



Trends of Gout Prevalence in South Korea Based on Medical Utilization: A National Health Insurance Service Database (2002 ~ 2015)

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Objective. Although gout is the most common form of inflammatory arthritis, data on gout prevalence and management are sparse, especially in Korean populations. This study reevaluated the most recent prevalence and incidence of gout values in Korean people to update the findings from our previous study in 2011. **Methods.** We used the National Health Insurance Service-National Health Information Database (NHIS-NHID) to identify patients diagnosed with gout in South Korea during 2002 ~ 2015. We selected patients with gout as principal diagnosis or 1st ~ 4th additional diagnosis. **Results.** The prevalence of gout increased 5.17-fold, from 0.39% in 2002 to 2.01% in 2015. This increase occurred in all age groups, but was stronger in those aged 80 years or older, with a 13.1-fold increase from 2002 to 2015. The prevalence of gout increased in all regions of South Korea. The prevalence of the disease was also related to income levels: in 2015, medical insurance subscribers with the highest income were twice more likely to have gout than those in the lowest income bracket. By contrast, the prevalence of gout in medical benefit recipients was 5.58- and 5.25-times higher than that of the general population and of those in the highest income bracket, respectively. **Conclusion.** The prevalence of gout has increased rapidly, although the degree of increase varied according to sex, age, region, and income group. This study sheds some light on the current prevalence of gout among national insurance subscribers in Korea, and will help educate patients and medical staff on the management of gout. (*J Rheum Dis* 2020;27:174-181)

Key Words. Gout, Prevalence, South Korea, National Health Insurance

INTRODUCTION

Gout is caused by elevated uric acid levels in blood due to excessive synthesis or decrease in the urinary excretion of uric acid. This condition promotes the deposition of uric acid crystals in the joints or soft tissues [1]. If gout is left untreated, deformity and discomfort due to gout tophi occur, in addition to various complications such as kidney disease and urolithiasis [2]. However, most patients are only aware of other more well-known joint diseases and are unaware of the seriousness of long-term complications associated with gout.

The prevalence of gout is increasing due to lifespan ex-

tension and lifestyle changes. In South Korea, the number of patients treated for gout increased by 8.5% annually from 220,000 in 2010 to 300,000 in 2014. Health insurance expenses as a result of gout increased from 39.5 billion won in 2010 to 59.4 billion won in 2014, corresponding to an average yearly increase of 10.8%. In order to establish accurate treatment guidelines for gout in Korea, where the number of patients with gout is rapidly increasing, it is necessary to investigate its prevalence, and understand the demographics of patients with gout.

A study on the prevalence of gout in South Korea between 2001 and 2008 showed a rapid increase of gout (mainly in the those in their 20s and 30s) over the years,

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reaching 0.40% in 2008 [3]. Other sources show that in 2007, the prevalence of gout in Greece was 4.75% [4]. In France, the rate in 2013 was 0.9% [5], as determined through a phone survey. Furthermore, the prevalence rate was 3.2% in the UK (2012) [6] and Spain [7], 3% in Canada [8], and 3.9% in the US in 2007~2008 [9]. Some studies have also reported this rate in locations within Northeast Asia: 5.1% (in people aged 45 years and older) in Hong Kong in 2001 [8] and 0.53% in Qingdao (China) in 2004 [10]. A study using the National Health Insurance Research Database in Taiwan, a country with a health insurance system similar to that of South Korea, showed a prevalence rate of gout of 6.25% in 2010 [8]. Interestingly, the prevalence rates of gout in South Korea reported by Lee and Sung [3] between 2001 and 2008 were much lower than those estimated by Kim et al. [11] in a cohort of Korean hyperuricemic patients. According to the latter, gout was diagnosed in 16.6% out of 14.3% of men with hyperuricemia and in 6.7% out of 2.2% of women with hyperuricemia, comparing to an average global prevalence of 1.4% [11]. Even in the most recent study [12], the prevalence of gout in Korea in 2015 was 0.76%, significantly lower than the values reported in other countries.

One of the reasons that could explain this lower prevalence, is the limited number of diagnostic codes. This can lead to the reported prevalence of the disease being lower than the number of real case. In this scenario, it will be difficult for the public to understand the importance of gout management and for health care professionals to educate people about the disease. Therefore, we expanded the range of claim codes to reexamine recent changes in the prevalence of gout and further investigate the demographic and regional characteristics of this disease in South Korea. The purpose of this study was to investigate the most recent prevalence rates of gout among National Health Insurance Service (NHIS) subscribers and the demographic characteristics of Korean patients with gout.

