



Trends in hospital visits and healthcare costs of gout and seropositive rheumatoid arthritis in Korea from 2010 to 2017 using National Healthcare Claims

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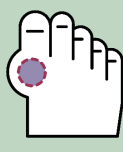
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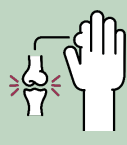
Patients



Health Insurance Review & Assessment Service
2010-2017



Gout



Seropositive rheumatoid
arthritis

Outcome



Hospital visit

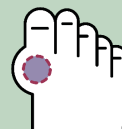
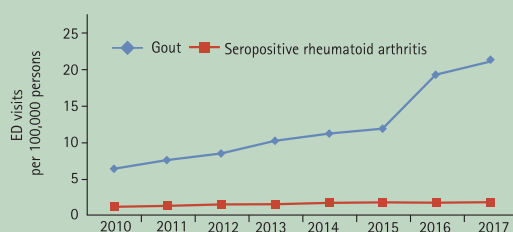


Cost



Trends

Results



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Background/Aims: We examined temporal trends in the rate of gout and seropositive rheumatoid arthritis (RA) hospital visits and healthcare costs in Korea.

Methods: We conducted a serial cross-sectional analysis of Korean national healthcare claims. We calculated the annual increase in hospital visits (emergency department [ED] visits, outpatient visits, and hospitalizations) and total healthcare costs per visit.

Results: From 2010 to 2017, the annual rates of ED visits, outpatient visits, and hospitalizations for gout increased from 6.28 to 21, from 638.38 to 1059.55, and from 12.37 to 15.6 per 100,000 persons, respectively. Before 2013, ED visits for gout were most common in patients over 70 years old, but they were most common in those aged between 30 and 49 years after 2013. The number of patients with ED visits, outpatient visits, and hospitalizations for RA from 2010 to 2017 increased from 1.25 to 1.87, from 219.04 to 307.49 and from 8.44 to 12.32 per 100,000 persons, respectively. However, there was no increase in the prevalence of ED visits for RA in any age group except for those older than 70 years. The cost per ED visit for gout significantly decreased from 496.3 to 273.6 US dollar during the study period. There was no significant change in the cost per ED visit for RA between 2010 and 2017.

Conclusions: There was a large increase in ED visits for gout during the study period. Further studies are needed to analyze the reason behind increased ED visits for gout and suggest ways on how to improve gout care.

Keywords: Gout; Arthritis, rheumatoid; Korea; Emergency service, hospital

INTRODUCTION

Gout and rheumatoid arthritis (RA) are the two most common forms of chronic inflammatory arthritis worldwide, with both being characterized by acute flares. Although these diseases can be optimally treated in an outpatient setting, both still require emergency department (ED) visits or hospitalizations in some cases, leading to substantial healthcare costs. With the development of biologic drugs and the standardization of treatment strategies, the hospitalization rate of RA has been declining. One study found that the hospitalization rate of Canadian patients with RA decreased by 49% from 2000 to 2011, while it decreased from 13.9 to 4.6 per 100,000 adults in the United States from 1993 to 2011 [1,2]. On the other hand, the number of patients with hospitalization for gout doubled from 3.8 to 7.6 per 100,000 Canadian adults and from 4.4 to 8.8 per 100,000 United States adults, reflecting an increase in prevalence and poor quality of care since suboptimal management of chronic diseases is often reflected in ED visit statistics. One study using US Nationwide Emergency Department Sample data showed that acute gout accounted for 0.2% of all ED visits and \$166 million in ED charges in 2008 [3]. A more recent study reported a 14% increase from 2006 to 2012 [4], while another study found that both the absolute number of ED visits and the cost per visit increased over time in the

United States [5]. Hyperuricemia and gout have a high prevalence in Asian countries [6], and the financial burden of RA is constantly increasing. Despite this, only a few studies have examined the pattern of healthcare utilization or ED visits for gout or RA in this region.

The objective of the present study was to examine temporal trends in hospital visits and healthcare costs for gout using a nationally representative sample as well as to compare them with equivalent trends for seropositive RA. RA was chosen for comparison because both gout and RA are ambulatory sensitive care conditions, and the use of ED or hospitalization might reflect suboptimal disease control.

We hypothesized that, over the past decade, gout and RA showed contrasting trends in this regard and that each condition could serve as the other's internal comparison group.

METHODS

Data source

South Korea has a universal health coverage system in which claims data from the Health Insurance Review & Assessment Service (HIRA) account for 90% of the total population in Korea [7]. In addition, Statistics Korea provides public data that are whole databases (DB) and electronic files that are electronically created or acquired and managed by public

institutions. We requested data for the diseases of interest provided publicly by HIRA (<https://data.go.kr>). Through this method, medical statistics data for each disease of interest were provided as well as data on the number of patients, claims, and charges for each hospital visit, distribution by gender, age, hospital type, and year of visit for the disease of interest. However, we could not check the raw data related to the patient for each claim, such as information on medications used, blood tests, and whether to use the hospital before or after. This study was approved by the Institutional Review Board of Hallym University Dongtan Sacred Heart Hospital (IRB approval number: HDT 2020-05-015). Informed consent was waived by the board.

Study population and identification of gout and seropositive RA

We included all patients who had gout or seropositive RA as a primary diagnosis and had visited hospitals for treatment between January 1, 2010 and December 31, 2017. The term “hospital visits” refers to ED visits, outpatient visits, and hospitalizations. ED visits were identified when an emergency medical care fee was charged. The data included patients who had attended primary care, secondary care, or tertiary care hospitals. We collected data from patients of both sexes who were aged more than 20 years and had placed at least one claim for a diagnosis of gout or seropositive RA. The diagnostic codes used were M10 for gout and M05 for seropositive RA according to the Korean Standard Classification of Disease, which is similar to the International Classification of Diseases, 10th Revision (ICD-10). The National Health Insurance Service (NHIS) in Korea covers medical costs for diagnostic tests, treatment (surgery, intervention, medication), and hospital care (outpatient, inpatient, or ED visits).

