound annual growth rate (CAGR), which can be interpreted as the average annual growth rate of the value (V) over a period of time (t years).

$$\text{CAGR} = (\text{V final} / \text{V begin})^{1/t} - 1$$

3. Method of analysis

The study analysis was divided into three parts: (1) macro-level analysis of the trend in Korean herbal preparation use, (2) analysis of the status of use for individual herbal preparations, and (3) market concentration of herbal preparations. First, to analyze the trend of herbal preparation use in Korea, both the total number and cost of claims were presented on an annual basis and the increase rate was calculated and compared to the total KM treatment expenses from health insurance. Afterward, this was again classified by sex (male and female) and by patient age (0-19 years, 20-64 years, and ≥ 65 years). Moreover, the use of herbal preparations was presented in subdivisions by region and by group of medicinal efficacies, confirming which region and which group of drugs with a certain medical efficacy were used more frequently and had increased rapidly. For the efficacy group based on the Ministry of Food and Drug Safety, only statistics for 2010-2017 were presented, which was the only period for which data could be obtained. Second, an analysis of individual herbal preparation claims identified which of the single or mixed herbal preparations were used the most and had increased in use. Finally, the market concentration of frequently used herbal preparations was presented as a concentration, which quantitatively identified its changes during the analysis period. Market concentration is a concept that measures the monopoly power and level of market competition of certain products in the market. However, in this study, the concentration ratio k (CRk) was used to refer to prior research

to indicate the share of the top *k* products in the market [11]. In other words, CR3 refers to the share of the top three products in the overall market, wherein a high concentration meant that only a few products were mainly used. In this study, CR3, CR5, and CR10 were measured for single herbal preparations and CR3, CR5, CR10, and CR20 were measured for mixed herbal preparations.

RESULTS

1. Annual claim status of herbal preparations

According to the 2010-2019 health insurance statistics, the number of herbal preparations claims and expenses steadily increased (Table 1). Specifically, the expenses of claims for herbal preparations increased by 11.6% annually while the number of claims increased by 22.5% annually, which indicates that the expenses of claims per case have been decreasing. In fact, the expense in 2010 was noted to be ₩36,000 KRW per prescription of herbal preparations, which decreased to ₩15,000 KRW per prescription in 2019. Moreover, according to a survey of claims for herbal preparations by type of nursing institution, herbal preparations were only used in KM hospitals and medicine clinics; by 2019, these institutions charged ₩2.7 billion KRW and ₩35.6 billion KRW, respectively. Furthermore, the rate of increase in prescribing expenses of KM clinics was 12.0%, which was higher than that of KM hospitals (6.7%). Therefore, herbal preparations were found to be mainly used in KM clinics rather than hospitals.

However, calculating the prescription expense per case showed that KM hospitals spent approximately ₩10,000 KRW in 2019 on average, whereas KM clinics only spent approximately ₩1,450 KRW on average, indicating that KM clinics prescribed relatively cheaper preparations. According to sex-specific usage, as of 2019, the number of claims made by men and women were 8.26 million and 16.49 million, respectively, costing ₩12.9 billion KRW and ₩25.4 billion KRW, respectively. Over the past decade, the use of herbal preparations by women was noted to have increased more rapidly than that by men, with women's claims increasing by 12.3% annually and men's claims by 10.3% annually. According to age-specific usage, 450,000 cases, 3.18 million cases, and 20.11 million cases of herbal preparations were reported in the age groups 0-19 years, 20-64 years, and ≥ 65 years, respectively. Over the past decade, the use of herbal preparations has decreased in the 0-19 years

Table 1. Utilization trends of Korean Medicine by prescriber type, patients sex, and age group

