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ORIGINAL RESEARCH

Burden of Malignant Neoplasm of Bone and Articular Cartilage: Trends (1990–2021), Projections to 2030, and Comparison Between China and the G20 Countries (GBD 2021)

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Purpose: This study aimed to compare the burden of malignant neoplasm of bone and articular cartilage (MNBAC) between China and the Group of Twenty (G20) countries from 1990 to 2021 and to project trends in China to 2030, thereby informing the development of targeted interventions.

Methods: We extracted data on the incidence, prevalence, mortality, disability-adjusted life years (DALYs), and their corresponding age-standardized rates (ASRs) for MNBAC from the Global Burden of Disease (GBD) 2021 study. Trends were assessed based on the magnitude and precision of the estimates, without relying on statistical significance testing. Joinpoint regression identified periods with meaningful trend changes, expressed as the average annual percent change (AAPC). Decomposition analysis was employed to quantify the drivers of changes in incidence, prevalence, mortality, and DALYs. The Bayesian age-period-cohort (BAPC) model was used to project the ASR burden of MNBAC in China up to 2030.

Results: From 1990 to 2021, the absolute number of MNBAC cases in China increased substantially. China's relative ranking among G20 countries rose dramatically: its age-standardized incidence rate (ASIR) climbed from 19th to 1st, age-standardized prevalence rate (ASPR) from 20th to 1st, age-standardized mortality rate (ASMR) from 13th to 4th, and age-standardized DALY rate (ASDR) from 16th to 6th. The MNBAC burden was consistently higher in males than females across all G20 countries. Decomposition analysis indicated that population aging and epidemiological changes were the primary drivers of the increasing burden in China, whereas population growth was the dominant factor in the G20 nations overall. Projections from the BAPC model suggest a decline in MNBAC-related ASIR, ASMR, and ASDR in China from 2022 to 2030.

Conclusion: Despite a substantial increase in the MNBAC burden in China over the past three decades, our projections indicate a forthcoming decline in the ASIR, ASMR, and ASDR, which is likely attributable to sustained public health efforts. These findings underscore the necessity for continued, targeted interventions, particularly for males and high-risk age groups.

Keywords: malignant neoplasm of bone and articular cartilage, epidemiological trends, global burden of disease, China, G20 countries, projections

Introduction

Bone tumors are a rare and heterogeneous group of neoplasms that are typically categorized as primary, secondary, or metastatic.[1] Primary malignant bone tumors are uncommon, accounting for only 0.2% of all human tumors, with a global

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incidence of approximately 2–3 cases per 100,000 people.[2] Among these, malignant neoplasms of bone and articular cartilage (MNBACs), including osteosarcoma, chondrosarcoma, and Ewing's sarcoma, represent a core subset with a substantial global health impact.[1] For instance, in 2024, an estimated 3,970 new cases of primary malignant bone tumors were diagnosed in the USA, resulting in 2,050 deaths.[3] This highlights the elevated mortality associated with these tumors, even in high-income countries with advanced healthcare.

MNBAC exhibits a bimodal age distribution, peaking in adolescents (10–14 years) and older adults (>65 years),[4] and is characterized by nonspecific early symptoms, local aggressiveness, and a high risk of pulmonary metastasis.[5,6] Effective management requires multidisciplinary care, which remains limited in many resource-constrained countries.

The global epidemiology of MNBAC shows significant geographic variation. Data from the Global Burden of Disease (GBD) 2021 study indicate a particularly higher burden in East Asia than in many developed Western nations.[7] These disparities may be attributed to differences in environmental conditions, healthcare system capacity (including access to early diagnosis and treatment), and racial or genetic factors.[8] As the world's second most populous country, China faces a substantial and growing MNBAC burden. According to the National Central Cancer Registry of China (NCCRC), 24,200 new cases and 17,900 deaths from primary malignant bone tumors occurred in 2015.[9] More recent estimates from the GBD 2021 reported 25,938 new cases and 18,085 deaths in China, reflecting increases of 306% and 242%, respectively, since 1990.[10]

While previous studies have highlighted the heavy MNBAC burden in East Asia and particularly in China,[7,11] systematic comparisons across countries grouped by economic development are limited. Moreover, although some studies have assessed the burden of major cancers in China and have made international comparisons, few have focused specifically on MNBAC.[12,13] The significant variations in MNBAC burden and diagnostic-therapeutic capabilities between China and developed Western countries underscore the need for comparative analyses within a broader international framework.

The Group of Twenty (G20), comprising the world's major developed and emerging economies from Asia, Africa, Europe, the Americas, and Oceania,[14] provides an ideal platform for such a comparison. Its members represent diverse geographical regions, economic development levels, and healthcare systems, ranging from high-resource settings (for example, the United States) to middle-resource nations such as China.[15] As a key G20 member, China's MNBAC trends not only reflect domestic public health challenges but also offer critical insights for other middle-income economies facing similar demographic and resource constraints. The comparative assessment of the MNBAC burden between China and other G20 countries could elucidate how factors such as healthcare resource allocation and population aging influence disease outcomes, thereby guiding targeted strategies. Nevertheless, a comprehensive assessment of this kind has not been conducted, leaving a critical gap in understanding the epidemiology of MNBAC and formulating effective policies.