MATERIALS AND METHODS

In this study, we used data from the National Health Insurance Service-National Health Information Database (NHIS-NHID), which is a longitudinal database containing the health care records and claims data of approximately 50 million national insurance subscribers and dependents in South Korea. Using the NHIS database, we

identified patients who had received a diagnosis of gout at hospitals, private clinics, or public health centers between January 2002 and the end of 2015.

From 2002 to 2015, the number of patients (age ≥ 20 years) diagnosed with gout (principal diagnosis or 1st~4th additional diagnosis) was evaluated, and the prevalence of the disease was monitored. Gout prevalence was confirmed in individuals who had a history of principal or 1st~4th additional diagnosis of code M10.0 according to the International Classification of Disease (ICD) (10th edition) at least once each calendar year. Through the detailed diagnosis data of NHIS-NHID, cases with provisional diagnosis were excluded. To determine the prevalence of gout per 100,000 people per year, the 2010 resident registration estimate of the middle of the year reported by the Korean Statistical Information Service was used in the denominator.

Based on these data, prevalence per year was calculated by sex, age, region, and income category. We classified patients into the following groups based on age: 20~29 years, 30~39 years, 40~49 years, 50~59 years, 60~69 years, 70~79 years, and 80 years of age and above. Prevalence was calculated for the capital, six metropolitan cities, and 9 provinces in South Korea: Seoul, Busan, Daegu, Incheon, Gwangju, Daejeon, Ulsan, Gyeonggi-do, Gangwon-do, Chungcheongbuk-do, Chungcheongnam-do, Jeollabuk-do, Jeollanam-do, Gyeongsangbuk-do, Gyeongsangnam-do, and Jeju-do. We measured the prevalence of gout in each income category set by the NHIS between 2009 and 2015. The NHIS categorizes income levels into a division in 20, except for those covered by the Medical Aid program, with monthly insurance charges (5.7% of the monthly basic income in 2010). According to the annual health insurance statistics, the number of medical benefit recipients covered by the Medical Aid program was 2.78%~3.31% of the total population from 2009 to 2015 (Supplementary Table 1). In our analysis, this population was defined as the income group "Q1".

The Institutional Review Board of National Health Insurance Service Ilsan Hospital approved this study (Institutional review board No: 2020-03-075).

RESULTS

Annual and sex-specific prevalence of gout (2002~2015)

From 2002 to 2015, the number of patients receiving medical care for gout increased steadily over the years

(Figure 1). A total of 148,256 cases were identified in 2002, resulting in a prevalence of 388 per 100,000 people (Table 1). This number increased to 2,005 per 100,000 people in 2015 (766,469 cases), corresponding to a 5.17-fold increase compared to 2002. The prevalence (per 100,000 people) increased from 588 in 2002 to 3,026 in 2015 in men (5.15-fold increase) and from 193 in 2002 to 1,009 in 2015 for women (5.23-fold increase). The male-to-female ratio was 3.0~3.8:1. The specific values for every year between 2002 and 2015 are detailed in Supplementary Table 2.

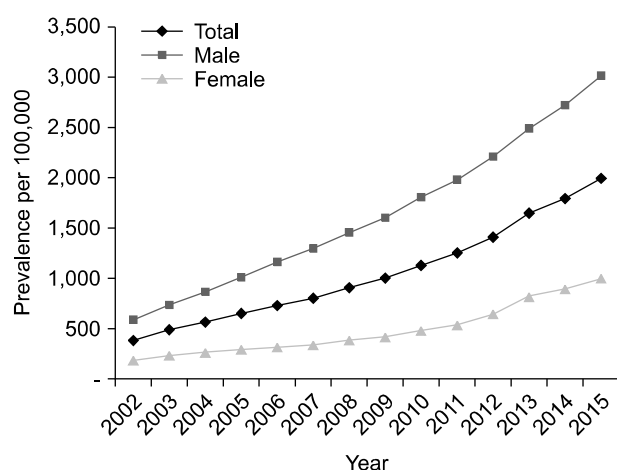


Figure 1. Annual and sex-specific prevalence per 100,000 people of gout in 2002~2015.