Year	Total			Hospital			Clinic			Male			Female			0-19 years			20-64 years			65+ years		
	Rx cases	Costs		Rx cases	Costs		Rx cases	Costs		Rx cases	Costs		Rx cases	Costs		Rx cases	Costs		Rx cases	Costs		Rx cases	Costs	
2010	3,981	142		165	15		3,816	128		1,528	5,312		2,454	8,916		653	2,060		2,742	9,936		587	2,232	
2011	11,510	259		162	14		11,348	245		3,836	8,933		7,673	16,946		681	2,142		3,386	11,537		7,442	12,200	
2012	12,916	271		202	14		12,714	257		4,310	9,333		8,608	17,744		670	2,092		3,465	11,672		8,783	13,313	
2013	14,518	281		192	15		14,325	266		4,815	9,597		9,707	18,479		605	1,916		3,448	11,535		10,469	14,625	
2014	16,020	279		205	16		15,815	263		5,224	9,401		10,796	18,547		566	1,891		3,397	11,386		12,057	14,671	
2015	17,524	284		222	19		17,302	265		5,752	9,555		11,771	18,869		525	1,817		3,374	11,431		13,624	15,176	
2016	19,518	309		238	22		19,281	288		6,395	10,390		13,122	20,541		506	1,833		3,392	11,994		15,619	17,104	
2017	21,996	340		248	24		21,748	315		7,233	11,385		14,764	22,580		469	1,784		3,615	12,846		17,913	19,339	
2018	22,681	358		259	25		22,422	333		7,557	12,045		15,125	23,758		457	1,763		3,918	13,691		18,307	20,349	
2019	24,749	382		268	27		24,481	356		8,257	12,879		16,490	25,356		458	1,843		4,179	14,571		20,110	21,821	
Growth rate	22.5%	11.6%		5.5%	6.7%		22.9%	12.0%		20.6%	10.3%		23.6%	12.3%		-3.9%	-1.2%		4.8%	4.3%		48.1%	28.8%	

Note: Rx means prescription. The unit of the Rx cases are 1,000 cases, and costs are 100,000,000 KRW. Growth rate was calculated using CAGR (Compound Annual Growth Rate) formula which means average growth rate of value (V) during time in years (t) calculated by a formula: $(V_{\text{final}}/V_{\text{begin}})^{(1/t)} - 1$.

group but has slightly increased in the 20-64 years group. However, use in the 20-64 years old group was lower than the overall average growth rate, which increased by 48.1% per year in the ≥ 65 years group, indicating that the use of herbal preparations among the elderly has led to an increase in the number of herbal preparations claims (Table 1 and Fig. 1). Claims by age group were also high among those aged ≥ 65 years, but the average annual growth rate was 28.8%, which was lower than that of the number of claims.

Looking at the expenses of claims made by 17 cities and provinces between 2010 and 2019, Seoul was found to use herbal preparations the most, followed by Gyeonggi, Busan,

Gyeongbuk, and Gyeongnam (Table 2). As of 2019, Seoul had used 8.1 billion KRW worth of herbal preparations, while Gyeonggi had used ₩7.7 billion KRW worth of herbal preparations. During the analysis period, Sejong's growth rate reached 27.5%, whereas the country's growth rate reached 11.6%. Since then, Gyeongnam, Busan, Gyeongbuk, and Jeju have been identified as areas with high growth rates.

As a result of classifying herbal preparations into therapeutic groups between 2010 and 2019, the use of drugs for the nervous system and sensory organs (190) was found to be the most common, followed by use as digestive organ solvents (239), heat-resisting painkillers (114), and digestive medicines (233)

Figure 1. Utilization trends of Korean Medicines by sex and age group: prescription cases (A) and cost (B).

Table 2. Utilization trends of Korean Medicines by region (unit: 1,000,000 KRW)

