Preplanned Studies

Burden and Risk Factors of Gout, Low Back Pain, Osteoarthritis, and Rheumatoid Arthritis — China, 1990–2023

Kun Xu[1]; Feng Pan[1]; Kunzhi Zhu[1]; Yuan Gao[1]; Jun Zhang[1,#]

Summary

What is already known on this topic?

Musculoskeletal disorders, including gout, low back pain (LBP), osteoarthritis (OA), and rheumatoid arthritis (RA), impose a substantial global health burden that intensifies with population aging. China confronts distinctive challenges stemming from rapid demographic aging and evolving occupational patterns, yet comprehensive analysis using the latest Global Burden of Disease (GBD) 2023 data to inform long-term prevention strategies remains absent.

What is added by this report?

This study demonstrates that from 1990 to 2023, the disease burdens of gout, OA, and RA increased continuously, whereas the burden of LBP declined. Predictive modeling indicates these divergent trajectories — growth for gout, OA, and RA versus reduction for LBP — will persist through 2043. Additionally, substantial gender- and age-specific variations in disease burden were identified, with peak impacts concentrated in the 40–80 age range.

What are the implications for public health practice?

The rising burden of these musculoskeletal diseases, concentrated in the 40–80 age group, necessitates urgent interventions aligned with "Healthy China 2030" objectives. Key priorities must include managing modifiable risk factors (body mass index, occupational ergonomics), implementing targeted screening programs for high-risk populations (males for gout, females for osteoarthritis and rheumatoid arthritis), and optimizing hierarchical diagnosis and rehabilitation systems to mitigate long-term disability.

ABSTRACT

Introduction: Musculoskeletal diseases including gout, low back pain (LBP), osteoarthritis (OA), and rheumatoid arthritis (RA) impose a substantial health burden in China. This study analyzes disease trends from 1990 to 2023 and projects trends over the next 20 years to inform evidence-based prevention and management strategies.

Methods: The study utilized Global Burden of Disease (GBD) 2023 data to assess the burden of gout, LBP, OA, and RA. Temporal trends were evaluated using annual percentage change (APC) and estimated annual percentage change (EAPC), with systematic stratification by gender, age, and risk factors. The Autoregressive Integrated Moving Average (ARIMA) model was employed to forecast future disease rates.

Results: In 2023, China's prevalence cases for gout, LBP, OA, and RA were 17.67, 95.32, 161.74, and 4.99 million, respectively. From 1990 to 2023, the burden of gout, OA, and RA increased substantially, while LBP declined. Gout burden was higher in males, whereas LBP, OA, and RA were higher in females, with disease concentration in the 40–80 age group. Disability-adjusted life years (DALYs) attributable to high body mass index (BMI) increased for gout, OA, and LBP. ARIMA projections indicate continued increases for gout, OA, and RA, but improvement for LBP.

Conclusion: The burden of gout, OA, and RA in China increased from 1990 to 2023, while LBP demonstrated improvement. Significant variations exist across gender and age groups. Strengthening health education and implementing comprehensive risk factor prevention strategies are crucial to reduce the future burden of these diseases.

Musculoskeletal disorders — damage to muscles, bones, joints, and connective tissues — cause functional limitations ranging from short-term disability to lifelong impairment. Globally, the prevalence of musculoskeletal disorders has increased substantially, imposing considerable economic and physical burdens on healthcare systems and individuals. Key risk factors include prolonged physical

labor, repetitive movements, poor posture, elevated body mass index (BMI), and inadequate rest periods. Aging represents a critical determinant, as the incidence of musculoskeletal disorders increases progressively with advancing age (*1*).

The Global Burden of Disease 2023 (GBD 2023) study provides comprehensive epidemiological data — including incidence, prevalence, and disability-adjusted life years (DALYs) — on musculoskeletal diseases across 204 countries and territories from 1990 to 2023, offering an invaluable analytical framework for public health research. China, the world's second most populous nation, faces distinctive challenges related to rapid demographic aging and evolving occupational exposures (*2*). Understanding the burden and epidemiological trends of musculoskeletal diseases in China is therefore essential for developing evidence-based public health strategies and resource allocation policies.

Leveraging GBD 2023 data, this study comprehensively analyzed the incidence, prevalence, and DALYs associated with gout, low back pain (LBP), osteoarthritis (OA), and rheumatoid arthritis (RA) in China from 1990 to 2023. We examined temporal trends and distribution patterns by gender and age group, evaluated associated risk factors, and projected future disease burdens. This research aims to elucidate the epidemiological characteristics of these four major musculoskeletal conditions in China, providing critical evidence to inform prevention strategies and clinical management policies.

Data were obtained from the GBD 2023 dataset, covering 375 diseases and 88 risk factors in 204 countries and territories. We extracted incidence, prevalence, DALYs, and age-standardized rates (ASRs) gor gout, LBP, OA, and RA in China from the global health data exchange (GHDx) platform. This study followed Guidelines for accurate and transparent health estimates reporting (GATHER) and required no ethical approval, as no personal or sensitive data was used (*3*).

Disease burden was assessed via incidence, prevalence, and DALYs (measuring life loss/disability). We used Joinpoint regression (version 5.0.2, National Cancer Institute, Bethesda, United States) to identify significant trend changes, calculating the Annual Percentage Change (APC). Time patterns were quantified using the Estimated Annual Percentage Change (EAPC), with trend direction determined by its 95% confidence interval (*CI*). We analyzed disease distribution by gender and 17 age groups and assessed risk factors contributing to DALYs. Future burden was predicted using the Autoregressive Integrated Moving Average (ARIMA) model, selected for its high accuracy and widely utilized in relevant epidemiological research (*4*).

In 2023, China recorded 3.22, 41.38, 11.89, and 0.26 million incident cases of gout, LBP, OA, and RA, respectively, corresponding to age-standardized incidence rates (ASIRs) of 151.27, 2,164.80, 550.20, and 13.84 per 100,000 population. Prevalent cases totaled 17.67, 95.32, 161.74, and 4.99 million, with age-standardized prevalence rates (ASPRs) of 809.69, 4,929.78, 6989.96, and 241.73 per 100,000, respectively. The age-standardized DALYs rates (ASDRs) were 25.14, 551.92, 243.86, and 40.23 per 100,000 for gout, LBP, OA, and RA, respectively. Overall, China experiences a substantial musculoskeletal disease burden, with the burden being highest for LBP and lowest for RA (Table 1).

From 1990 to 2023, the ASIR for gout, OA, and RA in China demonstrated increasing trends, with EAPCs of 0.98% (95% *CI*: 0.87%, 1.09%), 0.56% (95% *CI*: 0.49%, 0.64%), and 0.62% (95% *CI*: 0.59%, 0.64%), respectively. In contrast, the ASIR for LBP exhibited a decreasing trend (EAPC=−0.51%, 95% *CI*: −0.60%, −0.43%) (Table 1). Joinpoint regression analysis revealed an overall upward ASIR trajectory for gout from 1990 to 2023, although a decline occurred during 1990–1994 (APC=−1.24%). The ASIR for LBP showed an overall decline, most pronounced during 1990–1994 (APC=−3.23%), yet increased during 2014–2020 (APC=0.30%). The ASIR for OA followed a generally upward trajectory, with a notable decrease during 1990–1994 (APC=−0.55%). Similarly, the ASIR for RA demonstrated an overall upward trend, with the most substantial increase occurring during 2000–2009 (APC=0.84%) (Figure 1).