Age- and gender-specific prevalence of gout (2002~2015)

The values of gout prevalence according to age and sex are shown in Table 2. Individuals aged 20 years or older were selected and divided into 10-year age groups. We observed that the prevalence of gout increased for all age groups from 2002 to 2015 (Figure 2). In 2002, people in their 60s had the highest prevalence of gout (783 per 100,000 people). The prevalence increased gradually with age, reaching its maximal value in the 60~70-year age group (which had a prevalence rate 7.45-fold higher than that of people in their 20s), both in men and in women. In 2015, people in their 70s had the highest gout prevalence values (4,069 per 100,000 people), a value 8.37 times higher than that of those in their 20s, who showed the lowest prevalence. However, when looking at each sex individually, the prevalence of gout in males and females over 80 years was the highest among all age groups (8,691 and 2,164 per 100,000, respectively). These results demonstrate that gout prevalence increased markedly with age. Between 2002 and 2015, prevalence rates increased more than 4-fold across all age groups; particularly in those aged 80 years and older, which registered a 13.1-fold increase in prevalence when compared to the same age group in 2002. The specific values for every year between 2002 and 2015 are detailed in Supplementary Table 2.

Table 1. Annual and sex-specific prevalence of gout and sex ratio in 2002~2015

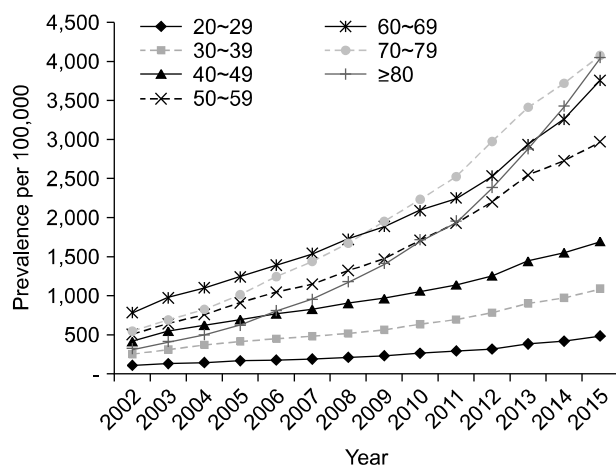
Year	Total		Male		Female		Male vs. Female ratio
	Total	Per 100,000	Total	Per 100,000	Total	Per 100,000	
2002	148,256	388	110,896	588	37,360	193	3.0
2003	187,863	491	140,698	745	47,165	244	3.1
2004	217,486	569	165,301	876	52,185	270	3.2
2005	250,517	655	192,539	1,020	57,978	300	3.4
2006	283,880	743	220,695	1,169	63,185	326	3.6
2007	312,174	817	245,630	1,301	66,544	344	3.8
2008	350,887	918	275,603	1,460	75,284	389	3.8
2009	385,810	1,009	303,696	1,609	82,114	424	3.8
2010	437,038	1,143	342,224	1,813	94,814	490	3.7
2011	481,312	1,259	375,383	1,989	105,929	547	3.6
2012	545,967	1,428	419,618	2,223	126,349	653	3.4
2013	633,125	1,656	471,965	2,500	161,160	833	3.0
2014	688,663	1,801	514,653	2,727	174,010	899	3.0
2015	766,469	2,005	571,091	3,026	195,378	1,009	3.0

Values are presented as number only.

Table 2. Comparison of gout prevalence by age and sex group in 2002 and 2015

Age (yr)		2002		2010	2015		2002 vs. 2015 ratio
		Total	Per 100,000	Reference population	Total	Per 100,000	
Total	20~29	7,263	105	6,927,509	33,665	486	4.6
	30~39	21,198	255	8,324,779	91,382	1,098	4.3
	40~49	37,196	427	8,715,639	147,937	1,697	4.0
	50~59	33,984	505	6,726,716	199,927	2,972	5.9
	60~69	32,036	783	4,092,725	153,642	3,754	4.8
	70~79	13,774	543	2,536,642	103,218	4,069	7.5
	≥80	2,805	309	907,282	36,698	4,045	13.1
Male	20~29	4,796	134	3,590,734	25,385	707	5.3
	30~39	16,163	381	4,244,774	75,110	1,769	4.6
	40~49	28,380	640	4,434,091	117,106	2,641	4.1
	50~59	25,441	755	3,369,420	145,356	4,314	5.7
	60~69	24,258	1,246	1,946,828	112,714	5,790	4.6
	70~79	9,898	963	1,027,907	72,702	7,073	7.3
	≥80	1,960	750	261,387	22,718	8,691	11.6
Female	20~29	2,467	74	3,336,775	8,280	248	3.4
	30~39	5,035	123	4,080,006	16,272	399	3.2
	40~49	8,816	206	4,281,548	30,831	720	3.5
	50~59	8,543	254	3,357,296	54,571	1,625	6.4
	60~69	7,778	362	2,145,897	40,928	1,907	5.3
	70~79	3,876	257	1,508,735	30,516	2,023	7.9
	≥80	845	131	645,895	13,980	2,164	16.5

Values are presented as number only.