Estimation of prevalence, rate of hospital visits, and healthcare costs

Since the rate of hospital visits may be affected by variation in prevalence, the prevalence for each year was first analyzed. The annual prevalence rates of gout and seropositive RA from 2010 to 2017 were calculated based on the number of individual patients divided by the total population in that year. The data of the total population were assessed using the Korean Statistical Information Service (<http://kosis.kr/index/index.do>). These are future population estimates published in March 2019 by Statistics Korea. The population

is confirmed from 2010 to 2016, and the data for 2017 are the results of median estimates (basic estimates) combining median households by population change factors (birth, death, and international migration). The annual rates of ED visits, outpatient visits, and hospitalizations for each disease were also calculated. These data are presented as the number of patients per 100,000 Koreans. Sex- and age-specific annual prevalence rates were also obtained. Age was stratified into six groups (20–29, 30–39, 40–49, 50–59, 60–69, and ≥ 70 years). We calculated the healthcare cost per visit by dividing the total healthcare cost of ED visits, outpatient visits, and hospitalizations by the visit number for each visit. The healthcare cost is shown as US dollar (USD), with 1 USD equaling 1,110 Korean won.

Statistical analysis

The annual prevalence trends of gout and seropositive RA were analyzed using the Mann-Kendall trend test, which is used to analyze data collected over time that reflect consistently increasing or decreasing trends. All statistical analyses were performed using R software version 3.5.3 (R Foundation for Statistical Computing, Vienna, Austria), and the Mann-Kendall trend test was performed using the ‘Kendall’ packages. Prevalence is represented with a 95% confidence interval (CI). Statistical significance was set at $p < 0.05$.

RESULTS

During the study period (2010–2017), the datasets included a total of 2,777,017 gout patients and 801,590 seropositive RA patients (raw data) (Supplementary Table 1).

Annual prevalence of gout and seropositive RA from 2010 to 2017

The annual sex- and age-specific prevalence of gout and seropositive RA from 2010 to 2017 are shown in Fig. 1. The annual prevalence of gout was 2,433 (95% CI, 2,428 to 2,438) per 100,000 persons in 2010 and 3,917 (95% CI, 3,911 to 3,923) per 100,000 persons in 2017. In male patients, the annual prevalence of gout was 4,638 (95% CI, 4,629 to 4,648) per 100,000 persons in 2010 and 7,505 (95% CI, 7,494 to 7,517) in 2017. In females, the annual prevalence of gout was 283 (95% CI, 281 to 285) per 100,000 persons in 2010 and 400 (95% CI, 397 to 402) in 2017. The prevalence was highest among men over 70