From 1990 to 2023, China's ASPR increased for gout (EAPC=1.08%, 95% *CI*: 0.96%, 1.19%), OA (EAPC=0.59%, 95% *CI*: 0.51%, 0.66%), and RA (EAPC=0.58%, 95% *CI*: 0.55%, 0.62%), while decreasing for LBP (EAPC=−0.54%, 95% *CI*: −0.64%, −0.45%) (Table 1). Joinpoint analysis revealed an overall upward trend in ASPR for gout, although a decline occurred during 1990–1994 (APC=−1.37%). LBP ASPR declined overall, with the steepest decrease

TABLE 1. Incidence, prevalence, and DALYs rates of gout, low back pain, osteoarthritis, and rheumatoid arthritis in China, 1990–2023.

Diseases	1990		2023		
	Number (95% *UI*)	ASR (95% *UI*)	Number (95% *UI*)	ASR (95% *UI*)	EAPC (95% *CI*)
Incidence					
Gout	1,188,962 (949,192, 1,476,316)	122.47 (98.09, 153.00)	3,215,472 (2,529,611, 4,037,875)	151.27 (120.46, 189.12)	0.98 (0.87, 1.09)
Low back pain	29,989,124 (26,335,876, 33,418,905)	2,859.73 (2,532.11, 3,187.09)	41,383,565 (36,417,179, 46,520,393)	2,164.80 (1,926.65, 2,383.57)	−0.51 (−0.60, −0.43)
Osteoarthritis	4,675,941 (4,110,513, 5,229,759)	487.11 (429.80, 545.72)	11,895,272 (10,472,533, 13,375,467)	550.20 (486.92, 616.09)	0.56 (0.49, 0.64)
Rheumatoid arthritis	128,308 (112,655, 147,427)	11.59 (10.23, 13.22)	257,758 (225,232, 294,722)	13.84 (12.27, 15.78)	0.62 (0.59, 0.64)
Prevalence					
Gout	6,008,711 (4,795,809, 7,613,438)	640.47 (511.00, 801.13)	17,672,308 (13,878,800, 22,353,430)	809.69 (647.27, 1,009.55)	1.08 (0.96, 1.19)
Low back pain	68,636,309 (59,816,847, 77,457,397)	6,636.60 (5,778.62, 7,462.02)	95,323,956 (83,625,063, 107,778,790)	4,929.78 (4,304.39, 5,494.10)	−0.54 (−0.64, −0.45)
Osteoarthritis	53,766,775 (47,130,666, 59,642,801)	6,149.80 (5,441.26, 6,801.46)	161,742,448 (142,905,114, 180,660,772)	6,989.96 (6,196.45, 7,784.64)	0.59 (0.51, 0.66)
Rheumatoid arthritis	2,052,564 (1,755,880, 2,383,913)	205.75 (179.74, 238.28)	4,985,071 (4,389,031, 5,800,940)	241.73 (211.74, 280.44)	0.58 (0.55, 0.62)
DALYs					
Gout	188,934 (125,368, 268,975)	19.88 (13.26, 28.28)	545,814 (363,327, 779,105)	25.14 (16.72, 35.52)	1.07 (0.95, 1.18)
Low back pain	7,732,428 (5,438,615, 10,477,031)	740.83 (525.01, 1,010.60)	10,635,869 (7,520,420, 14,715,745)	551.92 (388.90, 750.82)	−0.54 (−0.63, −0.44)
Osteoarthritis	1,837,689 (883,100, 3,937,170)	209.87 (100.56, 446.71)	5,648,544 (2,670,356, 12,144,957)	243.86 (115.42, 525.12)	0.66 (0.58, 0.73)
Rheumatoid arthritis	421,031 (301,535, 542,686)	43.91 (31.23, 56.56)	837,301 (621,306, 1,074,013)	40.23 (29.58, 52.40)	−0.22 (−0.27, −0.16)

Abbreviation: *CI*=confidence interval; *UI*=uncertainty interval; DALYs=disability-adjusted life years; ASR=age-standardized rate; EAPC=estimated annual percentage change.

during 1990–1994 (APC=−3.63%), followed by a modest increase during 2014–2020 (APC=0.34%). OA ASPR demonstrated an upward trajectory, with an initial decline during 1990–1994 (APC=−0.57%). Similarly, RA ASPR increased overall, with the most pronounced rise occurring during 2000–2010 (APC=0.90%) (Supplementary Figure S1, available athttps://weekly.chinacdc.cn/).

From 1990 to 2023, ASDR increased for gout (EAPC=1.07%) and OA (EAPC=0.66%), but decreased for LBP (EAPC=−0.54%) and RA (EAPC=−0.22%) (Table 1). Joinpoint analysis demonstrated overall ASDR increases for gout and OA, with initial declines during 1990–1994 (APC=−1.26%) and 1990–1993 (APC=−0.63%), respectively. LBP ASDR exhibited an overall decline, most pronounced during 1990–1994 (APC=−3.58%), yet increased during 2014–2020 (APC=0.40%). RA ASDR fluctuated throughout the study period, with the greatest decrease occurring during 1990–1998 (APC=−0.84%) and the most substantial increase during 1998–2005 (APC=0.55%) (Supplementary Figure S2, available at https://weekly.chinacdc.cn/).

In 2023, gout incidence and prevalence in China peaked in the 95+ age group and increased progressively with age. The gout burden was substantially higher in men, with cases peaking in the 55–59 age group (Figure 2A, Supplementary Figure S3, available at https://weekly.chinacdc.cn/). Conversely, LBP, OA, and RA imposed a considerably greater burden on women. OA incidence peaked in the 50-54 age group, whereas LBP and RA incidence, along with prevalence for all three conditions, peaked in the 55–59 age group (Figure 2, Supplementary Figure S3). DALYs demonstrated comparable age and sex distribution patterns (Supplementary Figure S4, available at https://weekly.chinacdc.cn/). Overall, the disease burden for these musculoskeletal conditions was concentrated in the 40–80 age group.

In China, elevated BMI and impaired renal function represent the primary risk factors contributing to gout-related DALYs. Between 1990 and 2023, the proportion of gout DALYs attributable to high BMI increased substantially, whereas the contribution from impaired renal function remained relatively stable (Figure 3A). For LBP, occupational ergonomic factors