Region	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Growth rate
Total	14,226	25,880	27,078	28,076	27,950	28,428	30,932	33,968	35,803	38,237	11.6%
Seoul	3,472	5,390	5,537	5,584	5,666	5,914	6,612	7,152	7,632	8,109	9.9%
Gyeonggi	2,869	4,998	5,097	5,207	5,337	5,470	6,060	6,715	7,093	7,706	11.6%
Busan	802	1,644	1,808	1,920	1,824	1,827	2,082	2,269	2,419	2,646	14.2%
Gyeongnam	603	1,266	1,452	1,610	1,606	1,682	1,753	1,914	1,954	2,109	14.9%
Gyeongbuk	633	1,470	1,509	1,567	1,566	1,646	1,681	1,833	1,889	2,066	14.0%
Incheon	689	1,175	1,193	1,260	1,266	1,247	1,365	1,497	1,698	1,834	11.5%
Daegu	640	1,153	1,250	1,293	1,325	1,359	1,457	1,596	1,672	1,784	12.1%
Daejeon	919	1,482	1,448	1,509	1,440	1,376	1,481	1,575	1,628	1,718	7.2%
Gwangju	568	867	955	1,077	1,178	1,215	1,306	1,541	1,559	1,640	12.5%
Chungnam	505	1,330	1,357	1,421	1,377	1,332	1,352	1,444	1,530	1,574	13.5%
Jeonbuk	520	992	1,088	1,114	1,193	1,218	1,351	1,484	1,488	1,536	12.8%
Jeonnam	490	1,261	1,384	1,419	1,312	1,289	1,354	1,557	1,538	1,525	13.4%
Chungbuk	533	974	1,000	1,015	928	939	1,004	1,096	1,134	1,235	9.8%
Gangwon	439	915	984	1,024	960	948	1,008	1,082	1,138	1,172	11.5%
Ulsan	414	610	611	604	551	550	594	682	775	857	8.4%
Jeju	131	353	371	365	335	330	372	413	501	543	17.1%
Sejong	-	-	33	85	86	87	100	117	155	181	27.5%

Table 3. Utilization trends of Korean Medicines by treatment group (unit: 1,000,000 KRW)

Treatment groups ¹⁾	2010	2011	2012	2013	2014	2015	2016	2017	Growth rate
Total	14,114	25,524	26,548	27,249	26,946	27,276	29,425	32,179	12.5%
(190) Other medicines for nervous system and sensory organs	4,006	8,577	8,262	8,166	7,503	7,426	7,880	8,445	11.2%
(239) Other digestive drugs	1,854	3,114	3,511	3,965	4,638	5,642	6,439	7,481	22.1%
(114) Antipyretic, analgesic, anti-inflammatory	3,923	5,932	6,196	6,029	5,517	5,238	5,453	5,614	5.3%
(233) Geonwi-sohwaje (digestive drugs)	1,012	1,865	1,965	2,043	1,992	2,036	2,176	2,419	13.3%
(222) Jinhae Geodamje (cough suppressant, sputum remover)	1,065	1,432	1,526	1,519	1,676	1,687	1,781	1,857	8.3%
(235) Antiemetics	154	728	954	1,215	1,369	1,184	1,300	1,654	40.4%
(329) Other nourishing agents	560	1,556	1,599	1,681	1,587	1,542	1,649	1,649	16.7%
(263) Purulent disease agents	515	719	815	846	866	782	830	880	8.0%
(253) Tong-gyeongje (emmenagogue)	461	701	680	666	592	537	587	629	4.5%
(132) Otorhinolaryngicide	281	351	400	423	506	536	570	619	11.9%
(119) Other drugs for central nervous system	93	145	159	174	207	205	261	392	22.8%
(399) Metabolic drugs, not elsewhere classified	29	156	168	191	170	166	169	177	29.5%
(229) Other respiratory drugs	71	90	108	115	109	96	108	112	6.7%
(219) Other circulatory drugs	22	52	73	70	70	72	83	95	23.2%
(238) Laxative	18	35	45	46	50	51	49	51	16.0%
(231) Dental oral medicine	18	29	35	40	33	29	33	37	10.8%
(259) Other drugs for genitourinary organs and anal use	15	19	21	24	23	22	26	32	11.4%
(290) Other medicines for individual organs	13	17	26	28	29	21	22	25	9.8%
(392) Antidote	4	6	6	8	9	7	8	10	14.0%

Note: Treatments groups are defined by Korean Ministry of Food and Drug Safety (MFDS). Statistics of classification by MFDS treatment group were available until 2017.

