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Evolving trends in the prevalence and treatment of ankylosing spondylitis in Korea from 2010 to 2023: a population-based study

Yu-Seon Jung[1], Soo-Kyung Cho[1,2], Se Rim Choi[1,2], Sun-Young Jung[3,4] & Yoon-Kyoung Sung[1,2]✉

Ankylosing spondylitis (AS) is a chronic inflammatory disease affecting the axial skeleton, resulting in severe pain, decreased mobility, and irreversible structural damage. This study explores the evolving prevalence, patient demographics, and treatment trends for AS in the Korean population from 2010 to 2023, alongside advancements in targeted therapies. This population-based study utilized data from the National Health Insurance Database covering 2010 to 2023. AS cases were identified using at least two ICD-10 (International Classification of Diseases, 10th Revision) codes and rare intractable disease registration codes, excluding diagnoses of rheumatoid arthritis and systemic lupus erythematosus. The annual prevalence of AS was calculated and standardized to the 2017 population. Patient characteristics, comorbidities, and treatment patterns were assessed. The prevalence of AS increased from 26.76 per 100,000 individuals in 2010 to 81.87 per 100,000 in 2023. The proportion of patients over 50 years rose from 19.5 to 32.5%, and female representation increased from 17.9 to 24.0%. Comorbidities such as metabolic syndrome and musculoskeletal complications became more prevalent. Tumor necrosis factor-alpha inhibitor prescriptions rose from 29.7 to 41.6%, while the use of conventional synthetic disease-modifying antirheumatic drugs declined. The introduction of interleukin-17 and Janus kinase (JAK) inhibitors, particularly as second- and third-line therapies, marked a significant development. The prevalence of AS has surged between 2010 and 2023, particularly among older and female patients. The concurrent rise in comorbidities underscores the need for integrated care. Future research should focus on optimizing therapeutic sequences and evaluating long-term outcomes in this changing patient population.

Keywords Ankylosing spondylitis, Prevalence, Biologics, Targeted therapy, Korean population

Abbreviations

AS	Ankylosing spondylitis
JAK	Janus kinase
IL-17	Interleukin-17
NSAID	Nonsteroidal anti-inflammatory drug
NHID	National Health Insurance Database
ICD-10	International Classification of Diseases, 10th Revision
RA	Rheumatoid arthritis
SLE	Systemic lupus erythematosus
RID	Rare intractable disease
csDMARDs	Conventional synthetic disease-modifying antirheumatic drugs
TNF-alpha	Tumor necrosis factor-alpha
SD	Standard deviations
BASADAI	Bath Ankylosing Spondylitis Disease Activity Index

[1]Hanyang University Institute for Rheumatology Research, Seoul, South Korea. [2]Department of Rheumatology, Hanyang University Hospital for Rheumatic Disease, 222-1 Wangsimni-ro, Seongdong-gu, Seoul 04763, South Korea. [3]College of Pharmacy, Chung-Ang University, Seoul, South Korea. [4]Department of Global Innovative Drugs, Graduate School of Chung-Ang University, Seoul, South Korea. ✉email: sungyk@hanyang.ac.kr

Ankylosing spondylitis (AS) is a chronic inflammatory axial spondyloarthritis characterized by radiographic sacroiliitis and often accompanied by peripheral arthritis and extra-articular manifestations[1,2]. AS predominantly affects individuals in their thirties, with a prevalence in men that is 3–4 times higher than in women[3]. It is marked by significant pain, reduced spinal mobility, and functional impairment and can result in structural damage to the spine[4]. Timely management of pain, inflammation, and prevention of progressive structural damage is the primary therapeutic goal in AS[1].

Globally, the prevalence of AS has shown increasing trends[3,5,6]. In Korea, a nationwide study also reported a rise in AS prevalence between 2010 and 2015[3]. However, nearly a decade has passed since these data were last updated, highlighting the need for more recent insights. Additionally, the introduction and reimbursement of interleukin-17 (IL-17) inhibitors and Janus kinase (JAK) inhibitors as treatment options for nonsteroidal anti-inflammatory drug (NSAID)–resistant AS in Korea occurred after this period, and these advancements are expected to further reshape the treatment landscape for AS[7].