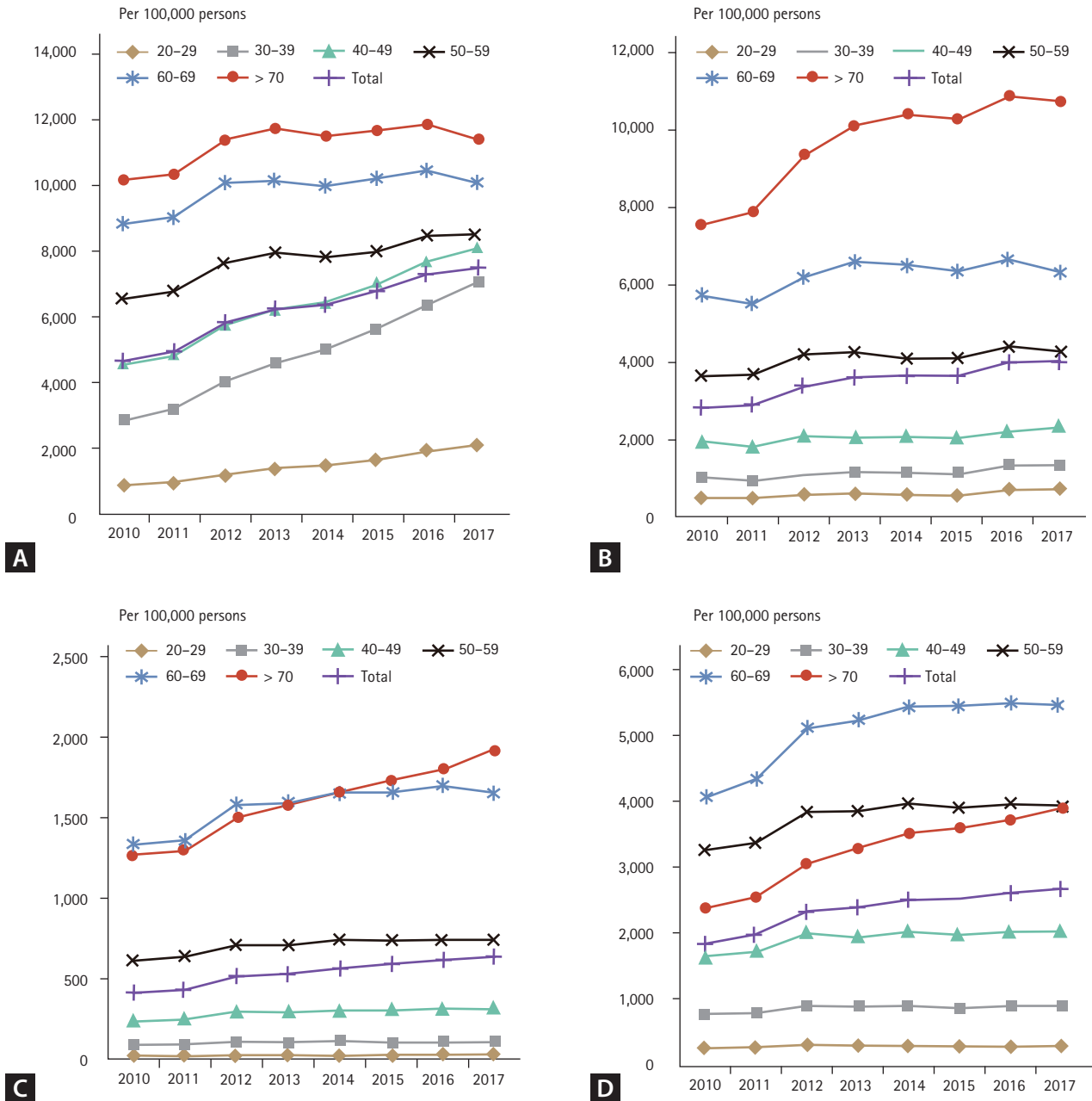


Figure 1. Sex- and age-specific prevalence of gout and seropositive rheumatoid arthritis. (A) Annual age-specific prevalence of gout (male). (B) Annual age-specific prevalence of gout (female). (C) Annual age-specific prevalence of seropositive rheumatoid arthritis (male). (D) Annual age-specific prevalence of seropositive rheumatoid arthritis (female).

years of age, although the increase in prevalence over time did not reach statistical significance ($p = 0.06$). On the other hand, the prevalence significantly increased in all other age groups over time ($p < 0.05$). Similar to males, females over 70 years old had the highest prevalence.

The annual prevalence of seropositive RA was 1,147 (95%

CI, 1,143 to 1,150) per 100,000 persons in 2010 and 1,665 (95% CI, 1,661 to 1,669) per 100,000 persons in 2017. In males, the annual prevalence was 417 (95% CI, 414 to 420) per 100,000 persons in 2010 and 641 (95% CI, 638 to 645) in 2017. In females, the annual prevalence of seropositive RA was 1,858 (95% CI, 1,852 to 1,864) per 100,000 per-

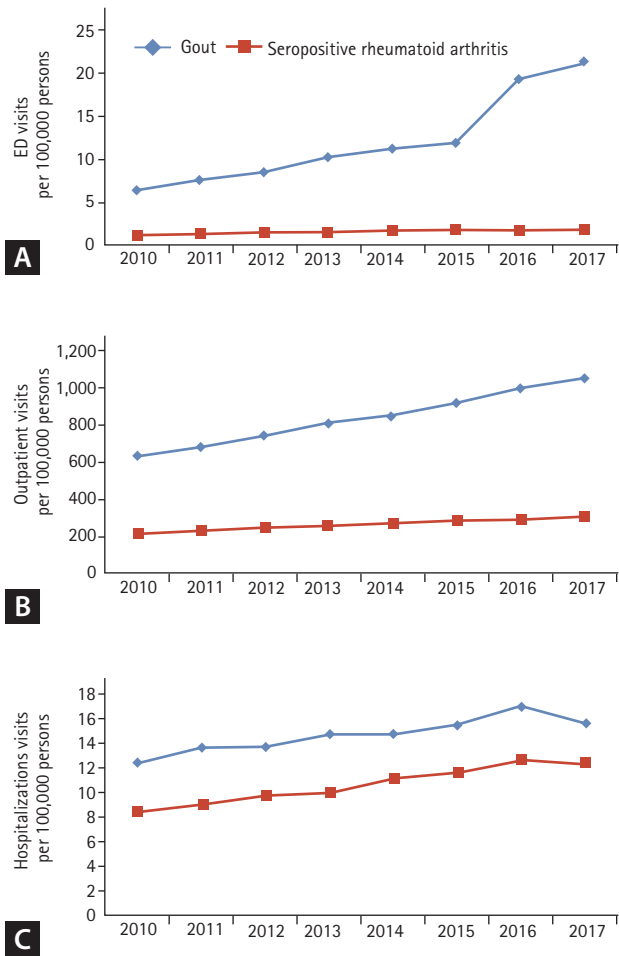


Figure 2. Annual rates of (A) emergency department (ED) visits, (B) outpatient visits, and (C) hospitalizations for gout and seropositive rheumatoid arthritis.

sons in 2010 and 2,668 (95% CI, 2,661 to 2,675) in 2017. Before 2014, the prevalence in male seropositive RA was highest in the 60 to 69 age group, while after 2014, it was highest among those older than 70 years. The prevalence of seropositive RA in women significantly increased over the study period in all age groups ($p < 0.001$). Its prevalence was the highest among those aged 60 to 69 years. Prevalence did not change among the 20 to 39 years age group; however, it increased significantly in other age groups ($p < 0.05$).

Annual rate of ED visits, outpatient visits, and hospitalizations for gout and seropositive RA from 2010 to 2017

The annual rates of hospital visits for gout and seropositive RA are shown in Fig. 2. In 2010, the annual rates of ED vis-

its, outpatient visits, and hospitalizations for gout were 6.28 (95% CI, 6.02 to 6.53), 638.38 (95% CI, 635.84 to 640.91), and 12.37 (95% CI, 12.02 to 12.73) per 100,000 persons, respectively. In 2017, the annual rates of ED visits, outpatient visits, and hospitalization were 21.01 (95% CI, 20.56 to 21.45), 1,059.55 (95% CI, 1,056.41 to 1,062.69), and 15.6 (95% CI, 15.22 to 15.98) per 100,000 persons, respectively. The number of ED visits, outpatient visits, and hospitalizations increased significantly from 2010 to 2017 ($p < 0.001$, $p < 0.001$, and $p = 0.002$, respectively). In particular, the number of ED visits for gout increased 3.8 times from 2010 to 2017. The ED visit rate for gout spiked in 2016, with a 51% increase over the previous year, and it increased more than the prevalence of gout (Supplementary Table 2). This increase in ED visit rate per prevalence was more pronounced in males and in the 50 to 59 years age group.