**Figure 2.** Annual prevalence per 100,000 people of gout by age group in 2002~2015.

Gout prevalence by region

The prevalence rates of gout for different regions in Korea are shown in Table 3. The national prevalence rate of gout in 2002 was 0.39% (388 per 100,000 people). The region with the highest prevalence was Jeollabuk-do (578 per 100,000 people), followed by Jeollanam-do (555 per

100,000 people) and Busan (470 per 100,000 people). The region with the lowest prevalence was Incheon (278 per 100,000 people), followed by Chungcheongbuk-do (305 per 100,000 people) and Daejeon (323 per 100,000 people). There was a 2.07-fold difference in prevalence rate between the regions with the highest (Jeollabuk-do) and lowest prevalences (Incheon).

In 2015, the prevalence of gout was 2.01% (2,005 per 100,000 people). The highest prevalence rate was 2,819 per 100,000 people in Busan. The region with the second highest prevalence was Gyeongsangnam-do (2,524 per 100,000 people), followed by Jeollanam-do (2,400 per 100,000 people). The region with the lowest prevalence was Daejeon (1,518 per 100,000 people), followed by Incheon (1,633 per 100,000 people) and Gwangju (1,639 per 100,000 people). There was a 1.86-fold difference in prevalence rate between the regions with the highest (Busan) and lowest prevalences (Daejeon). As in 2002, the prevalence was higher in the southern coastal region than in the central inland region in 2015 (Supplementary Figure 1). When comparing the regional changes in prevalence between 2002 and 2015, there was a 3.0- to

Table 3. Gout prevalence by region in 2002 and 2015

Region	2002		2015		2002 vs. 2015 ratio
	Total	Per 100,000	Total	Per 100,000	
Seoul	30,252	376	137,112	1,704	4.5
Busan	13,182	470	79,095	2,819	6.0
Daegu	6,833	360	37,223	1,961	5.4
Incheon	5,727	278	33,639	1,633	5.9
Gwangju	4,246	404	17,209	1,639	4.1
Daejeon	3,579	323	16,835	1,518	4.7
Ulsan	2,694	326	17,633	2,137	6.5
Gyeonggi-do	29,952	347	164,089	1,903	5.5
Gangwon-do	3,979	338	26,759	2,276	6.7
Chungcheongbuk-do	3,569	305	20,306	1,737	5.7
Chungcheongnam-do	5,866	372	27,320	1,734	4.7
Jeollabuk-do	8,216	578	24,951	1,755	3.0
Jeollanam-do	8,233	555	35,613	2,400	4.3
Gyeongsangbuk-do	7,885	376	43,764	2,087	5.6
Gyeongsangnam-do	11,268	456	62,406	2,524	5.5
Jeju-do	2,605	413	13,293	2,110	5.1

Values are presented as number only.

Table 4. Gout prevalence by income level by year (2009~2015)

Year	Q1 (Medical benefit)		Q2 (1~4 segment)		Q3 (5~8 segment)		Q4 (9~12 segment)		Q5 (13~16 segment)		Q6 (17~20 segment)	
	Total	Per 100,000	Total	Per 100,000	Total	Per 100,000	Total	Per 100,000	Total	Per 100,000	Total	Per 100,000
2009	87,830	5,237	49,320	507	53,614	551	64,960	668	78,932	812	112,645	1,159
2010	108,149	6,461	56,976	582	60,277	616	72,658	743	89,812	918	124,637	1,274
2011	101,352	6,299	64,047	650	66,327	673	80,661	818	98,921	1,003	139,288	1,413
2012	106,756	7,084	71,936	724	75,012	755	90,271	909	112,078	1,128	160,422	1,615
2013	131,817	9,035	83,535	836	87,856	879	105,227	1,052	130,177	1,302	179,848	1,799
2014	106,060	7,360	94,030	934	99,214	986	117,229	1,165	144,733	1,438	195,363	1,941
2015	172,676	11,184	100,533	996	106,105	1,051	127,658	1,264	158,763	1,572	215,217	2,131

Values are presented as number only.