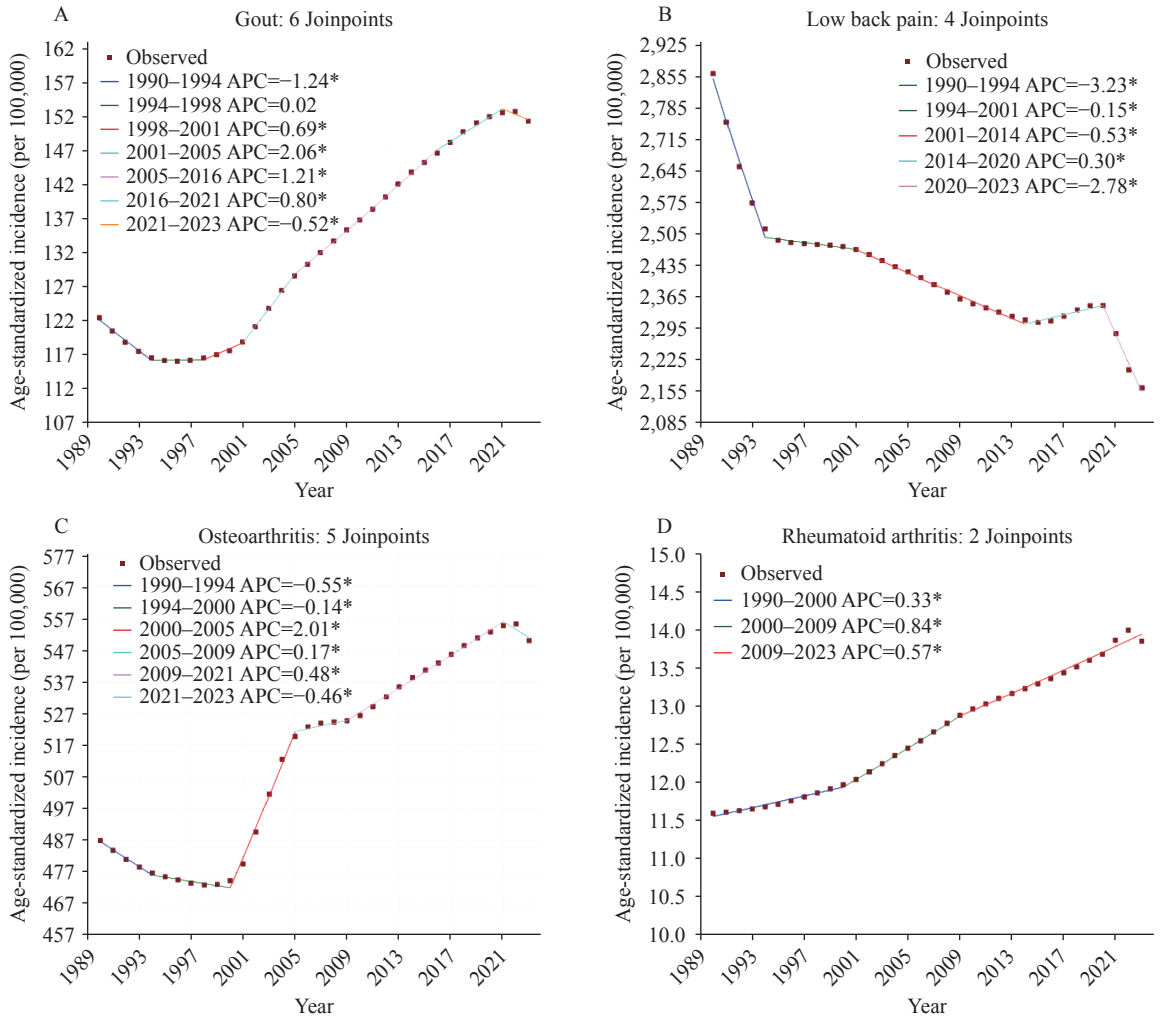


FIGURE 1. Trends of age-standardized incidence in gout, low back pain, osteoarthritis, and rheumatoid arthritis in China from 1990 to 2023. (A) Gout; (B) Low back pain; (C) Osteoarthritis; (D) Rheumatoid arthritis.
Abbreviation: APC=annual percentage change.
* *P*<0.05 indicates that the average annual rate of change during this period was significant.

constituted the largest contributor to DALYs, followed by elevated BMI and smoking. During this same period, the contribution of occupational factors declined, while smoking-attributable DALYs increased progressively (Figure 3B). Elevated BMI emerged as a major risk factor for OA, with its proportional contribution to DALYs rising continuously throughout the study period (Figure 3C). In contrast, the proportion of RA-related DALYs attributable to smoking demonstrated a declining trend (Figure 3D).

Figures 4 and Supplementary Figures S5–S6 (available at https://weekly.chinacdc.cn/) present ARIMA model projections for China's musculoskeletal disease burden over the next 20 years, derived from GBD data. Our forecasts indicate increasing ASIR and ASPR for gout, OA, and RA, contrasted by a substantial decline in LBP rates. Similarly, ASDR is projected to rise for gout and OA while decreasing for both LBP and RA. Collectively, these projections suggest an expanding burden for gout, OA, and RA, whereas the LBP burden is expected to improve significantly.

DISCUSSION

This study employed Joinpoint regression and ARIMA modeling to analyze long-term trends in incidence, prevalence, and DALYs for gout, LBP, OA, and RA in China, examining disease burdens across sex and age groups, associated risk factors, and future projections. Our analysis demonstrated rising age-

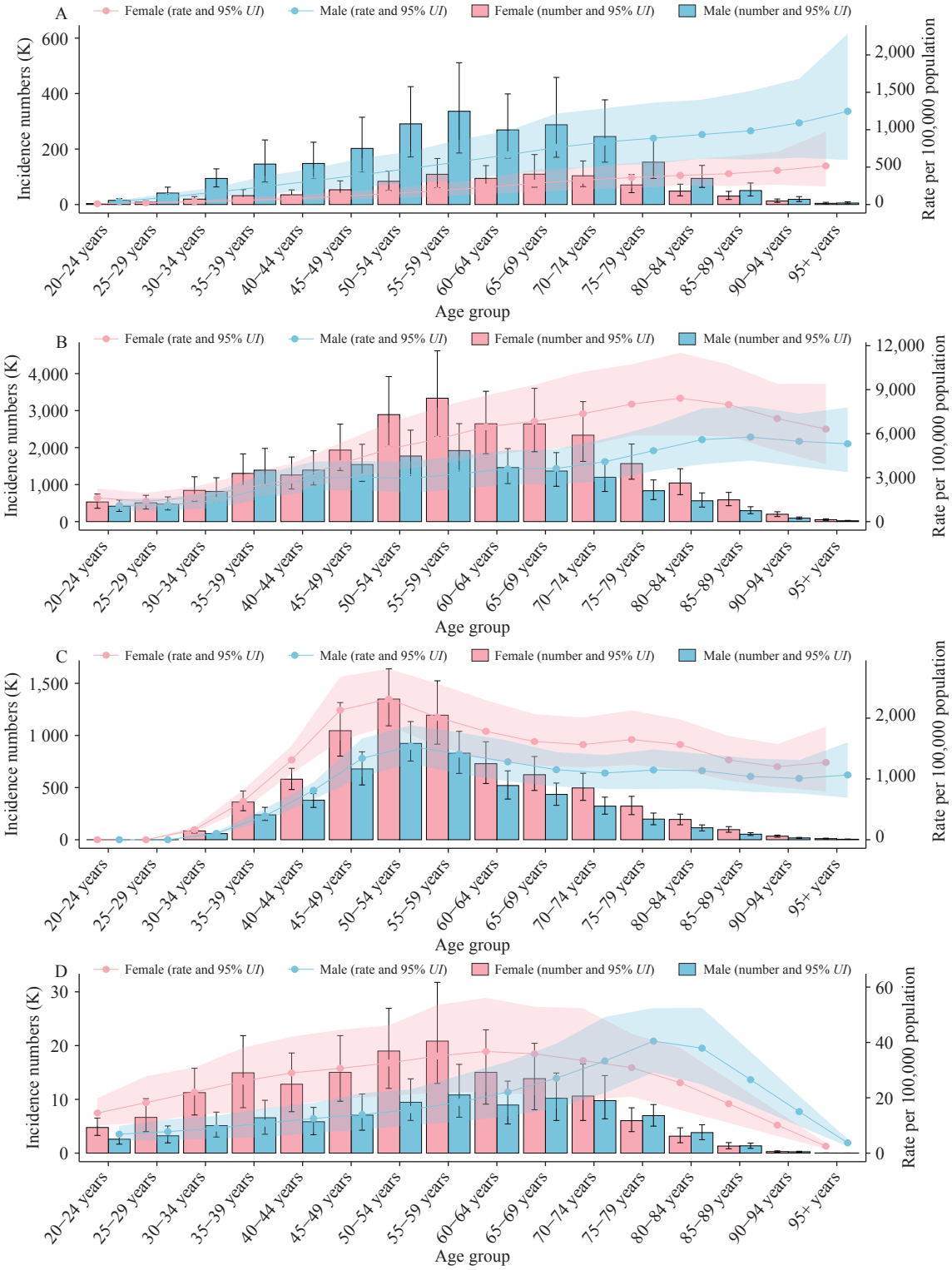


FIGURE 2. Incidence of gout, low back pain, osteoarthritis, and rheumatoid arthritis by gender and age group in China in 2023. (A) Gout; (B) Low back pain; (C) Osteoarthritis; (D) Rheumatoid arthritis.
Abbreviation: *UI*=uncertainty interval.