With the passage of another decade, it is anticipated that significant changes have occurred in the prevalence, patient demographics, and treatment landscape for AS; however, current data on these trends remain limited. To address this gap, we conducted a population-based study utilizing a national health insurance database to estimate the national prevalence of AS between 2010 and 2023 and assess shifts in patient characteristics and treatment patterns in Korea. Understanding these evolving trends is essential for informing future clinical practice and optimizing management strategies for AS.

Methods

Study design and data source

This population-based study used data from the National Health Insurance Database (NHID) of South Korea, covering the period from January 2010 to December 2023. The NHID provides a comprehensive dataset that captures a wide range of patient-related information, including sociodemographic factors, health screenings, diagnoses, clinical procedures, and prescriptions reimbursed by the national healthcare system[8]. Patients diagnosed with AS from 2010 to 2023 were included in this study, with exclusions for incomplete data on age, sex, or insurance quintile.

Identification of AS cases

AS cases were identified based on two or more primary diagnoses using the International Classification of Diseases, 10th Revision (ICD-10) code M45, with exclusions for rheumatoid arthritis (RA) and systemic lupus erythematosus (SLE) diagnoses. Confirmation was supported by the rare intractable disease (RID) codes for AS (V140), RA (V223), and SLE (V136). This AS definition has been previously validated, showing a positive predictive value of 91.7% in a tertiary hospital setting, likely involving rheumatologists[9]. The RID program provides cost coverage for patients with severe, rare diseases such as AS. For AS, physician confirmation is required based on the modified New York, which include either bilateral sacroiliitis of grade ≥ II or unilateral sacroiliitis of grade III or IV, along with at least two of the following three clinical criteria: (1) low back pain and stiffness lasting at least three months that improves with exercise but not with rest; (2) limited motion of the lumbar spine in both the sagittal and frontal planes; and (3) reduced chest expansion[10]. This approach enhances the validity of AS cases in administrative claims databases[10]. We also performed a sensitivity analysis using an alternative definition that included rheumatologist visits[11].

Changes in baseline characteristics and comorbidities in Korean patients with AS

Baseline characteristics, including sociodemographic factors, healthcare utilization, and comorbidities, were assessed for patients with AS in 2010 and 2023 to evaluate changes over time. Sociodemographic factors included age, sex, and insurance level as a proxy for income. Healthcare utilization was examined by analyzing the type of institution and physician department visited to assess patient experiences. Biannual health screenings, which are mandatory for all Korean citizens, closest to 2010 and 2023, were used to compare body mass index and smoking status, both of which are relevant to AS.

Comorbidities were identified using ICD-10 codes, focusing on extra-articular manifestation of AS and metabolic syndrome (e.g., ischemic heart disease, hypertensive disease, hyperlipidemia) (Supplemental Table S1). Additional prevalent comorbidities included osteoporosis, spinal fracture, asthma, and sleep apnea. The CCI (Charlson Comorbidity Index) was also calculated to quantify the overall burden of comorbid conditions.

Changes in pharmacological treatment patterns of Korean patients with AS

Annual pharmacological treatment trends were analyzed in patients with confirmed AS from 2010 to 2023. Treatment was defined as the presence of at least one prescription during each year of the study period. NSAID use was defined as a prescription lasting more than 7 consecutive days, given the frequent prescribing of NSAIDs for other conditions in Korea. The primary treatments analyzed included NSAIDs, conventional synthetic disease-modifying antirheumatic drugs (csDMARDs), tumor necrosis factor (TNF)-alpha inhibitors, IL-17 inhibitors, and JAK inhibitors, all of which were approved and reimbursed for AS treatment in South Korea (Supplemental Table S2).

Targeted therapy episodes were identified among new users of targeted therapies diagnosed with AS between 2013 and 2023, excluding those with AS diagnoses from 2010 to 2012. Treatment episodes were constructed using 180-day grace periods, with any lapse in prescriptions exceeding 180 days considered a discontinuation. First-, second-, and third-line targeted therapy choices were also examined.

Statistical analysis

The annual prevalence rate per 100,000 population was calculated as the number of patients with AS divided by the total South Korean population for each year. Age- and sex-adjusted prevalence and incidence rates were standardized to the 2017 population to accurately reflect trends over time, with 95% confidence intervals provided. Descriptive statistics for patient characteristics are presented as means and standard deviations (SD) for continuous variables and as frequencies and percentages for categorical variables. Annual medication prescribing was analyzed among existing AS cases for each year. The first, second, and third-line targeted therapies were examined as percentages, and the time to targeted therapy initiation from the diagnosis date was reported in both mean and median days, along with SD and interquartile range. All statistical analyses were performed using SAS version 9.4 (SAS Institute, Cary, North Carolina, USA).