The annual sex- and age-specific rates of hospital visits for gout and seropositive RA are shown in Tables 1-3. Before 2013, ED visits for gout were most common among patients over 70 years old, but after 2013, they were most common among those aged 30 to 39 years (Table 1). ED and outpatient visits for gout increased in all age groups during the study period. The number of claims, instead of the number of patients, for ED and outpatient visits due to gout from 2010 to 2017 also showed a similar trend (Supplementary Table 3).

In 2010, the annual rates of ED visits, outpatient visits, and hospitalizations for RA were 1.25 (95% CI, 1.14 to 1.36), 219.04 (95% CI, 217.55 to 220.52), and 8.44 (95% CI, 8.15 to 8.73) per 100,000 persons, respectively. In 2017, the annual rates of ED visits, outpatient visits, and hospitalizations were 1.87 (95% CI, 1.73 to 2.00), 307.49 (95% CI, 305.8 to 309.18), and 12.32 (95% CI, 11.98 to 12.66) per 100,000 persons, respectively.

The annual rate of ED visits, outpatient visits, and hospitalizations for seropositive RA also increased significantly from 2010 to 2017 ($p < 0.001$ in all cases). ED visits for seropositive RA were most common among those over 70 years of age. The increases in ED visits and hospitalization rates were most pronounced in the older age groups (≥ 70 and ≥ 60 years, respectively).

Cost of outpatient care, hospitalizations, and ED visits for gout and seropositive RA

The annual healthcare costs per visit for ED visits, outpatient visits, and hospitalizations for gout and seropositive RA are

Table 1. The number of patients visited emergency department for gout and seropositive rheumatoid arthritis per 100,000 persons

	2010	2011	2012	2013	2014	2015	2016	2017	<i>p</i> for trend
Gout									
Overall	6.28	7.57	8.35	10.08	11.05	11.91	18	21	< 0.001
Sex									
Male	11.86	14.2	15.74	19.09	21.03	22.81	34.53	40.42	< 0.001
Female	0.83	1.09	1.13	1.28	1.27	1.25	1.8	1.97	0.009
Age group, yr									
20–29	2.81	3.53	3.65	4.33	5.11	5.28	7.15	9.16	< 0.001
30–39	6.1	8.37	10.11	12.49	14.09	16.35	23.86	27.67	< 0.001
40–49	7.26	8.43	9.3	11.2	13.32	13.51	21.67	26.21	< 0.001
50–59	6.88	7.63	8.58	10.74	10.53	11.95	18.95	22.52	0.001
60–69	7.11	8.19	7.94	9.3	10.22	10.63	16.34	17.34	0.001
≥ 70	9.03	10.32	10.55	11.77	11.75	12.33	17	19.56	0.001
Seropositive rheumatoid arthritis									
Overall	1.25	1.43	1.58	1.6	1.69	1.82	1.75	1.87	0.001
Sex									
Male	0.61	0.57	0.78	0.75	0.92	0.86	0.93	0.92	0.035
Female	1.88	2.26	2.36	2.43	2.44	2.75	2.54	2.79	0.001
Age group, yr									
20–29	0.08	0.2	0.18	0.25	0.15	0.09	0.14	0.17	0.901
30–39	0.3	0.36	0.41	0.36	0.39	0.48	0.46	0.27	0.536
40–49	0.43	0.67	0.74	0.51	0.7	0.66	0.69	0.85	0.173
50–59	1.27	1.6	1.93	1.72	1.74	1.81	1.77	1.76	0.173
60–69	4	3.9	3.69	4.02	4.01	4.35	3.53	3.93	0.173
≥ 70	4.67	4.78	5.3	5.71	5.94	6.3	6.15	6.39	0.001

p for trend was analyzed using the Mann-Kendall trend test.

shown in Fig. 3. In 2010, the mean cost per outpatient visit for gout patients was 27.6 USD. It significantly increased during the study period, with a mean cost per outpatient visit of 33.8 USD in 2017 (*p* = 0.01). The mean cost per hospitalization for gout significantly increased from 1,203.7 to 1,403.5 USD between 2010 and 2017 (*p* = 0.01). However, the mean cost per ED visit significantly decreased from 491.9 to 271.2 USD in 2010 and 2017 (*p* = 0.002). However, the total cost of ED visits for gout increased significantly from \$13.18 million in 2010 to \$35.71 million in 2017 (Supplementary Fig. 1).

The annual cost of ED visits for seropositive RA did not change significantly between 2010 and 2017 (4,581.9 USD vs. 4,377.7 USD, respectively; *p* = 0.71), as well as the mean

cost per hospitalization (2,986.2 USD vs. 2,854.7 USD, *p* = 0.39). However, the cost per outpatient visit almost doubled from 108 to 197.6 USD between 2010 and 2017 (*p* < 0.001).