standardized rates for gout, OA, and RA, whereas LBP rates declined from 1990 to 2023. These trends align with prior research and can be attributed to economic development, increasingly sedentary lifestyles, and population aging (5). The disease burden concentrates predominantly in the 40–80 age group, underscoring

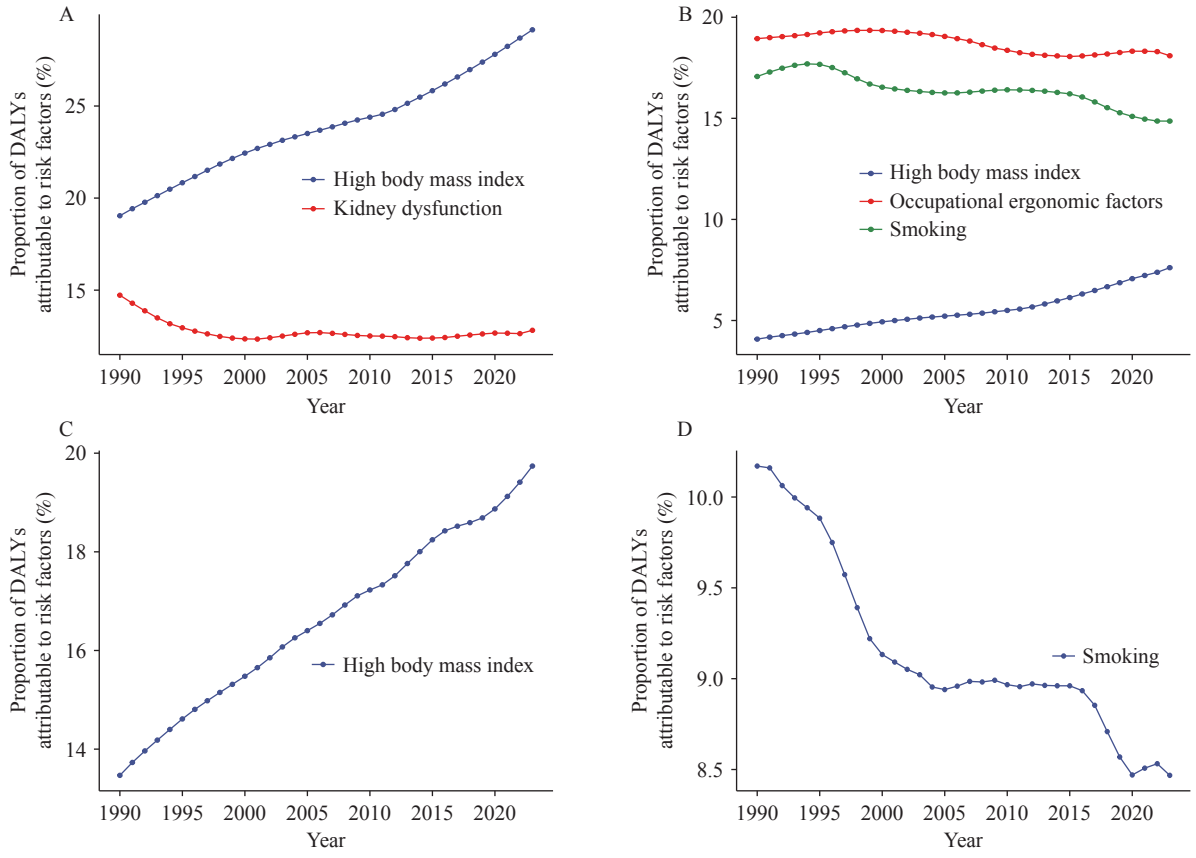


FIGURE 3. Risk factors contributing to DALYs for gout, low back pain, osteoarthritis, and rheumatoid arthritis in China, 1990–2023. (A) Gout; (B) Low back pain; (C) Osteoarthritis; (D) Rheumatoid arthritis.
Abbreviation: DALY=disability-adjusted life year.

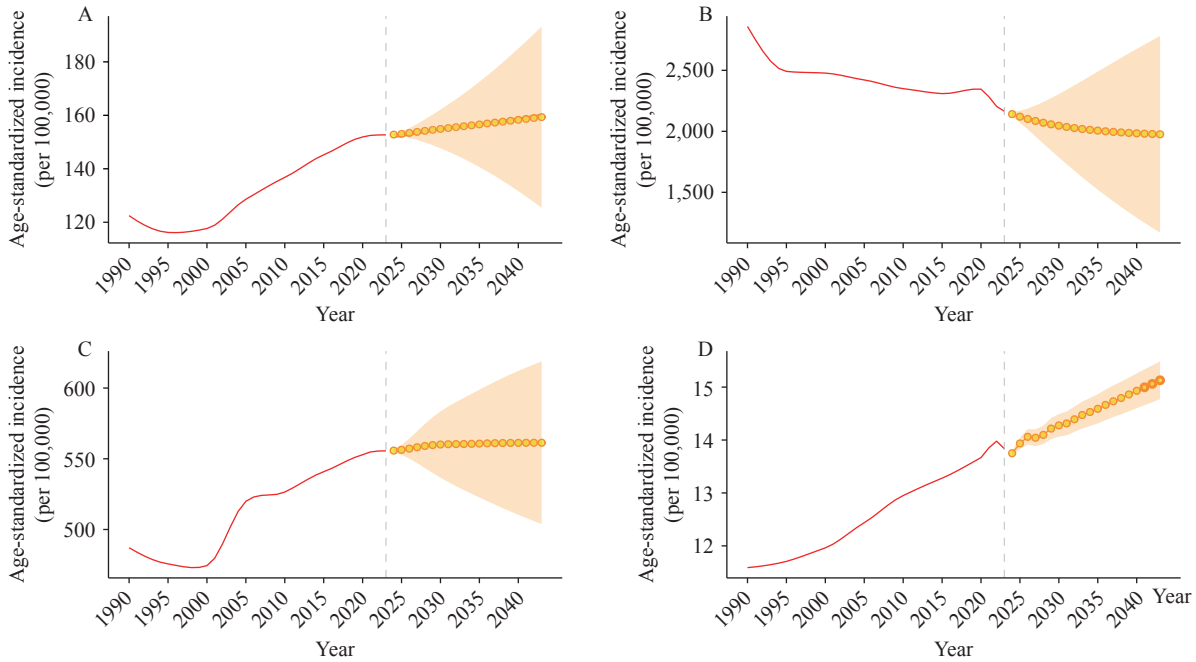


FIGURE 4. Projected age-standardized incidence rates for gout, low back pain, osteoarthritis, and rheumatoid arthritis in China. (A) Projected results for gout; (B) Projected results for low back pain; (C) Projected results for osteoarthritis; (D) Projected results for rheumatoid arthritis.

the urgent need for age-targeted prevention policies.