Results

The prevalence of AS in Korea increased from 26.76 per 100,000 individuals in 2010 to 81.87 per 100,000 in 2023, based on age- and sex-adjusted rates using the 2017 population as the reference (Table 1). When applying the more stringent definition of AS, which limits cases to rheumatologist visits, the prevalence was slightly lower, rising from 21.83 per 100,000 in 2010 to 72.98 per 100,000 in 2023 (Supplemental Table 3). The proportion of patients aged 50 years and older increased significantly, accounting for 19.5% of the AS population in 2010 and rising to 32.5% in 2023 (Fig. 1). Additionally, the proportion of female AS patients expanded from 17.9% in 2010 to 24.0% in 2023. These trends remained consistent in a sensitivity analysis based on the rheumatologist visit-limited definition of AS.

A comparison of patient characteristics between 2010 and 2023 showed changes in demographics and clinical characteristics (Table 2). The mean age of patients in 2023 was 46 years (SD 13.9), compared to 38.6 years (SD 12.2) in 2010. The proportion of male patients was 82.7% in 2010 and 76.7% in 2023. The proportion of patients in the 0-5th insurance level was 23.6% in 2023 and 19.8% in 2010. In 2023, 30.0% of patients received care at general hospitals, compared to 21.3% in 2010, while tertiary hospital care decreased from 60.5% in 2010 to 51.3% in 2023. Rheumatologist visits accounted for 75.6% of patient visits in 2023 compared to 68.6% in 2010, and orthopedic visits decreased from 2.3% in 2010 to 1.0% in 2023.

Body mass index was similar across both years, while the proportion of current smokers increased from 34.9% in 2010 to 39.9% in 2023. The prevalence of metabolic conditions increased significantly: diabetes rose from 7.8% in 2010 to 21.3% in 2023, ischemic heart disease from 3.3 to 5.6%, hypertensive disease from 17.0 to 31.2%, and hyperlipidemia from 23.7 to 65.5%. Musculoskeletal conditions, such as osteoporosis (12.4% in 2010 to 16.3% in 2023) and spinal fractures (10.2% in 2010 to 12.4% in 2023), were more common in 2023. Additionally, the prevalence of asthma increased from 6.6% in 2010 to 10.2% in 2023, and sleep apnea from 0.2 to 1.2%. The mean CCI score increased from 0.65 (SD 1.14) in 2010 to 1.01 (SD 1.41) in 2023.

While the absolute number of patients prescribed each drug category increased with the rising prevalence of AS, the proportion of patients without any treatment and prescribed NSAIDs remained consistent from 2010 to 2023 (Fig. 2). The use of csDMARDs decreased from 60.4% in 2010 to 38.9% in 2023, while prescriptions for TNF-alpha inhibitors increased from 29.7% in 2010 to 41.6% in 2023. Both IL-17 inhibitors and JAK inhibitors showed an upward trend in usage, with a significant increase in IL-17 inhibitors beginning in 2017 and JAK inhibitors in 2020.

Among patients who received a first-line targeted therapy ($n = 13,517$), the mean time to initiation was 434.9 days (SD 641.8), and the median was 157 days (interquartile range [IQR]: 92–456 days) (Table 3). TNF-alpha inhibitors were the most frequently prescribed first-line targeted therapy, accounting for 99.6% of cases. A second-line targeted therapy was initiated in 24.7% of patients, with a mean time to initiation of 1235.7 days (SD 867.4) and a median of 1053.5 days (IQR: 518–1790 days). For second-line targeted therapies, TNF-alpha

Year	Total population	Prevalent cases	Prevalence rate per 100,000 (95% confidence interval)[a]
2010	50,515,666	13,501	26.76 (26.31–27.21)
2011	50,734,284	15,443	30.38 (29.90–30.86)
2012	50,948,272	17,231	33.71 (33.20–34.21)
2013	51,141,463	19,094	37.22 (36.69–37.75)
2014	51,327,916	21,210	41.21 (40.66–41.77)
2015	51,529,338	23,045	44.63 (44.05–45.21)
2016	51,696,216	25,428	49.03 (48.42–49.63)
2017	51,778,544	27,498	53.02 (52.40–53.65)
2018	51,826,059	29,561	56.94 (56.29–57.59)
2019	51,849,861	31,863	61.54 (60.87–62.22)
2020	51,829,023	33,553	64.97 (64.27–65.66)
2021	51,638,809	36,942	71.98 (71.25–72.71)
2022	51,439,038	39,235	77.18 (76.42–77.94)
2023	51,325,329	41,415	81.87 (81.09–82.65)

Table 1. Annual prevalence of ankylosing spondylitis from 2010 to 2023. [a]Age- and sex-adjusted rates, standardized to the 2017 population.

