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 treatments in cost was calculated as the concentration ratio (CR) 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 antithrombotic 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).

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\text{CAGR} = \left( \frac{V_{\text{final}}}{V_{\text{begin}}} \right)^{\frac{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
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 men has increased more rapidly than that by women, 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
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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       | 968       | 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%       |
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 Glycyrrhiza 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 Glycyrrhiza 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 Glycyrrhiza 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.
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

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**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          | 2     | 3     | 7     | 6     | 5     | 8     | 15    | 18    | 15    | 12    | 7.4%  |
| Atractyloides 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     | 1     | 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; \((V_{final}/V_{begin})^{(1/t)} - 1\).

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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.
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     | 2,262     | 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%    |
| Bojungki-tang               | 349       | 1,175     | 1,217     | 1,298     | 1,210     | 1,165     | 1,234     | 1,151     | 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%   |
| Samsoeam                    | 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%   |
| Hyangssyeongwi-san          | 594       | 964       | 1,025     | 1,077     | 1,084     | 1,129     | 1,198     | 1,208     | 1,176     | 1,247     | 8.6%    |
| Youngyopoedoc-san           | 515       | 719       | 815       | 846       | 866       | 782       | 830       | 880       | 956       | 1,043     | 8.2%    |
| Banhaekchulchoenma-tang     | 494       | 674       | 657       | 639       | 690       | 834       | 908       | 872       | 965       | 932       | 7.3%    |
| Hyunggaseungyo-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       | 654       | 640       | 570       | 517       | 567       | 607       | 645       | 707       | 5.1%    |
| Soshihoo-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%   |
| Bulhwangumjeonggi-san       | 135       | 231       | 267       | 283       | 264       | 270       | 311       | 318       | 358       | 408       | 13.0%   |

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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 W3 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 W38.2 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 Glycyrrhiza 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, Glycyrrhiza 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 Gunggah-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 *Glycyrrhiza Radix* among sweetened herbal preparations can be explained by the omission of Jakyak-gamcho-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*, *Glycyrrhiza 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

The authors declare no conflicts of interest.

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