Musculoskeletal disorders impose substantial burdens through pain, stiffness, reduced mobility, functional impairment, depressive symptoms, and considerable economic costs (*6*). Gout management relies on urate-lowering medications and lifestyle modifications. LBP treatment strategies encompass opioid therapy and surgical intervention, although concerns regarding overuse persist (*7*). The long-term efficacy of OA pain management remains controversial, frequently necessitating surgical intervention and emphasizing the importance of preventive approaches. RA treatment involves anti-rheumatic and analgesic medications, though their long-term risk-benefit profiles continue to be debated (*8*). Non-surgical interventions are often compromised by poor patient adherence, resulting in suboptimal outcomes. Consequently, prevention through comprehensive health education represents a critical priority.

The next 20-year projections indicate increasing burdens in ASIR, ASPR, and ASDR for gout, OA, and RA, requiring immediate policy interventions. Although LBP burden is projected to decline, it will remain substantial. These trends necessitate alignment of public health strategies with "Healthy China 2030" objectives (*9*). Future priorities should emphasize targeted interventions, including strengthening risk factor management (addressing high BMI for gout and OA; improving occupational ergonomics for LBP), enhancing national health literacy, and implementing early screening programs for high-risk populations (males for gout; females for OA and RA). Additionally, optimizing hierarchical diagnosis and treatment services for primary care management and enhancing rehabilitation systems to reduce DALYs are essential. Integrating multidisciplinary care approaches, including psychological support and long-term follow-up (*10*), should aim to reduce incidence, prevalence, and DALYs while prioritizing sustained patient management.

This results represents the most comprehensive GBD-based analysis examining the burden, risk factors, and future trends of these four musculoskeletal diseases in China. Several limitations warrant consideration: potential underestimation of intermittent gout due to GBD exclusion of asymptomatic periods; incomplete risk factor analysis limited to impaired renal function, high BMI, and smoking; static predictions that do not account for future changes in risk factors or policy interventions; and inherent GBD data collection and modeling biases. Despite these limitations, our findings provide valuable evidence to inform prevention and control strategies.

In conclusion, the burden of gout, OA, and RA in China has significantly increased, while LBP has improved, with variations by sex and age. Multifaceted strategies aligned with "Healthy China 2030" are essential. These must include strengthening health literacy and risk factor management (high BMI, occupational risks), optimizing hierarchical services for early diagnosis and chronic care, and improving rehabilitation systems to mitigate this burden.

Conflicts of interest: No conflicts of interest.

Acknowledgements: All staff members who contributed to data collection and participated in this study.

Funding: Supported by the Key Advantageous Discipline Construction Project of Guizhou Provincial Health Commission in 2025; the Science and Technology Foundation Project of the Guizhou Provincial Health Commission (gzwkj2024-156); and the Department of Science and Technology of Guizhou ([2022]232).

doi: 10.46234/ccdcw2025.273

[#] Corresponding author: Jun Zhang, zhangjun@stu.jnu.edu.cn.

[1] Joint Surgery, Beijing Jishuitan Hospital Guizhou Hospital, Guiyang City, Guizhou Province, China.

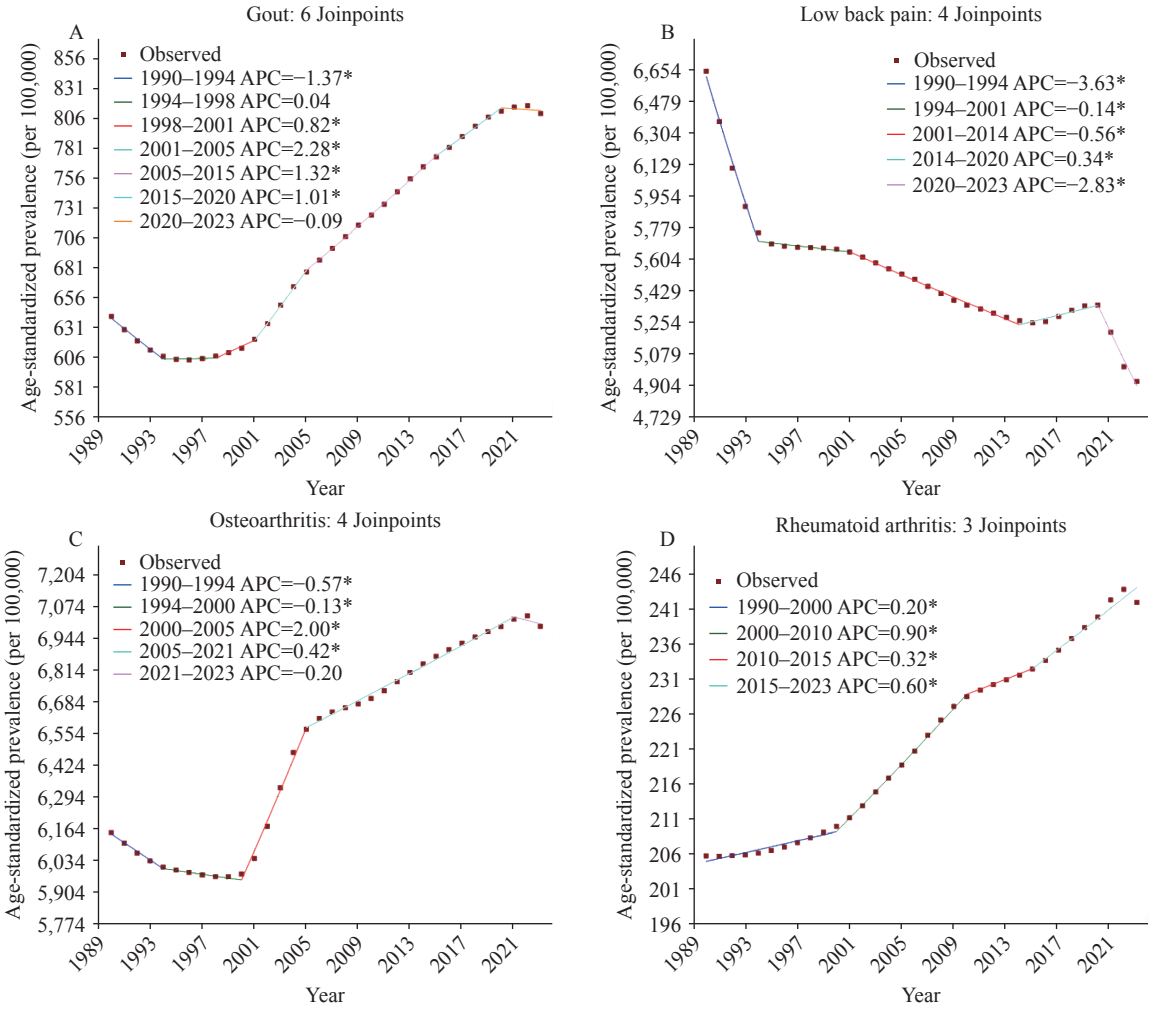
Submitted: November 08, 2025
Accepted: December 16, 2025
Issued: December 26, 2025