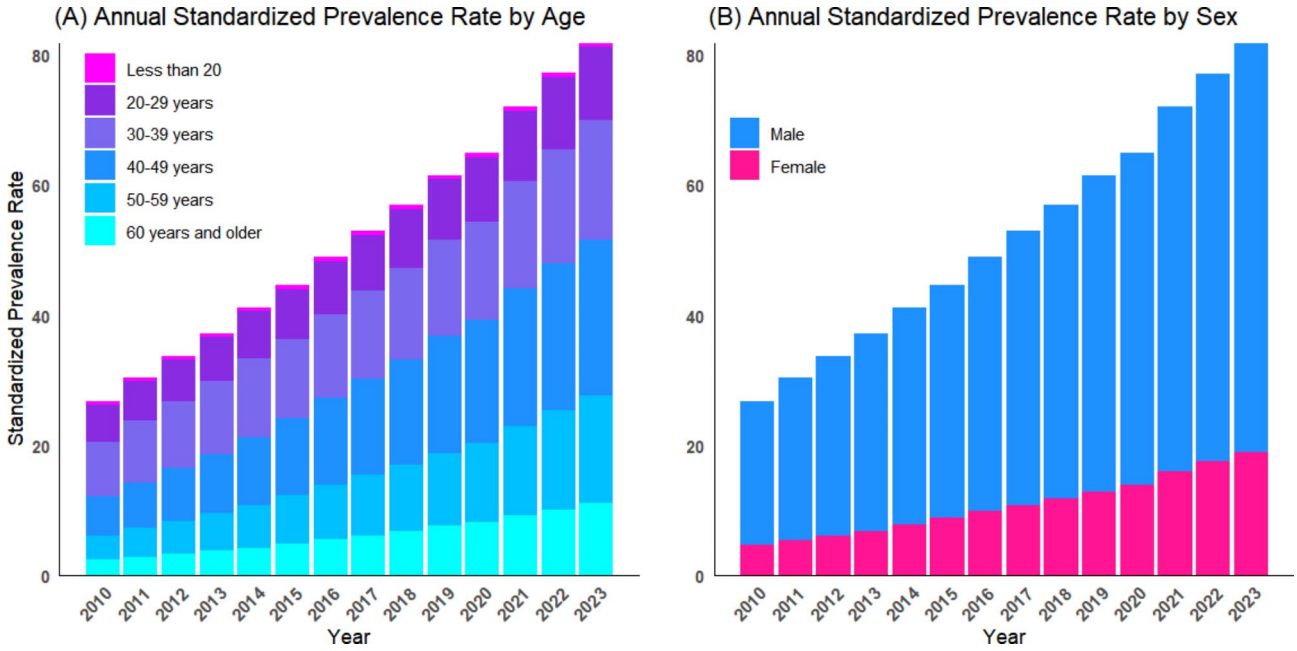

Fig. 1. Prevalence of ankylosing spondylitis (2010–2023) by age group (**A**) and sex (**B**). The unit of standardized prevalence is per 100,000 population.

inhibitors remained the most commonly used (84.9%), while IL-17 inhibitors accounted for 14.6% and JAK inhibitors for 0.5%.

A third-line targeted therapy was administered to 29.5% of second-line targeted therapy users, with a mean time to initiation of 1702.6 days (SD 855.0) and a median of 1631 days (IQR: 1042–2327 days). Among third-line targeted therapies, TNF-alpha inhibitors continued to be the most frequently used (80.9%), followed by IL-17 inhibitors (18.4%) and JAK inhibitors (0.7%).