DISCUSSION

Gout is one of the most common chronic diseases affecting adults, and its prevalence has almost doubled over the last few decades [8]. In a recent study, the prevalence and incidence of gout varied widely according to the population studied and methods employed but ranged from a prevalence of < 1% to 6.8% and an incidence of 0.58 to 2.89 per

Table 2. The number of patients visited outpatient clinics for gout and seropositive rheumatoid arthritis per 100,000 persons

	2010	2011	2012	2013	2014	2015	2016	2017	ρ for trend
Gout									
Overall	638.38	687.54	751.32	815.93	854.18	922.31	1,004.79	1,059.55	< 0.001
Sex									
Male	1,181.95	1,276.9	1,395.18	1,517.87	1,592.79	1,722.3	1,877.04	1,984.93	< 0.001
Female	108.31	112.49	122.72	130.02	131.62	138.96	150.18	152.63	< 0.001
Age group, yr									
20–29	157.58	176.07	194.2	219.77	239.21	265.51	305.24	342.81	< 0.001
30–39	438.65	487.21	545.69	621.77	685.51	772.59	890.67	993.538	< 0.001
40–49	660.23	700.38	767.8	833.54	876.29	954.51	1,055.48	1,136.31	< 0.001
50–59	912.89	953.45	1,005.11	1,062.45	1,078.8	1,135.27	1,210.58	1,238.29	< 0.001
60–69	1,088.17	1,143.47	1,223.1	1,271.17	1,292.27	1,352.15	1,407.31	1,414.41	< 0.001
≥ 70	962.24	1,014.6	1,093.14	1,162.9	1,179.93	1,241.58	1,294.58	1,318.66	< 0.001
Seropositive rheumatoid arthritis									
Overall	219.04	232.96	250.5	260.63	274.28	288.45	295.51	307.49	< 0.001
Sex									
Male	81.32	86.5	93.89	98.2	104.98	111.63	115.76	121.36	< 0.001
Female	353.32	375.87	403.39	419.35	439.9	461.59	471.63	489.91	< 0.001
Age group, yr									
20–29	29.72	31.96	32.02	30.65	29.29	30.22	29.39	29.75	0.386
30–39	89.03	92.95	96.68	96.16	97.34	98.29	95.38	99.7	0.002
40–49	186.91	192.21	201.1	204.58	210.51	215.92	519.25	224.27	< 0.001
50–59	365.66	376.3	389.5	397.16	411.88	427.44	427.87	429.52	< 0.001
60–69	504.02	535.93	579.7	597.78	618.09	638.83	636.5	650.43	0.002
≥ 70	370.36	392.1	429.9	454.15	485.38	510.98	531.54	567.26	< 0.001

ρ for trend was analyzed using the Mann-Kendall trend test.

1,000 person-years [9]. At the same time, it is a condition that can be effectively managed using currently available medications. However, suboptimal care for patients with gout leads to acute flares, which then results in ED visits or hospitalizations. Thus, the pattern of ED utilization and hospitalization might reflect the level of care for gout [3].

In the present study, the annual rate of ED visits for gout increased by 3.8 times from 2010 to 2017, while that of ED visits for seropositive RA increased by 1.49 times. Conversely, the annual increase in the hospitalization rate for gout was less pronounced at 26%. The increase in ED visits for gout was highest among those between 30 and 50 years of age, while that for seropositive RA was highest among those aged ≥ 70 years.

Two studies reported an increase in ED visits for gout in the United States [4,5]. A study using US National ED Sample data showed that ED visits and costs increased from 2009 to 2012, with total ED visit charges increasing by 47%. A serial cross-sectional analysis of the same DB showed that the rate of ED visits for gout increased by 14% between 2006 and 2012. The increase was most pronounced (29%) in those aged 45 to 54 years. On the other hand, a study within a single healthcare system in Hawaii reported that the rates of gout ED visits in 2017 trended downward and that they had significantly decreased since 2011 [10]. The rates of RA outpatient visits, which were used as an internal comparison group, also decreased in 2017, as did the rates of outpatient and inpatient visits for gout. Therefore, these results reflect

Table 3. The number of patients hospitalized for gout and seropositive rheumatoid arthritis per 100,000 persons

Year	2010	2011	2012	2013	2014	2015	2016	2017	<i>p</i> for trend
Gout									
Overall	12.37	13.6	13.72	14.77	14.71	15.45	16.95	15.6	0.004
Sex									
Male	22.98	25.1	25.36	27.52	27.11	28.48	31.13	28.43	0.009
Female	2.03	2.39	2.36	2.32	2.57	2.68	3.06	3.02	0.018
Age group, yr									
20–29	3.7	4.12	4.33	5.76	5.43	5.7	7	6.39	0.009
30–39	8.74	10.7	10.53	11.51	13.24	14.19	16.88	14.83	0.004
40–49	12.1	12.68	12.93	13.31	13.6	14.51	15.82	14.75	0.001
50–59	14.24	15.58	16.04	17.4	16.06	16.06	17.84	16.48	0.035
60–69	18.27	19.41	19.18	18.9	17.35	18.86	19.66	17.57	0.711
≥ 70	28.65	29.44	27.84	29.36	28.61	28.2	29.09	27.47	0.265
Seropositive rheumatoid arthritis									
Overall	8.44	9.02	9.77	9.94	11.14	11.67	12.57	12.32	0.002
Sex									
Male	3.35	3.5	3.62	3.73	4.33	4.75	5.13	5.04	0.002
Female	13.41	14.41	15.78	16.02	17.81	18.44	19.86	19.46	0.002
Age group, yr									
20–29	0.93	1	0.99	1.06	0.89	0.69	0.82	0.6	0.063
30–39	2.13	2.07	2.2	2.29	2.11	1.8	2.1	2.04	0.265
40–49	4.87	4.88	5.17	4.78	4.6	4.73	5.12	4.53	0.265
50–59	12.22	12.79	12.96	12.89	13.47	13.55	13.79	12.9	0.035
60–69	23.06	23.08	24.01	24.33	26.31	27.44	27.72	25.21	0.009
≥ 70	23.11	26.09	29.33	29.31	36.49	38.26	41.84	43.02	0.002

p for trend was analyzed using the Mann-Kendall trend test.