REFERENCES

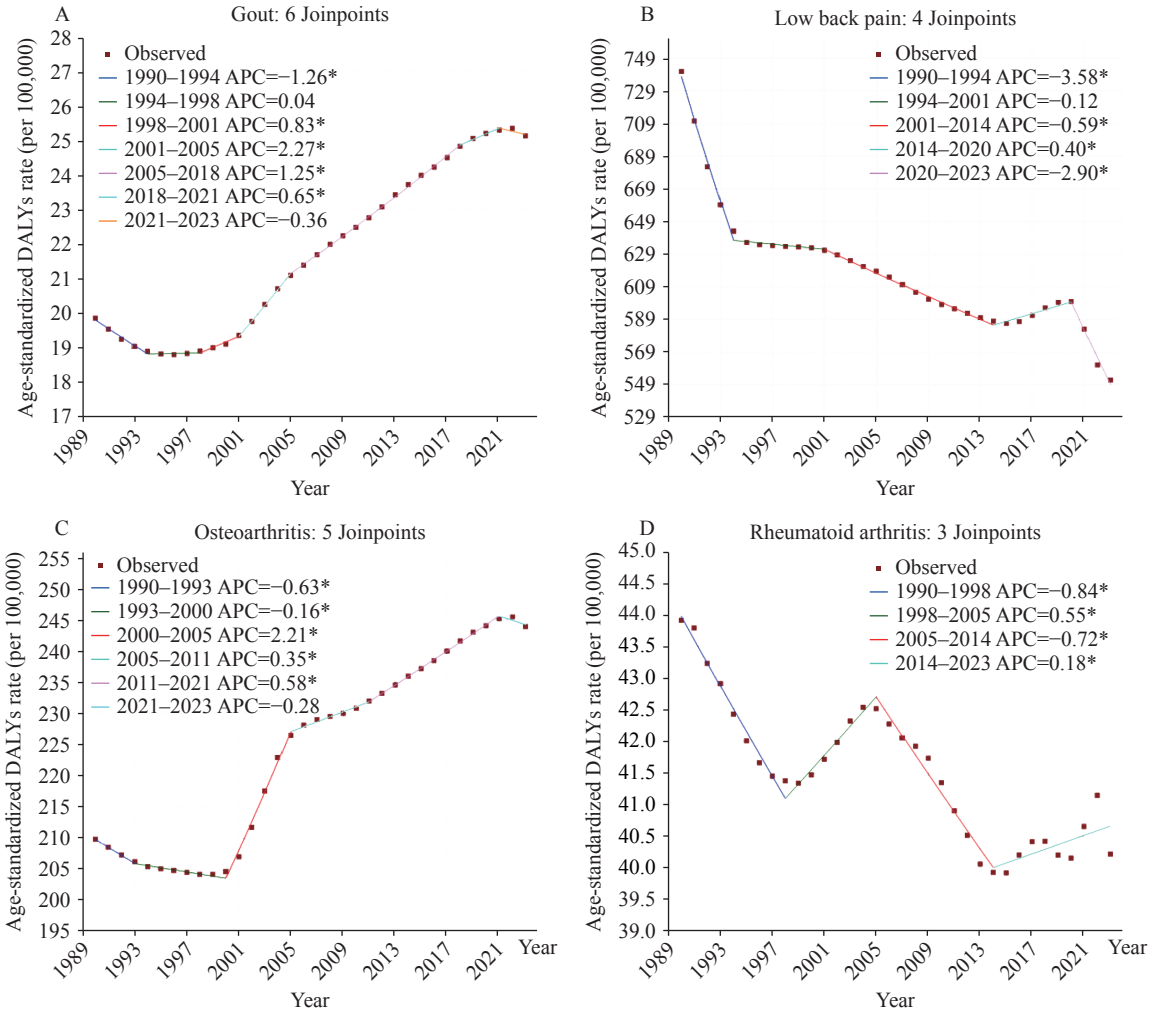
1. GBD 2019 MSK in Adolescents Collaborators. Global pattern, trend, and cross-country inequality of early musculoskeletal disorders from 1990 to 2019, with projection from 2020 to 2050. Med 2024;5(8):943 – 62.e6. https://doi.org/10.1016/j.medj.2024.04.009.
2. Gong JQ, Wang GW, Wang YF, Chen XX, Chen YF, Meng QQ, et al. Nowcasting and forecasting the care needs of the older population in China: analysis of data from the China Health and Retirement Longitudinal Study (CHARLS). Lancet Public Health 2022;7(12):e1005 – 13. https://doi.org/10.1016/S2468-2667(22)00203-1.
3. Stevens GA, Alkema L, Black RE, Boerma JT, Collins GS, Ezzati M, et al. Guidelines for accurate and transparent health estimates reporting: the GATHER statement. Lancet 2016;388(10062):e19 – 23. https://doi.org/10.1016/S0140-6736(16)30388-9.
4. Yao LA, Nie J, Kong LJ, Shao S, Xu XM. The global epidemiology of

gastrointestinal cancer burden attributable to dietary risks: a systematic analysis of the Global Burden of Disease Study 2021. Front Nutr 2025;12:1677735. https://doi.org/10.3389/fnut.2025.1677735.
5. Nygaard NPB, Thomsen GF, Rasmussen J, Skadhauge LR, Gram B. Ergonomic and individual risk factors for musculoskeletal pain in the ageing workforce. BMC Public Health 2022;22(1):1975. https://doi.org/10.1186/s12889-022-14386-0.
6. Dubé MO, Dillon S, Gallagher K, Ryan J, McCreesh K. One and done? The effectiveness of a single session of physiotherapy compared with multiple sessions to reduce pain and improve function and quality of life in patients with a musculoskeletal disorder: a systematic review with meta-analyses. Arch Phys Med Rehabil 2024;105(6):1171 – 80. https://doi.org/10.1016/j.apmr.2023.09.017.
7. Corp N, Mansell G, Stynes S, Wynne-Jones G, Morsø L, Hill JC, et al. Evidence-based treatment recommendations for neck and low back pain across Europe: a systematic review of guidelines. Eur J Pain 2021;25(2): 275 – 95. https://doi.org/10.1002/ejp.1679.
8. Brown P, Pratt AG, Hyrich KL. Therapeutic advances in rheumatoid arthritis. BMJ 2024;384:e070856. https://doi.org/10.1136/bmj-2022-070856.
9. Sun XM, Sun ZZ, Peng W, Zhang JD, Gou B, Tian XY, et al. Expert consensus and call on actions for weight management in China: advancing healthy China initiative through strategic actions. China CDC Wkly 2024;6(51):1347 – 53. https://doi.org/10.46234/ccdcw2024.268.
10. Drosos GC, Vedder D, Houben E, Boekel L, Atzeni F, Badreh S, et al. EULAR recommendations for cardiovascular risk management in rheumatic and musculoskeletal diseases, including systemic lupus erythematosus and antiphospholipid syndrome. Ann Rheum Dis 2022;81(6):768 – 79. https://doi.org/10.1136/annrheumdis-2021-221733.