(Table 3). Other groups of drugs with a rapid increase in prescription expenses were as follows: emetic drugs (235) were the highest, with a 40.4% increase annually; followed by metabolic drugs (399), which were not classified separately and increased by 29.5% annually; and lastly by other metabolic drugs (219), which increased by 23.2% annually and were higher than the herbal preparations overall growth rate of 12.5%.

2. Herbal preparations claims per case

Looking at the claims for single herbal preparations for 2010-2019, these preparations were found to have the highest levels of *Paeonia lactiflora* and *Glycyrrhizae Radix*, for which the annual usage increased rapidly (Table 4, Fig. 2A). In 2019,

the claims for *Paeonia lactiflora* were about ₩11.1 billion KRW, and those for *Glycyrrhizae Radix* were about ₩600 million KRW, with an annual average growth rate of 14.0% and 40.4%, respectively. Subsequently, there were many claims, such as *Glycyrrhizae Radix*, *Panax ginseng*, *Angelica koreana*, and *Aralia cordata*. In the case of single herbal preparations, the expenses of claims for many drugs decreased during the analysis period, while the concentration of claims on the top drugs intensified. On the other hand, examining the claims of mixed herbal preparations during the same period showed that Ojeok-san was used the most annually, with a claim amounting to ₩7.9 billion KRW in 2019. Furthermore, the fastest-growing herbal preparation was Gungha-tang, which increased by 80% annually, followed by Gumi-Ganghwaltang, Banha-Sashimtang,

Table 4. Utilization trends of highly used Korean Medicines: simple formulation (unit: 1,000,000 KRW)

Treatments	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	CAGR
Total (simple formulation)	111	355	529	826	1,003	1,152	1,506	1,788	1,825	1,951	37.5%
Paeoniae Radix	9	67	141	276	375	496	711	928	1,008	1,113	95.1%
Glycyrrhizae Radix	7	43	90	187	252	327	450	556	605	657	14.0%
Ginseng Radix	3	6	3	4	43	112	121	90	67	61	40.4%
Angelicae Pubescentis Radix	1	7	13	17	22	20	26	27	19	20	24.8%
Osterici Radix	3	12	16	26	45	38	40	37	23	18	22.2%
Saposhnikoviae Radix	2	10	15	18	28	26	29	29	19	17	12.1%
Angelicae gigantis Radix	5	20	31	39	36	24	24	23	16	15	24.9%
Cinnamomi Ramulus	3	10	20	27	17	12	19	23	17	13	17.0%
Zingiberis Rhizoma Recens	2	3	7	6	5	8	15	18	15	12	7.4%
Atractylodis Rhizoma	3	9	14	17	21	16	19	18	12	11	25.7%
Zizyphi Fructus	2	4	8	10	7	4	6	7	7	7	2.4%
Rehmanniae Radix Preparat	2	8	9	10	7	3	3	4	3	1	13.2%
Schizonepetae Spica	1	1	1	1	1	0	0	1	0	1	12.5%
Liriopes Radix	2	7	4	7	13	11	17	14	8	1	36.0%
Poria	9	13	14	16	9	3	2	1	1	1	10.7%
Rehmanniae Radix	2	3	2	1	1	1	0	1	0	0	19.1%
Peucedani Radix	0	0	0	0	1	0	0	1	0	0	12.0%
Puerariae Radix	3	13	15	16	14	5	3	1	1	0	25.4%
Pinelliae Rhizoma	4	12	14	13	17	16	7	1	1	0	29.5%
Scutellariae Radix	2	3	3	3	1	0	0	0	0	0	1.8%

Note: Treatments are ordered by cost in 2019. CAGR (Compound Annual Growth Rate) is average growth rate of value (V) during time in years (t) calculated by a formula; $(V_{\text{final}}/V_{\text{begin}})^{(1/t)} - 1$.

Figure 2. Utilization trends of Korean Medicines by formulation: simple formulation (A) and mixed formulation (B).