a change in the overall healthcare utilization pattern, rather than a true decrease in ED visit rates among patients with gout. In addition, patients with gout had higher rates of ED visits than those with RA, suggesting that gout care may be suboptimal in Hawaii. To our knowledge, the present study is the first to examine the use of ED for gout in a Korean population. We found a larger increase in the annual rate of ED visits for gout than in previous studies done in the United States. In a study using the National Health Claims DB, the prevalence of gout in Korea nearly doubled from 2007 to 2015 (3.49 vs. 7.48 per 1,000 persons), and the incidence of gout was growing faster in the young population than in the older population [11]. However, the increase in ED visit rate for gout was higher even after taking the increase in prevalence into account. In particular, the cause of the spike

from 2015 to 2016 was unclear. The Korea National Health and Nutrition Examination Survey (KNHANES) found that men in their fourth decade had the highest rate of alcohol intake and excessive caloric intake [12,13], which may partly explain the high ED visits in this age group. Although suboptimal hyperuricemic control might lead to frequent attacks and ED visits, the factors contributing to ED visits for gout have not been studied. Therefore, the factors that lead to ED visits for gout must be examined, including medication use and abrupt lowering of uric acid levels, which we plan to address in a future study. In a previous survey study of United States primary care physicians, only half of primary care providers reported optimal treatment practices for the management of acute gout [14]. In addition, non-compliance with the treatment guidelines by clinicians in real practice

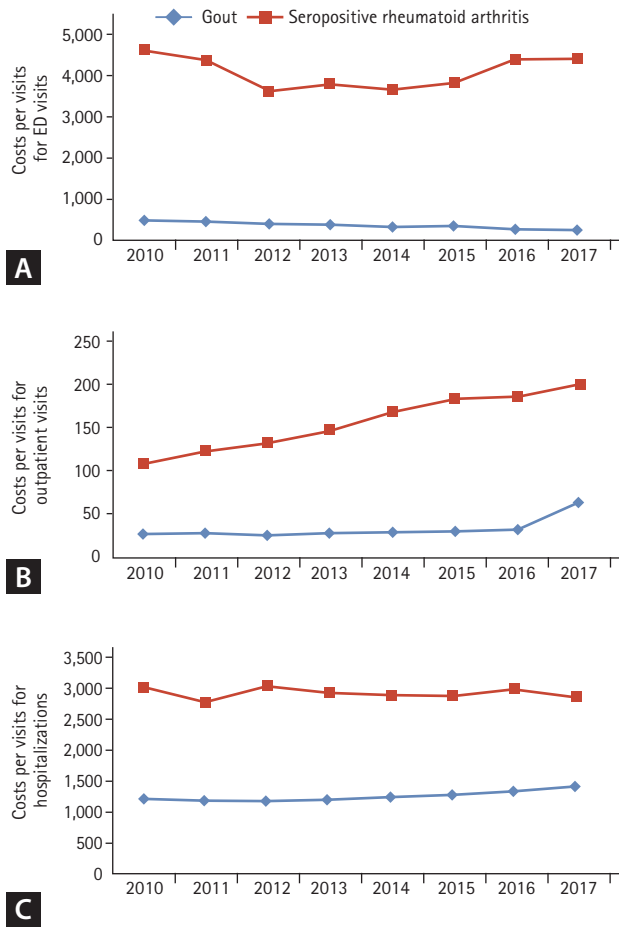


Figure 3. Annual healthcare costs per visit for (A) emergency department (ED) visits, (B) outpatient visits, and (C) hospitalizations for gout and seropositive rheumatoid arthritis.

may lead to an increase in ED visits for gout, and it would be helpful to see if the physicians followed the guidelines for gout treatment in real practice [14-16]. Because interruption of urate-lowering therapy (ULT) during gout flare was also found to lead to ED visits for gout [16], it is important to educate gout patients who regularly take ULT regarding adherence.

During the study period, the annual healthcare cost per outpatient visit and hospitalization for gout increased, whereas the ED visit costs for gout decreased. This is in contrast to United States studies. It is hypothesized that recent increases in visits may be mostly due to acute attacks, which are more easily treated than other complications such as infection or adverse drug effects.

Among patients with seropositive RA, the rate of ED vis-

its also increased during the observation period but was less pronounced than in those with gout. In the sex- and age-specific analysis, the ED visits for seropositive RA did not increase except for the oldest age group, suggesting that patients with RA were better managed in the outpatient setting than those with gout in younger age groups. The doubling of the cost per visit for outpatients with seropositive RA may have occurred because the drug cost increased after the use of biologic agents. Another study showed that the healthcare cost for RA in Korea nearly doubled from 2004 to 2013, which was in line with our results [17].

The present study had several limitations. We used the HIRA DB, which provides analyzed partial data for all patients with the disease of interest rather than the full data for each patient. Thus, we could not analyze risk factors for flares of gout, such as individual serum uric acid level, concomitant medications (allopurinol or febuxostat), or dietary intake, and it was not possible to confirm the reason for ED visit. Second, for the diagnosis of gout and seropositive RA, the ICD-10 codes could not be validated. Diagnostic codes based on claims data that are collected with the purpose of reimbursing healthcare services, and not for clinical purposes, may not match the actual disease. In particular, in the case of mild disease such as gout, it is possible that more information other than the actual diagnosis code was included. To confirm the diagnosis of the disease, an operational definition using prescribed medications may also be considered. Finally, because only seropositive RA was included, not all hospital visits for RA were identified. However, using the national health claims DB, we could assess the prevalence of healthcare usage for gout among the general Korean population. We plan to examine the factors associated with ED visits for gout patients in a future study, which would elucidate possible choices for optimization of treatment of gout and guide policy decisions. Many studies have addressed the prevalence of ED visits for gout in Western countries [2,5,10,18-20], but very little research has been carried out in Asian countries. The present study was the first to analyze hospital visits due to gout in Korea.