SUPPLEMENTARY MATERIAL



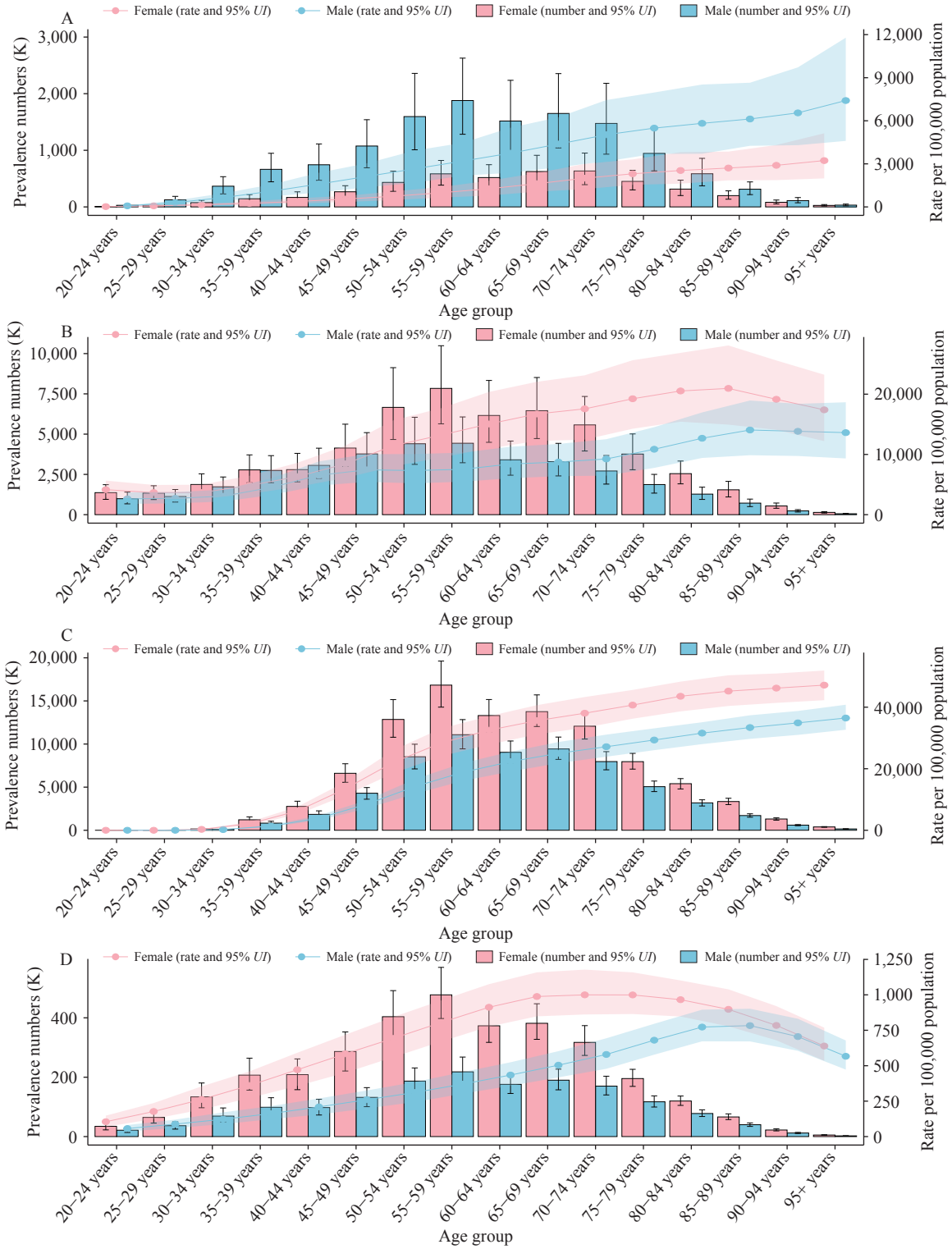
SUPPLEMENTARY FIGURE S1. Trends in age-standardized prevalence rates for gout, low back pain, osteoarthritis, and rheumatoid arthritis in China, 1990–2023. (A) Gout; (B) Low back pain; (C) Osteoarthritis; (D) Rheumatoid arthritis.
Abbreviation: APC=annual percentage change.
* $P<0.05$ indicates that the average annual rate of change during this period was significant.



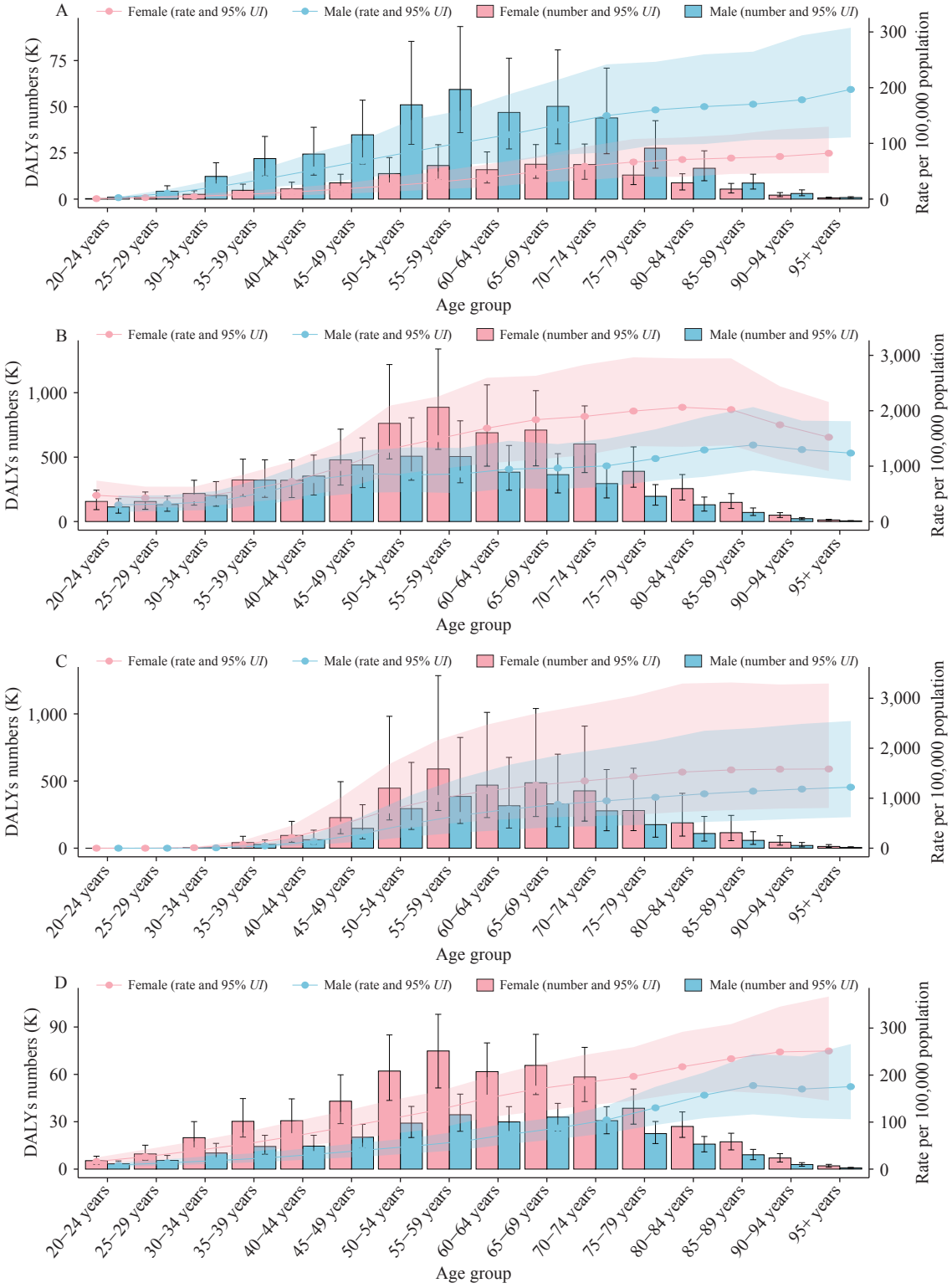
SUPPLEMENTARY FIGURE S2. Trends in age-standardized disability-adjusted life years (DALYs) rates for gout, low back pain, osteoarthritis, and rheumatoid arthritis in China, 1990–2023. (A) Gout; (B) Low back pain; (C) Osteoarthritis; (D) Rheumatoid arthritis.