Socheongryong-tang, and Bojungikgi-tang (Table 5, Fig. 2B). The growth rates of Leejin-tang, Hwangryeon-Haedogtang, and Banha-Sashimtang were also noted to be high.

3. Concentration of claims for high-use herbal preparations

The concentrations of claims for 2010-2019 are presented separately for single and mixed herbal preparations (Table 6). Based on the insurance payment list of herbal preparations in December 2019, single-extract preparations had a total of 67

Table 5. Utilization trends of highly used Korean Medicines: mixed formulation (unit: 1,000,000 KRW)

Treatments	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	CAGR
Total (mixed formulation)	14,114	25,523	26,548	27,249	26,946	27,275	29,425	32,179	33,977	36,285	11.1%
Ojeok-san	3,809	8,292	7,992	7,883	7,207	7,126	7,563	8,123	7,947	7,932	8.5%
Gungha-tang	22	522	865	1,302	1,754	2,365	2,776	3,456	3,676	4,435	80.3%
Gumiganghwal-tang	833	1,956	2,179	2,162	2,010	1,972	2,088	2,187	2,417	2,661	13.8%
Banhasasim-tang	312	534	595	627	809	996	1,234	1,575	1,981	2,388	25.4%
Socheongryong-tang	949	1,162	1,236	1,228	1,373	1,406	1,476	1,537	1,757	1,808	7.4%
Bojungikgi-tang	349	1,175	1,217	1,298	1,210	1,165	1,234	1,215	1,533	1,675	19.0%
Yijin-tang	154	728	954	1,215	1,369	1,184	1,301	1,654	1,590	1,588	29.6%
Samsoeum	1,086	1,256	1,304	1,246	1,346	1,352	1,355	1,310	1,296	1,320	2.2%
Pyungwi-san	380	855	892	921	865	861	920	1,170	1,212	1,277	14.4%
Hyangsapyeongwi-san	594	964	1,025	1,077	1,084	1,129	1,198	1,208	1,176	1,247	8.6%
Youngyopaedoc-san	515	719	815	846	866	782	830	880	956	1,043	8.2%
Banhabaekchulchoenma-tang	494	674	657	639	690	834	908	872	965	932	7.3%
Hyunggaeyungyo-tang	282	351	400	423	506	536	570	619	738	835	12.8%
Galgeun-tang	973	1,312	1,291	1,242	771	549	612	704	726	801	-2.1%
Kamisoyo-san	453	683	656	640	570	517	567	607	645	707	5.1%
Soshiho-tang	319	427	411	401	470	476	501	551	576	654	8.3%
Hwangryunhaedok-tang	72	112	127	152	188	193	251	382	513	594	26.4%
Insampaedok-san	651	730	730	693	712	688	656	628	617	584	-1.2%
Pamul-tang	194	324	319	308	294	306	348	376	401	471	10.4%
Bulhwangeumjeonggi-san	135	231	267	283	264	270	311	318	358	408	13.0%

Note: Treatments are ordered by cost in 2019. CAGR (Compound Annual Growth Rate) is average growth rate of value (V) during time in years (t) calculated by a formula; $(V_{\text{final}}/V_{\text{begin}})^{(1/t)} - 1$.

Table 6. Concentration ratio (CR) trends of highly used Korean Medicines

Concentration ratio	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Simple formulation										
Total cost of the market (1,000,000 KRW)	111	356	530	826	1,004	1,152	1,506	1,789	1,826	1,951
CR ₃	22.1%	36.5%	49.4%	60.7%	66.9%	81.2%	85.1%	88.0%	92.1%	93.8%
CR ₅	29.7%	44.0%	56.3%	67.1%	74.8%	86.8%	89.7%	91.7%	94.3%	95.8%
CR ₁₀	44.4%	59.4%	69.6%	77.4%	85.2%	94.5%	96.7%	97.8%	98.6%	99.2%
Mixed formulation										
Total cost of the market (1,000,000 KRW)	14,114	25,524	26,548	27,249	26,946	27,276	29,425	32,179	33,977	36,285
CR ₃	41.6%	45.3%	43.2%	41.6%	40.7%	42.0%	42.2%	42.8%	41.3%	41.4%
CR ₅	54.2%	54.8%	52.7%	51.0%	50.9%	52.1%	51.9%	52.8%	52.3%	53.0%
CR ₁₀	73.4%	72.2%	71.4%	71.8%	70.8%	71.7%	71.9%	72.8%	72.4%	72.6%
CR ₂₀	92.1%	91.6%	91.3%	91.1%	91.1%	91.3%	91.1%	91.3%	91.5%	91.9%