Discussion

This study provides an updated analysis of AS trends, revealing an increase in AS prevalence from 26.76 per 100,000 individuals in 2010 to 81.87 per 100,000 in 2023. A notable shift in patient demographics was observed, with a growing proportion of individuals over 50 years of age and an increasing number of female patients. Comorbidities, particularly metabolic conditions such as diabetes, ischemic heart disease, hypertension, and hyperlipidemia, became more prevalent during this period. Additionally, the prevalence of current smokers increased in 2023 compared to 2010. Healthcare utilization patterns shifted, with visits to general hospitals and rheumatologists increasing, while visits to tertiary hospitals and orthopedic departments decreased.

The increase in AS prevalence observed in this study is consistent with previous studies despite the stricter AS definition applied, which required both two or more ICD codes and an RID code, while excluding RA and SLE diagnoses. An earlier study using the NHID, which applied only a single ICD and RID code, similarly reported a rise in AS prevalence from 31.62 per 100,000 individuals in 2010 to 52.30 per 100,000 in 2015[3]. Likewise, a United States (US) study using IBM MarketScan, Medicaid, and Medicare databases reported an increase in AS prevalence from 40 to 90 per 100,000 individuals between 2006 and 2016. In the United Kingdom (UK), data from UK general practitioners showed an increase in AS prevalence from 130 per 100,000 in 1998 to 180 per 100,000 in 2017[6].

The rising prevalence, particularly among older adults and female patients, reflects trends observed in other recent studies. A US study from 2006 to 2014 reported a higher prevalence in older adults and female patients[5]. Similarly, UK data from the CPRD (Clinical Practice Research Datalink) from 1998 to 2017 showed a significant increase in AS prevalence among women and patients aged 60 or older[6]. Although this study is limited in drawing conclusions, this demographic shift may be partially explained by increased awareness of sex-specific symptom differences in AS among females in Korea. These differences are often characterized by slower radiological progression and frequent misclassification of clinical symptoms, potentially leading to a delayed age at diagnosis[6,12]. Further studies are warranted to explore the underlying factors driving these changes.

The significant increase in the prevalence of comorbidities, including metabolic syndrome (observed in 2023) were comparable to findings from the US study, where diabetes prevalence increased between 2006 and 2014[5]. AS patients are known to have a higher incidence of hypertension, hyperlipidemia, and cardiovascular events compared to the general population[13,14]. The older age and longer disease duration may have contributed to the high prevalence, highlighting the need for further research to better understand these trends. Some overestimation of comorbidities such as diabetes, hypertension, and hyperlipidemia may occur due to the limitations of claims databases—particularly where coding practices are influenced by reimbursement policies.

Patient characteristics	2010 (*N* = 13,478)		2023 (*N* = 41,256)	
Sociodemographic factors				
Age, mean (SD)	38.6 (12.2)		46.0 (13.9)	
Less than 20	300	(2.2)	234	(0.6)
20–29	2882	(21.4)	5259	(12.7)
30–39	4766	(35.4)	8434	(20.4)
40–49	3111	(23.1)	11,127	(27.0)
50–59	1529	(11.3)	8716	(21.1)
60 or more	890	(6.6)	7486	(18.1)
Male	11,147	(82.7)	31,643	(76.7)
Insurance level				
0–5th	2665	(19.8)	9727	(23.6)
6–10th	2575	(19.1)	6746	(16.4)
10–15th	3566	(26.5)	10,521	(25.5)
16–20th	4672	(34.7)	14,262	(34.6)
Types of institution				
Tertiary hospital	8148	(60.5)	21,170	(51.3)
General hospital	2870	(21.3)	12,388	(30.0)
Community hospital/long-term care	401	(3.0)	1332	(3.2)
Clinics	1862	(13.8)	5284	(12.8)
Others	197	(1.5)	1082	(2.6)
Physician department				
Dermatology	1	(0.0)	6	(0.0)
Internal medicine (general physician)	1242	(9.2)	3870	(9.4)
Orthopedic	310	(2.3)	410	(1.0)
Rheumatology	9252	(68.6)	31,180	(75.6)
Others	2673	(19.8)	5790	(14.0)
Body Mass Index, mean (SD)	24.19 (3.63)		24.96 (3.97)	
Underweight (Less than 18.5 kg/m2)	459	(3.4)	1003	(2.4)
Normal (18.5–23 kg/m^2)	4017	(29.8)	9802	(23.8)
Overweight (23–25 kg/m^2)	2661	(19.7)	7667	(18.6)
Obese (25 kg/m^2 or more)	4447	(33.0)	15,868	(38.5)
Missing	1894	(14.1)	6917	(16.8)
Smoking status				
Current smoker	4706	(34.9)	16,468	(39.9)
Past smoker	2641	(19.6)	9219	(22.3)
Non-smoker	4222	(31.3)	8658	(21.0)
Missing	1909	(14.2)	6911	(16.8)
Comorbidities				
Uveitis	2055	(15.2)	6642	(16.1)
Ulcerative colitis	34	(0.3)	250	(0.6)
Crohn's disease	266	(2.0)	522	(1.3)
Psoriasis	236	(1.8)	1237	(3.0)
Diabetes	1053	(7.8)	8804	(21.3)
Ischemic heart disease	443	(3.3)	2320	(5.6)
Hypertensive disease	2292	(17.0)	12,871	(31.2)
Hyperlipidemia	3193	(23.7)	27,038	(65.5)
Osteoporosis	1668	(12.4)	6714	(16.3)
Spinal fracture	1380	(10.2)	5108	(12.4)
Asthma	885	(6.6)	4206	(10.2)
Continued				