Abbreviation: APC=annual percentage change.

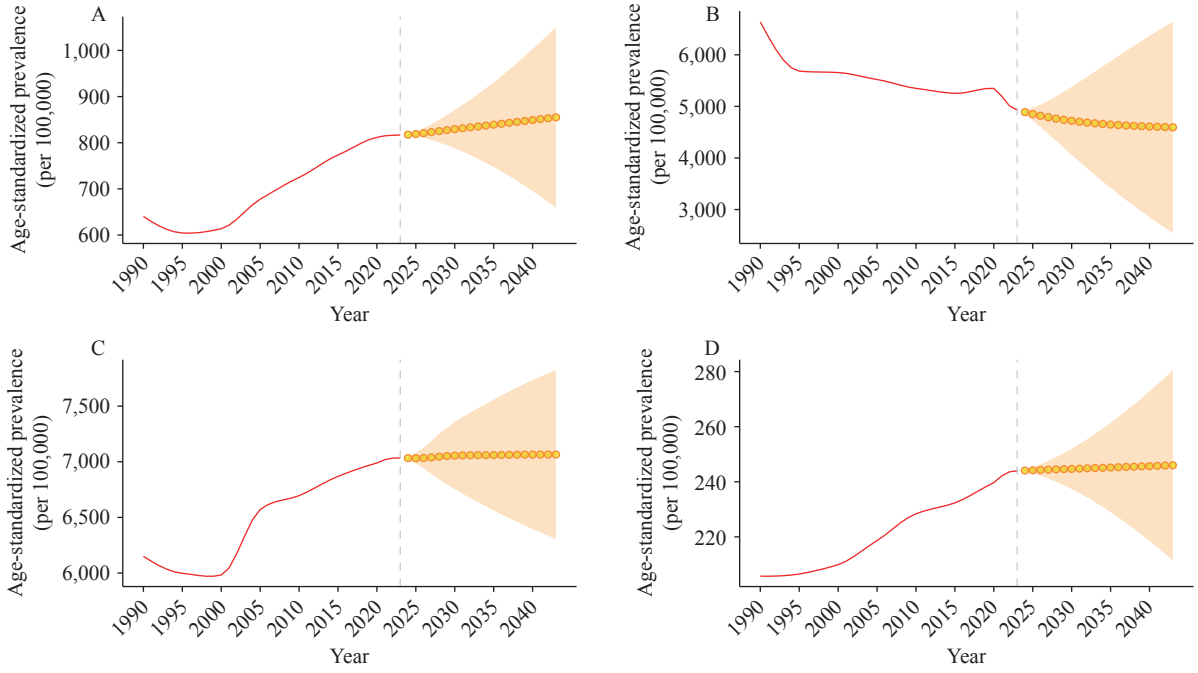
* *P*<0.05 indicates that the average annual rate of change during this period was significant.



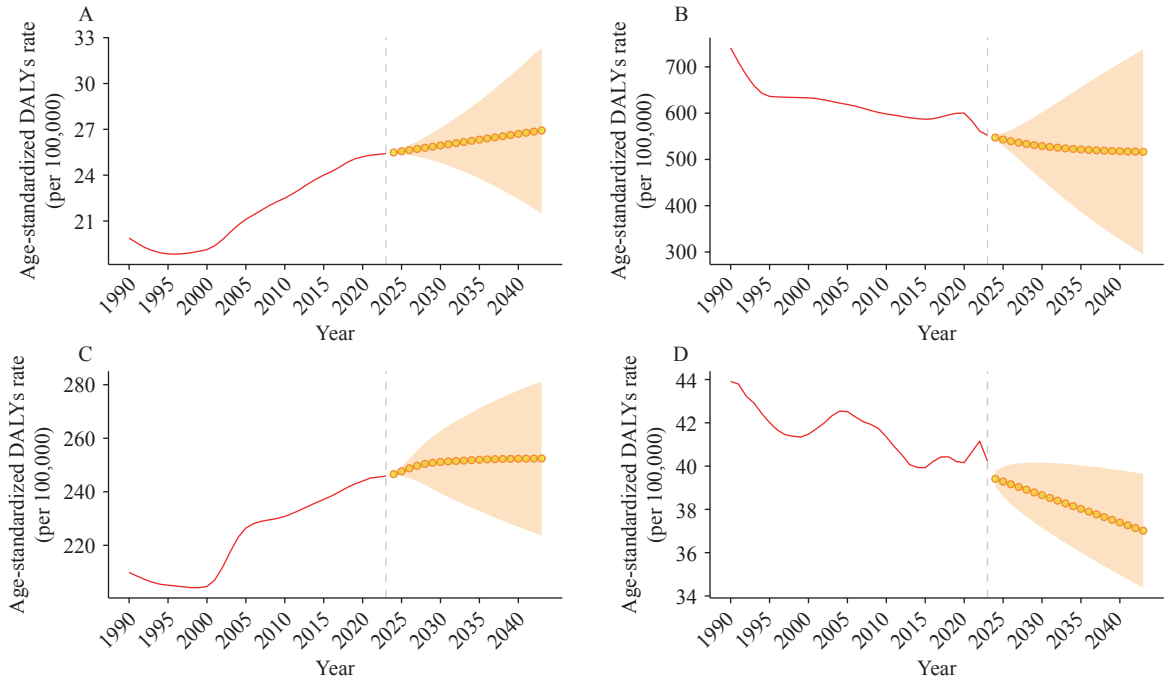
SUPPLEMENTARY FIGURE S3. Prevalence of gout, low back pain, osteoarthritis, and rheumatoid arthritis by gender and age group in China in 2023. (A) Gout; (B) Low back pain; (C) Osteoarthritis; (D) Rheumatoid arthritis.
Abbreviation: *UI*=uncertainty interval.



SUPPLEMENTARY FIGURE S4. Disability-adjusted life years (DALYs) rates of gout, low back pain, osteoarthritis, and rheumatoid arthritis by gender and age group in China in 2023. (A) Gout; (B) Low back pain; (C) Osteoarthritis; (D) Rheumatoid arthritis.
Abbreviation: *UI*=uncertainty interval.



SUPPLEMENTARY FIGURE S5. Projected age-standardized prevalence rates for gout, low back pain, osteoarthritis, and rheumatoid arthritis in China. (A) Projected results for gout; (B) projected results for low back pain; (C) projected results for osteoarthritis; (D) projected results for rheumatoid arthritis.



SUPPLEMENTARY FIGURE S6. Projected age-standardized disability-adjusted life years (DALYs) rates for gout, low back pain, osteoarthritis, and rheumatoid arthritis in China. (A) Projected results for gout; (B) projected results for low back pain; (C) projected results for osteoarthritis; (D) projected results for rheumatoid arthritis.