Note: Concentration ratio (CR_k) means the proportion of the cost from the highest k products out of the total market cost. As of December 2020, 67 treatments (680 products) are listed as simple formulation, and 56 treatments (626 products) are listed as mixed formulation on the National Health Insurance.

prescriptions (680 items), and CR3, which represents the top three prescriptions, accounted for 93.8% of the total, showing a high concentration with a significant increase compared to the 22.1% it accounted for in 2010. During the same period, the concentration of the top five herbal preparations, CR5, increased from 29.7% to 95.8%, and the concentration of the top 10 herbal preparations, CR10, increased from 44.4% to 99.2%.

In December 2019, a total of 56 prescriptions (626 items) were listed in the herbal preparation payment list, of which CR3 was 41.4%, showing a lower concentration than that of single herbal preparations. In comparison to the 41.6% CR3 concentration in 2010, the concentration level was almost unchanged. During the same period, CR5 decreased from 54.2% to 53.0%, CR10 from 73.6% to 73.4%, and CR20 from 92.1% to 91.9%. Additionally, the overall increase in claims for single herbal and mixed herbal preparations was 37.5% and 11.1%, respectively, and the concentration of certain herbal preparations was also greater in single herbal preparations, which intensified during the analysis period.

DISCUSSION

This study used statistics for 2010-2019, during the time when the International Classification of Diseases (ICD) code for herbal preparations in the National Health Insurance (NHI) was refined to reconstruct the approximate claims of herbal preparations and suggest the implications of changes in the use of herbal preparations. By looking at these changes over the past decade, we have been able to observe changes in herbal treatment expense, claims of herbal preparations, and the characteristics of these prescriptions and the patients taking them. More importantly, by looking at the change in expense by the prescription name of herbal preparations, frequently used herbal preparations were identified annually, as were the intensified concentrations of use of certain single herbal preparations.

Among the results of the study, the results presented in the annual statistics on herbal preparations are as follows. First, the use of herbal preparations increased more rapidly than Korean medical expenses in NHI. In 2019, Korean medical expenses amounted to about ₩3 trillion KRW, or 3.8% of the total health insurance expenses, which have increased by 6.7% annually over the past decade. On the other hand, herbal preparation was reported to be worth ₩38.2 billion KRW in 2019, which accounts for only 1.3% of Korean medical expenses and 0.05% of total health insurance costs. Despite this, its annual growth

rate was 11.6% during the same period, which was greater than that of Korean medical expenses. Although small, the dynamic changes in herbal preparation use in the public domain will be an important reference for improving the herbal preparation-related system and establishing policies.

Second, statistics by age group showed that the use of herbal preparations in women was higher than that in men and has increased rapidly. While herbal preparation use in patients aged 0-19 has decreased, its use in people ≥ 65 years has increased significantly, suggesting that its use by older patients has led to an increase in the claims of herbal preparations. However, the number of prescriptions for herbal preparations in the elderly has increased by approximately 50% each year, whereas the prescription expense has increased by 29%, which indicates that the bills per case in this population are gradually decreasing, thereby suggesting more low-unit-cost prescriptions.

Third, regional statistics showed that Seoul had the most herbal preparation use. However, considering that the use of herbal preparations was mainly by the elderly, it was expected that many herbal preparations would be used in areas where the population has aged due to its distribution. Given that the growth rate has increased more rapidly in provincial areas than in Seoul or metropolitan cities, one cannot doubt that there is a link between the aging level by region and herbal preparation prescription.