Patient characteristics	2010 (*N* = 13,478)		2023 (*N* = 41,256)	
Sleep apnea	33	(0.2)	496	(1.2)
Charlson Comorbidity Index	0.65 (1.14)		1.01 (1.41)	
0	8872	(65.8)	21,632	(52.4)
1–2	3775	(28.0)	14,244	(34.5)
3 or more	831	(6.2)	5381	(13.0)

Table 2. Comparison of sociodemographic characteristics, healthcare utilization, and comorbidities of patients with ankylosing spondylitis in 2010 and 2023. Values are presented as n (%). *SD* standard deviation, *GERD* gastroesophageal reflux disease.

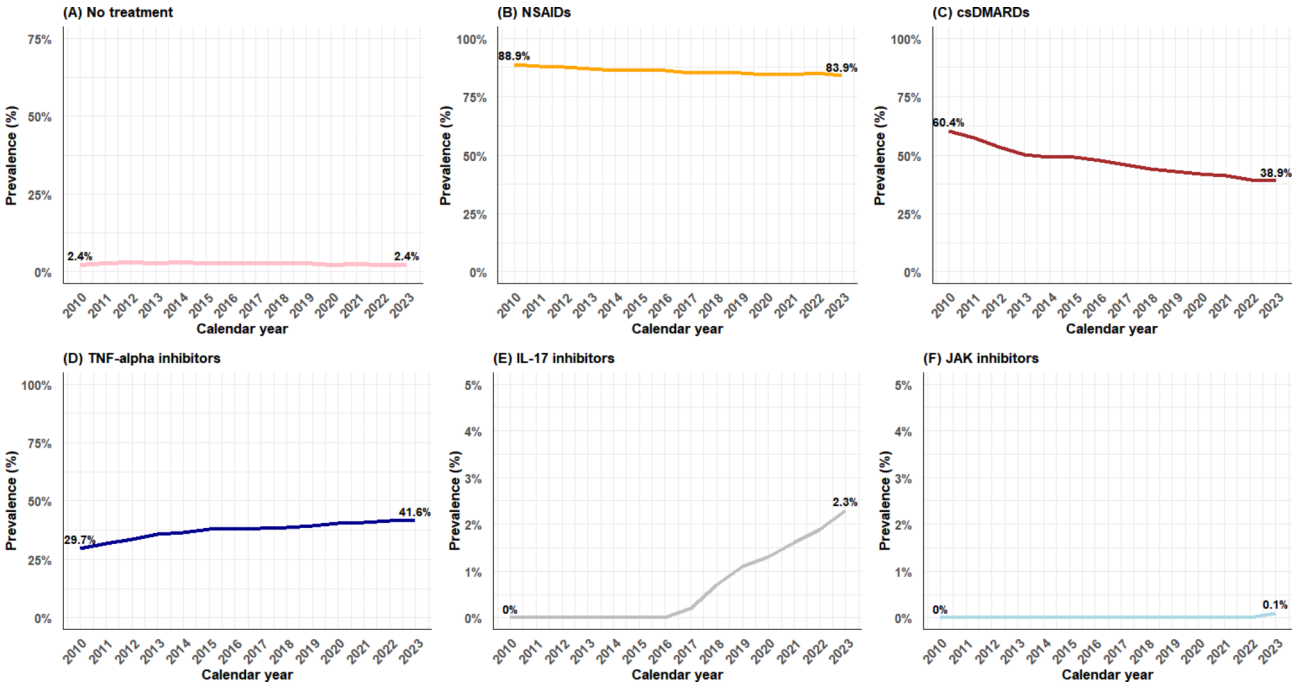

Fig. 2. Prescribing trend of no treatments (**A**), nonsteroidal anti-inflammatory drugs (NSAIDs) (**B**), conventional synthetic disease-modifying drugs (csDMARDs) (**C**), tumor necrosis factor (TNF)-alpha inhibitors (**D**), interleukin (IL)-17 inhibitors (**E**), and Janus kinase (JAK) inhibitors (**F**) for ankylosing spondylitis from 2010 to 2023. *NSAIDs* nonsteroidal anti-inflammatory drugs, *csDMARDs* conventional synthetic disease-modifying antirheumatic drugs, *TNF-alpha inhibitors* tumor necrosis factor-alpha inhibitors, *IL-17 inhibitors* interleukin-17 inhibitors, *JAK inhibitors* Janus kinase inhibitor.

However, the overall trend of increasing prevalence remains clear when applying a stricter definition requiring more than one diagnosis code (Supplemental Table 4).

The rise in the proportion of current smokers is also noteworthy. Smoking is a well-established risk factor for the worsening of AS disease activity, functional disability, and even the accelerated progression of structural damage[15,16]. A single-blind observational study of 92 AS patients showed improvements in the BASADAI (Bath Ankylosing Spondylitis Disease Activity Index), quality of life, and physical function following smoking cessation[17]. Given that smoking may reduce the efficacy of treatment, physicians should carefully assess smoking status when determining treatment options, as it may influence both therapeutic success and disease progression. Although a previous study suggests that smoking does not significantly alter the effect of TNF-alpha inhibitors on health-related quality of life, smokers consistently reported poorer health-related quality of life compared to non-smokers[18]. Evidence regarding the impact of smoking on other targeted therapies remains limited.