6.5-fold increase in all regions. The specific values for every year between 2002 and 2015 are detailed in Supplementary Table 3.

Gout prevalence by income group (2009~2015)

The yearly gout prevalence according income level is shown on Table 4. Among health insurance subscribers, the prevalence of gout increased with the income level. Those receiving medical benefits represented approximately 3% of the total population, and had the highest level of gout prevalence: it was almost 5-times higher than that of the highest income group. In 2015, the gout prevalence (per 100,000 people) in medical benefit recip-

ients was 11,184. This value was 5.58- and 5.25-times higher than that of the general population and of those in the highest income bracket, respectively.

DISCUSSION

The prevalence of gout increased steadily until 2015 (especially in older people), according to a survey of patients treated for gout (ICD M10.0) between January 1, 2002 and December 31, 2015, based on data from the NHIS-NHID. We found that the prevalence rate of gout in South Korea in 2015 was 2.01%, which represents a 5.17-fold increase compared to the rate reported in 2002

(0.39%). This increase is greater than what was observed in other countries (according to the Clinical Practice Research Datalink in the UK, the prevalence of gout increased 1.64 times from 1997 to 2012 [13]). This increase is thought to be due to an increase in the aging population, obesity, metabolic disease, and an increased awareness of gout. Compared to Korean studies on gout prevalence [3,12], the prevalence rates reported in this study are 2-fold higher, which is similar to the gout prevalence determined in actual outpatient clinics. Even prevalence in men reached 3.03%, confirming that gout was not a rare disease.

The male-to-female ratio in this study was 3.0~3.8:1, although the proportion of women diagnosed with gout was relatively higher than what had been reported previously (5~9:1) [3]. This value (male to female ratio 3~4:1) is similar to that reported in many countries, including Taiwan, USA, New Zealand, and the UK [8,14,15]. In 2015, the prevalence was the highest in people in their 70s. This is not explained by lower gout rates in individuals in their 80s; as we have shown, both males and females in their 80s have higher prevalence rates of gout than males and females in their 70s. This apparent contradiction is explained by a longer life expectancy in women, which leads to a shift in the male-female ratio from 1:1.5 in individuals in their 70s to 1:2.5 in individuals in their 80s. Since the prevalence of gout is higher in males, the resulting lower male-female ratio also leads to a reduction in gout prevalence when calculated for the population as a whole.

When comparing gout prevalence by age, it was observed that the age group with the highest prevalence changed from 60s in 2002 to 70s in 2015. It would be correct to interpret that patients with existing gout have continued to be treated for gout 10 years later, rather than saying that the onset age of gout has increased. This change shows that gout is not a temporary acute disease but a chronic disease that requires ongoing treatment. In all age groups, the rate of increase was the highest in people over 80 years of age (13 times higher than that in the lowest prevalence age group). In the previous study that only included patients with a principal diagnosis of gout, the age group with the greatest increase in prevalence of gout was in the 20s [3]. This difference may be due to the fact that our study design took into account not only the principal diagnosis but also the four additional diagnosis groups. We have opted to do so because gout often occurs during the treatment of other severe chronic

diseases, rather than as the main symptom. This leads to gout being often classified as an additional diagnosis.

We observed that the prevalence rates increased in all regions, but the extent of the increase differed by region. The prevalence in the southern coastal region was almost 2-fold higher than that in the central inland region. In particular, the prevalence in Busan Metropolitan City increased significantly from 2002 to 2015. The reason for differences in prevalence by region can be explained by the incidence of gout increasing with warmer weather [16]. However, in the case of Jeju Island, which has a similar climate to the southern coastal region, the prevalence of the disease was low. Therefore, it is necessary to study the risk factors for gout such as obesity, drinking, exercise, and diet in each region.