The analysis of each type of herbal preparation has also produced meaningful results, with the expense of claims made by the top single herbal preparations, such as *Paeonia lactiflora* and *Glycyrrhizae Radix*, accounting for a large portion of the total herbal preparations. In 2019, CR3 was 93.8%, meaning that claims for three single herbal preparations—*Paeonia lactiflora*, *Glycyrrhizae Radix*, and *Panax ginseng*—accounted for 93.8% of the total 67 prescriptions. This concentration has intensified rapidly over the past decade, whereas other prescriptions have been decreasing, resulting in the total expense of claims for single herbal preparations increasing significantly. Notably, this phenomenon has been observed more severely in single herbal than in mixed herbal preparations. In comparison, the concentration of mixed herbal preparations (CR3, CR5, CR10, and CR20) did not change significantly during the analysis period. However, there has been a rapid increase in some prescriptions, such as Gungghal-tang.

Patterns regarding the prescriptions by KM doctors for these herbal preparations can be interpreted as the result of a system designed to raise the total treatment cost for senior citizens

from ₩15,000 KRW to ₩20,000 KRW when administered by KM institutions. These institutions have a structure in which the total cost of medication is included in the total medical expenses when patients take insurance-covered KM. In this case, if the cost of medication increases, the total medical expenses may exceed the standard for the flat-rate system application in the elderly. In such cases, it will be converted to a fixed-rate system, possibly resulting in a sharp increase in personal burden compared to the flat-rate system. Considering this environment, it can be explained why herbal medicine prescriptions have been increasing in the elderly while the administrative fee per prescription is decreasing. Additionally, considering that the main target of KM clinics is the elderly and women, it can be estimated that herbal preparation use is increasing due to these populations. Furthermore, the high concentration of *Paeonia lactiflora* and *Glycyrrhizae Radix* among sweetened herbal preparations can be explained by the omission of Jakyakgamcho-Tang, which is often used for muscle and joint pain.

Based on the 2019 statistics, the expense of claims for single herbal preparations was only ₩1.9 billion KRW, but that for mixed herbal preparation was ₩36.3 billion KRW, which shows that 95% of the prescription expense for herbal preparations was in mixed herbal preparations. This can be seen as a big result of the current medical charge of herbal preparations, which tend to prefer mixed herbal preparations due to the difficulty of preparing prescriptions with various kinds of single herbal preparations in the clinical setting. Therefore, it would be desirable to reasonably revise the medical charge of single herbal preparations or diversify the standard prescription of mixed herbal preparations so that appropriate herbal preparations can be prescribed to patients.

Given that herbal preparation is a prescription that is covered by health insurance benefits and is managed according to the payment list, its prescription and usage are accumulated as big data. This means that more in-depth analyses on herbal preparation use, herbal prescription, and effectiveness are likely to be used through the aggregation of these data from patient groups in the future. This study is the first long-term aggregation of herbal preparation use covered by insurance and is meaningful in providing basic academic and policy data.

However, it should be noted that the situation of herbal preparations excluded from insurance cannot be determined, that various external variables can act on the prescription patterns of herbal preparations, and that sufficient time series data were not analyzed before and after 2011, when the flat-rate

scheme for the elderly was introduced.

CONCLUSION

In this study, the usage status of herbal preparations covered by health insurance was analyzed by reconstructing the drug statistics of the HIRA data for 2010-2019. As a result, it was found that even if the size of herbal preparations was small, the use of herbal preparations has increased more rapidly than the total cost of KM over the past decade, especially among the elderly. However, many of the increased prescriptions were low-cost, which was closely related to the rapid increase in single herbal preparations. Furthermore, these single herbal preparations were concentrated on a small number of herbs, including *Paeonia lactiflora*, *Glycyrrhizae Radix*, and *Panax ginseng*.

Health preparation covered by NHI is an area where claims data have been accumulated following the establishment of health care big data. Moreover, there are various possibilities for future research using this data, as the basic results of this study will be a reference for future research and policy arrangements.

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CONFLICTS OF INTEREST

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