Treatment patterns have also evolved significantly over the past decade with the increased use of biologics such as TNF-alpha inhibitors, IL-17 inhibitors, and JAK inhibitors, alongside a decline in csDMARD usage. A study in Korea using NHID data from 2006 to 2016 confirmed this trend, reporting a decrease in DMARD use from 71.1 to 63.4%, while biologic use rose from 11.4 to 33.7%[19]. This shift reflects the increasing preference of using TNF-alpha inhibitors, as they have been proven more effective than conventional DMARDs in the treatment of AS[20]. TNF-alpha inhibitors were the predominant choice, used in 99.7% of first-line targeted therapies, 84.9% of second-line targeted therapies, and 80.9% of third-line targeted therapies. IL-17 inhibitors were increasingly used

Targeted therapy	*n*	(%)
First-line targeted therapy	13,517	(100.0)
Time to first-line targeted therapy, days	434.9 (641.8)	157 (92, 456)
TNF-alpha inhibitors	13,465	(99.6)
IL-17 inhibitor	41	(0.3)
JAK inhibitors	11	(0.1)
Second-line targeted therapy	3341	(24.7)
Time to second-line targeted therapy, days	1235.7 (867.4)	1053.5 (518, 1790)
TNF-alpha inhibitors	2836	(84.9)
IL-17 inhibitor	489	(14.6)
JAK inhibitors	16	(0.5)
Third-line targeted therapy	984	(29.5)
Time to third-line targeted therapy, days	1702.6 (855.0)	1631 (1042, 2327)
TNF-alpha inhibitors	796	(80.9)
IL-17 inhibitor	181	(18.4)
JAK inhibitors	7	(0.7)

Table 3. First-, second-, and third-line targeted therapy choices and time to treatment initiation. Values are presented as n (%), and time to treatment initiation as mean (SD) and median (Q1, Q3). *SD* standard deviation, *TNF-alpha inhibitors* tumor necrosis factor-alpha inhibitors, *IL-17 inhibitors* interleukin-17 inhibitors, *JAK inhibitors* Janus kinase inhibitors.

in second- and third-line targeted therapies, accounting for 14.6% and 18.4%, respectively, while JAK inhibitors were prescribed in smaller percentages (0.5% and 0.7%). Notably, 34% of AS patients initiated a targeted therapy, with 24.7% progressing to a second-line targeted therapy. This rate for first-line targeted therapy is higher than in other regions; for example, a Japanese study found that 24.2% of AS patients used biologic DMARDs, while only 9.8% did so in a German study[21,22]. The growing use of targeted therapies highlights a shift toward more advanced treatments for AS, yet further research is needed to determine the long-term efficacy and safety of treatment sequences, particularly as the characteristics of AS patients, such as age and comorbidities, continue to change.