In case of income group, except for those covered by the Medical Aid program, the prevalence of gout increased with an increase in income. There is a misunderstanding that can be explained because gout is the classic “King’s disease”. As an example, the gout prevalence in medical benefits recipients was higher than in any other income group. Therefore, one must exert caution when interpreting the prevalence results according to income group, as it would not be accurate to claim that the prevalence of gout increased as a result of increased meat intake by those with higher incomes. Furthermore, according to the 2015 Korea National Health and Nutrition Examination Survey (KNHANES), as income level increased, the obesity rate (body mass index 25 kg/m² and above), which is a risk factor of gout, decreased (<https://knhanes.cdc.go.kr>). Therefore, it would be more likely that those with easy access to medical care have a higher probability of receiving proper medical treatment and diagnosis for gout. Based on the above, general studies in which income is investigated as risk factor should exclude medical benefits recipients from the analysis, in order not to bias the results.

Previous studies have shown that the prevalence of gout in South Korea is lower than in other countries. This may be explained by the strict definition of gout patients as having a “gout (ICD code M10) as principal diagnosis”. However, gout is a relatively mild disease, and thus, when a patient being treated for more severe diseases is diagnosed with gout, it is at times considered an additional diagnosis. For example, chronic kidney disease (CKD) is associated with hyperuricemia and is an independent risk factor for gout [17]. Patients with CKD are up to 3-times more likely to develop gout than those without CKD [18].

The incidence of gout increases as the renal function decreases, leading to a prevalence of 35.6% in those with stages 4 and 5 CKD [19]. If a patient who has been regularly treated for CKD is also then treated for gout, many doctors enter “CKD” as the principal diagnosis and “gout” as an additional diagnosis. Other chronic diseases such as coronary artery obstructive disease, cerebrovascular accident, and chronic heart failure are also considered principal diseases before gout. This occurs due to the relative importance given to the disease by the attending physician and also because of the code input for insurance claims. Based on that, we thought that, by only considering a principal diagnosis of gout as an inclusion criterion for our study, the above cases could be excluded. Thus, we decided to include up to 4 additional diagnoses.

The limitations of this study are similar to those of other studies using health insurance data. First, the disease is defined through an operational definition rather than a proven disease definition. Polarization microscopy, which is considered a very accurate technique for gout diagnosis, is rarely performed in practice. Most cases are diagnosed clinically based on the presence of hyperuricemia and typical gout attacks. In particular, if only the disease code is used as an operational definition, in mild diseases based on outpatient care, the degree of agreement between the disease and the disease code is reduced. This degree of agreement may be partially corrected through the specific medicine used in the target disease and the number of outpatient visits. However, gout is a mild illness that is usually treated in outpatient clinics. Furthermore, the recognition of chronic diseases is still insufficient, and the outpatients do not repeatedly visit after acute treatment. In addition, the importance of long-term use of disease-controlling medicines such as uric acid lowering agents is still unknown in principal medical institutions [8,13,20]. According to a survey in Taiwan, only approximately 30% of all gout patients are taking uric acid lowering agents [8]. Lastly, according to the health insurance system in South Korea, where a certain diagnostic code must be included in the bill to claim national health insurance, the use of medication (ex. uric acid lowering drug) code does not increase the accuracy of gout diagnosis. For example, in addition to gout, uric acid-lowering agents may be used to prevent tumor lysis syndrome in cancer patients or hyperuricemia in chronic kidney disease. However, according to the insurance standards of South Korea, uric acid lowering drugs are not covered by health insurance except for those for gout

diagnosis. Considering these limitations of operational definition, it would be more accurate to interpret this study as a representation of the current health care utilization for gout, rather than an accurate representation of its prevalence in the whole population.

CONCLUSION

This study investigated the prevalence of gout (which had previously been identified as the principal diagnosis or the principal diagnosis and first additional diagnosis) in Korea, taking into account up to four additional diagnosis. Considering the types of gout and the insurance situation in South Korea, this study may help understand changes in the prevalence of gout that could be applied to clinical practice. It may also help predict future changes in prevalence and help identify health care usage patterns in terms of region, income level, sex, and age groups in Korea. Finally, this study sheds some light on the current prevalence of gout among national insurance subscribers in Korea, and will help educate patients and medical staff on the management of gout.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

AUTHOR CONTRIBUTIONS

J.S.P., M.J.K., H.S.L. contributed to an acquisition of data and analysis. C.H.L. and J.S.S. contributed to the conception and study design and edited the manuscript. All authors were involved in analysis and interpretation of the data, drafting the article, and revising it critically for important intellectual contents, and approving the final version of the article.

SUPPLEMENTARY DATA

Supplementary data can be found with this article online at <https://doi.org/10.4078/jrd.2020.27.3.174>.

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