In conclusion, between 2010 and 2017, the prevalence of ED visits for gout increased more than that of ED visits for seropositive RA in the Korean population. The NHIS should consider this trend and focus on the optimal management of gout in the outpatient healthcare setting.

KEY MESSAGE

1. Between 2010 and 2017, the prevalence of emergency department (ED) visits for gout increased more than that of ED visits for seropositive rheumatoid arthritis in the Korean population.
2. Clinicians should consider this trend and focus on the optimal management of gout in the outpatient healthcare setting.

Conflict of interest

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

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REFERENCES

1. Lim SY, Lu N, Oza A, et al. Trends in gout and rheumatoid arthritis hospitalizations in the United States, 1993-2011. *JAMA* 2016;315:2345-2347.
2. Rai SK, Avina-Zubieta JA, McCormick N, et al. Trends in gout and rheumatoid arthritis hospitalizations in Canada From 2000 to 2011. *Arthritis Care Res (Hoboken)* 2017;69:758-762.
3. Garg R, Sayles HR, Yu F, et al. Gout-related health care utilization in US emergency departments, 2006 through 2008. *Arthritis Care Res (Hoboken)* 2013;65:571-577.
4. Jinno S, Hasegawa K, Neogi T, Goto T, Dubreuil M. Trends in emergency department visits and charges for gout in the United States between 2006 and 2012. *J Rheumatol* 2016;43:1589-1592.
5. Singh JA, Yu S. Time trends, predictors, and outcome of emergency department use for gout: a nationwide US Study. *J Rheumatol* 2016;43:1581-1588.
6. Paul BJ, James R. Gout: an Asia-Pacific update. *Int J Rheum Dis* 2017;20:407-416.
7. Kim L, Kim JA, Kim S. A guide for the utilization of Health Insurance Review and Assessment Service National Patient Samples. *Epidemiol Health* 2014;36:e2014008.
8. Zhu Y, Pandya BJ, Choi HK. Prevalence of gout and hyperuricemia in the US general population: the National Health and Nutrition Examination Survey 2007-2008. *Arthritis Rheum* 2011;63:3136-3141.
9. Dehlin M, Jacobsson L, Roddy E. Global epidemiology of gout: prevalence, incidence, treatment patterns and risk factors. *Nat Rev Rheumatol* 2020;16:380-390.
10. Mak VP, Siu AM, Choi SY, Jun Ahn H, Lim SY. Patterns of health care utilization of gout patients in Hawai'i-high rates of emergency department utilization as compared to rheumatoid arthritis. *PLoS One* 2019;14:e0220978.
11. Kim JW, Kwak SG, Lee H, Kim SK, Choe JY, Park SH. Prevalence and incidence of gout in Korea: data from the national health claims database 2007-2015. *Rheumatol Int* 2017;37:1499-1506.
12. Yun S, Kim HJ, Oh K. Trends in energy intake among Korean adults, 1998-2015: results from the Korea National Health and Nutrition Examination Survey. *Nutr Res Pract* 2017;11:147-154.
13. Choe SA, Yoo S, JeKarl J, Kim KK. Recent trend and associated factors of harmful alcohol use based on age and gender in Korea. *J Korean Med Sci* 2018;33:e23.
14. Harrold LR, Mazor KM, Negron A, Ogarek J, Firreno C, Yood RA. Primary care providers' knowledge, beliefs and treatment practices for gout: results of a physician questionnaire. *Rheumatology (Oxford)* 2013;52:1623-1629.
15. Spaetgens B, Pustjens T, Scheepers LEJM, Janssens HJEM, van der Linden S, Boonen A. Knowledge, illness perceptions and stated clinical practice behaviour in management of gout: a mixed methods study in general practice. *Clin Rheumatol* 2016;35:2053-2061.
16. Towiwat P, Phungoen P, Tantrawiwat K, et al. Quality of gout care in the emergency departments: a multicentre study. *BMC Emerg Med* 2020;20:27.
17. Choi IA, Lee JS, Song YW, Lee EY. Mortality, disability, and healthcare expenditure of patients with seropositive rheumatoid arthritis in Korea: a nationwide population-based study. *PLoS One* 2019;14:e0210471.
18. Kiadaliri AA, Englund M. Temporal trends and regional disparity in rheumatoid arthritis and gout hospitalizations in Sweden, 1998-2015. *Clin Rheumatol* 2018;37:825-830.
19. Singh JA, Yu S. Gout-related inpatient utilization: a study of predictors of outcomes and time trends. *Arthritis Res Ther* 2016;18:57.
20. Zleik N, Elfshawi MM, Kvgic Z, et al. Hospitalization increases the risk of acute arthritic flares in gout: a population-based study over 2 decades. *J Rheumatol* 2018;45:1188-1191.