A limitation of this study is the reliance on an administrative claims database, which introduces potential misclassification bias in estimating AS prevalence and associated comorbidities. The reimbursement policy in Korea adopts a conservative approach, using the Modified New York Criteria for diagnosing rather than the ASAS criteria. As a result, the database may inherently exclude some AS patients with multiple spinal region involvement but without radiographic evidence of progression, potentially omitting cases in the early stages of AS. Additionally, potential misdiagnoses, including errors in interpreting radiological progression or misclassification of inflammatory bowel disease and psoriatic arthritis with axial involvement, cannot be fully addressed in this database. However, in Korea, separate RID codes for psoriatic arthritis (V237) and IBD (Crohn's disease V130 and ulcerative colitis V131) along with distinct diagnostic criteria are applied, which may help reduce misclassification.

To mitigate potential misclassification bias in AS diagnosis, we applied the definition from previous study with a PPV of 91.7% for the AS definition and conducted sensitivity analyses using rheumatologist visit data, which confirmed the increasing prevalence trends. While this approach likely reflects a higher PPV, it may exclude patients diagnosed in other departments. Additionally, the PPV reported in previous studies may not be entirely applicable to our study due to differences in timelines and increased awareness of AS, which could contribute to the overdiagnosis of AS. Treatment patterns may also be misclassified when medications are prescribed for conditions other than AS; however, this reflects real-world practices for AS patients with comorbidities, adding to the study's clinical relevance.

The strength of this study lies in its application of a more stringent definition of AS, which required at least two ICD and RID codes, while excluding RA and SLE diagnoses. This approach increased diagnostic specificity compared to previous research. Additionally, a sensitivity analysis was conducted by further restricting case definitions to rheumatologist visit. The use of a population-based dataset spanning from 2010 to 2023 enabled a long-term evaluation of AS trends, particularly during 2010 to 2023 when IL-17 and JAK inhibitors became available, offering valuable insights into treatment evolution.

The prevalence of AS has steadily increased from 2010 to 2023, with a particularly notable rise in older adults and female patients. These shifts in demographics have been accompanied by a higher prevalence of comorbidities, such as metabolic syndrome and musculoskeletal complications, as well as increasing smoking rates. During this period, the use of TNF-alpha inhibitors has grown, while csDMARD prescriptions have declined. The use of IL-17 and JAK inhibitors has increased since 2020, particularly in second- and third-line targeted therapies. These demographic changes and advancements in treatment options highlight the need for tailored treatment and management strategies, considering the growing prevalence of metabolic disorders, smoking, and older and female patient populations. These factors should guide future medication selection and treatment approaches.

Data availability

The National Health Service System in Korea, the data provider, requires all involved researchers to pledge not to share, release, or review the data with other entities. Any request regarding data and the study itself should be directed to the corresponding authors, who have signed the data release agreement form of the National Health Service System in Korea.

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Author contributions

Conceptualization: Jung YS, Cho SK, Jung SY, Sung YK. Data acquisition: Jung YS, Cho SK, Sung YK. Analysis: Jung YS, Jung SY. Methodology investigation: Jung YS, Cho SK, Choi SR, Jung SY, Sung YK. Writing – original draft: Jung YS, Cho SK, Sung YK. Writing – review & editing: Jung YS, Cho SK, Choi SR, Jung SY, Sung YK.

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Declarations

Consent for publication

The use of secondary claims data permitted the study to obtain a waiver of informed consent.

Competing interests
The authors declare no competing interests.

Ethical approval and consent to participate
The study protocol received an exemption from review by the Institutional Review Board at Hanyang University due to its use of anonymized secondary data (IRB No: HYUH202401047-HE001), and informed consent requirements were waived.

Ethical statement
The study protocol was exempted from review by the Institutional Review Board of Hanyang University, as it involved the use of anonymized secondary data (IRB No: HYUH202401047-HE001). The requirement for informed consent was also waived.

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Correspondence and requests for materials should be addressed to Y.-K.S.

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