Supplementary Table 1. Demographics and patient characteristics (n = 3,578,607)

	2010	2011	2012	2013	2014	2015	2016	2017
Gout								
Total no. of patients	251,195	274,000	302,613	332,882	352,522	384,786	425,729	453,290
Age groups, yr								
20–39	49,122	54,069	59,494	66,900	72,386	80,024	91,604	100,745
40–59	122,061	132,941	146,454	160,055	168,020	181,138	198,149	208,119
> 60	80,012	86,990	96,665	105,927	112,116	12,3624	135,976	144,426
Male sex	22,9673	251,304	277,621	306,123	325,086	355,527	393,663	420,369
Hospital visits								
ED visit	1,896	2,328	2,597	3,233	3,672	4,028	6,313	7,720
Outpatient visit	244,061	265,812	293,973	323,038	342,201	373,697	411,414	438,150
Hospitalization	5,238	5,860	6,043	6,611	6,649	7,061	8,002	7,420
Seropositive rheumatoid arthritis								
Total no. of patients	87,451	94,111	102,456	107,761	115,028	122,342	126,866	133,026
Age groups, yr								
20–39	9,745	10,091	10,281	9,981	9,834	9,782	9,644	9,600
40–59	42,258	45,259	48,519	50,261	53,187	55,522	56,192	56,844
> 60	35,548	38,761	43,656	46,882	5,2007	5,7038	61,030	66,582
Female sex	71,350	76,815	83,457	87,666	93,188	98,837	102,177	106,964
Hospital visits								
ED visit	95	139	137	163	192	182	173	205
Outpatient visit	83,741	90,067	98,012	103,187	109,882	11,6874	120,999	127,155
Hospitalization	3,615	3,905	4,307	3,937	4,954	5,286	5,694	5,666

ED, emergency department.

Supplementary Table 2. The ratio of emergency department visit for gout to prevalence of gout per 100,000 persons from 2010 to 2017

	2010	2011	2012	2013	2014	2015	2016	2017
ED visit /prevalence × 100								
Total	0.26	0.29	0.27	0.31	0.33	0.34	0.47	0.54
Sex								
Male	0.26	0.29	0.27	0.31	0.33	0.34	0.47	0.54
Female	0.30	0.38	0.34	0.35	0.35	0.34	0.45	0.49
Age groups, yr								
20–29	0.60	0.68	0.56	0.59	0.64	0.60	0.70	0.81
30–39	0.41	0.50	0.48	0.52	0.54	0.56	0.72	0.75
40–49	0.30	0.33	0.31	0.34	0.40	0.37	0.54	0.62
50–59	0.20	0.21	0.21	0.26	0.26	0.28	0.42	0.50
60–69	0.16	0.18	0.15	0.18	0.20	0.20	0.30	0.33
≥ 70	0.21	0.24	0.21	0.23	0.23	0.24	0.33	0.38

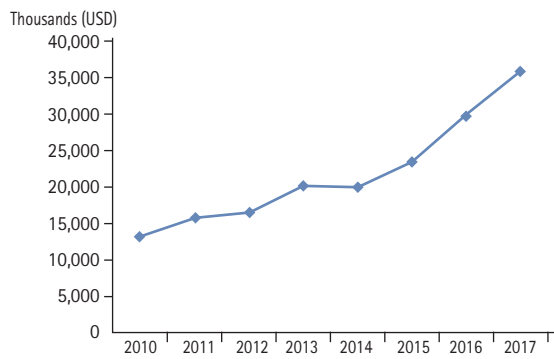
ED, emergency department.

Supplementary Table 3. The number of claims for emergency department visits and outpatient visits due to gout per 100,000 persons

	2010	2011	2012	2013	2014	2015	2016	2017	ρ for trend
ED visit									
Overall	6.98	8.58	10.23	12.54	14.26	15.34	26.7	31.77	< 0.001
Sex									
Male	13.26	16.2	19.46	23.88	27.47	29.65	51.95	62.01	< 0.001
Female	0.86	1.15	1.21	1.45	1.33	1.32	1.99	2.13	0.009
Age group, yr									
20–29	3.13	4.03	4.69	5.55	6.28	6.32	10.05	11.84	< 0.001
30–39	7	9.53	11.84	15.97	19.07	22.2	36.79	44.41	< 0.001
40–49	8.05	9.82	11.05	13.93	18.54	16.98	32.58	41.9	0.001
50–59	7.61	8.79	12.69	13.35	12.91	15.8	28.94	34.81	0.001
60–69	8.06	9.27	8.93	12.11	13.42	14.94	23.41	24.6	0.001
≥ 70	9.52	10.74	11.12	12.96	12.33	13.3	22.93	24.93	0.001
Outpatient visits									
Overall	2,441.9	2,597.83	3,059.57	3,276.86	3,342.42	3,551.94	3,823.47	3,930.2	< 0.001
Sex									
Male	4,653.09	4,962.94	5,844.74	6,257.76	6,382.89	6,801.57	7,313.82	7,528.57	< 0.001
Female	285.65	290.14	350.39	364.04	368.03	369.99	403.71	403.56	0.001
Age group, yr									
20–29	464.03	518.8	654.09	737.02	794.7	880.69	1,021.21	1,128.79	< 0.001
30–39	1,493.95	1,676.16	2,091.33	2,392.04	2,583.97	2,922.66	3,314.57	3,652.5	< 0.001
40–49	2,407.33	2,545.97	3,047.51	3,254.87	3,361.96	3,638.99	3,992.67	4,207.54	< 0.001
50–59	3,481.21	3,584.63	4,059.35	4,234	4,147.25	4,249	4,499.35	4,509.29	0.001
60–69	4,521.83	4,623.93	5,198.93	5,268.96	5,197.81	5,335.37	5,462.25	5,287.12	0.018
≥ 70	4,297.54	4,409.96	4,965.54	5,195.04	5,141.05	5,244.17	5,370.52	5,255.22	0.004

ρ for trend was analyzed using the Mann-Kendall trend test.

ED, emergency department.



Supplementary Figure 1. Annual total healthcare costs for emergency department visit in Korean goat patients from 2010 to 2017. p for trend = 0.002 and it was analyzed using the Mann-Kendall trend test. USD, US dollar.