Therefore, to address this gap, this study aims to systematically analyze trends in the disease burden of MNBAC in China and other G20 countries from 1990 to 2021 using data from the GBD 2021. Specifically, we adopted joinpoint regression for trend segmentation, decomposition analysis to examine the impact of aging, epidemiological changes and population growth on the MNBAC burden, and the Bayesian age-period-cohort (BAPC) model to forecast 2022–2030 trends. This BAPC model integrated demographic information, incorporated age, period, and cohort effects, and more accurately predicted long-term MNBAC trends through population changes, improvements in medical practices, and social impacts to better guide healthcare planning and policy development.[16] Finally, through this study, we seek to provide a scientific basis for formulating targeted prevention, early diagnosis, and treatment strategies in different resource environments, with particular relevance for middle-income countries facing similar public health challenges.

Materials and Methods

Data Sources

This analysis was based on publicly available data from the GBD 2021 study, coordinated by the Institute for Health Metrics and Evaluation (IHME).[17] GBD 2021 provides comprehensive estimates of incidence, prevalence, mortality, and disability-adjusted life years (DALYs) for 371 diseases and injuries across 204 countries and territories.[18] For this study, we extracted data for the following parameters: GBD estimate (cases), measure (incidence, prevalence, deaths, and DALYs), metric (number, rate), cause (malignant neoplasm of bone and articular cartilage), location (all G20 countries), age (all ages, age-standardized, and 5-year age groups from under 5 to over 95 years), sex (both female and male), and year (from 1990 to 2021) (https://vizhub.healthdata.org/gbd-results/). All disease estimates incorporate 95% uncertainty intervals (UIs) to enhance reliability and precision. These UIs quantify potential error ranges arising from variations in source data sample sizes, model specifications, and data accessibility. Specifically, UIs were generated via 1000 draws from the posterior distribution of the models, performed for every combination of spatial unit, age, and sex.[19] The 2.5th and 97.5th percentiles of these draws defined the final 95% uncertainty range. We adhered to the Guidelines for Accurate and Transparent Health Estimation Reporting (GATHER) to ensure accuracy and transparency.[20]

ICD Codes for MNBAC

MNBAC cases were identified using the following International Classification of Diseases, Tenth Revision (ICD-10) codes: C40-C40.92, C41.0-C41.4, and C41.8-C41.9.[18] This definition specifically targets primary bone and cartilage malignancies and excludes secondary metastatic lesions to bone.

Statistical Analysis

Trend Analysis: Joinpoint Regression

We analyzed trends in the age-standardized rates (ASRs) of MNBAC using joinpoint regression (Joinpoint Regression Program, Version 5.2.0; National Cancer Institute, USA).[21] This method identifies points where the linear trend of a time series changes significantly. Model selection was based on a permutation test, allowing for a maximum of 6 joinpoints. The final model was used to calculate the annual percent change (APC) for each segment and the average annual percent change (AAPC) over the entire period (1990–2021). The results are presented as AAPCs with 95% confidence intervals (CIs). Trends were interpreted based on the magnitude and direction of the AAPC point estimate, with the width of the CI indicating the precision of the estimate. A detailed description of the AAPC calculation has been published previously.[10] For the interpretation of trends, an AAPC with a magnitude greater than 0.5% per year was considered a meaningful trend for a rare cancer like MNBAC. This threshold was chosen because, over the 32-year study period, such a trend would result in a cumulative increase or decrease of approximately 16–17% in the ASRs, which we judge to be important for public health planning and resource allocation. This approach, focusing on the long-term public health impact of observed trends, is aligned with the perspective of comprehensive burden assessments such as the GBD study.[22]

Decomposition Analysis

We employed decomposition analysis to quantify the influence of population aging, epidemiological changes, and population growth on the absolute number of MNBAC cases between 1990 and 2021. This additive approach attributes the total change in case numbers to these distinct demographic and epidemiological drivers for incidence, prevalence, mortality, and DALYs.

Bayesian Age–Period–Cohort Analysis

To project the age-standardized incidence rate (ASIR), mortality rate (ASMR), and DALY rate (ASDR) of MNBAC in China up to 2030, we utilized the BAPC model. This model integrates demographic information to capture age, period, and cohort effects, supporting accurate long-term trend predictions, which is particularly crucial for cancers with dynamic epidemiological patterns.[16,23] The BAPC model leverages integrated nested Laplace approximations (INLA) to approximate marginal posterior distributions, thereby avoiding the mixing and convergence challenges associated with traditional Markov Chain Monte Carlo (MCMC) sampling.[24] We specified second-order random walk priors for the age, period, and cohort effects to ensure smooth transitions across these dimensions. The analysis was conducted using the BAPC packge in R software (R version 4.4.2).

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Table 1 Burden of Malignant Neoplasm of Bone and Articular Cartilage (MNBAC) in China and Its Ranking Among All G20 Countries from 1990 to 2021

Metrics	All-Age Cases in China in 2021 (95% UI)	Changes in China from 1990 to 2021 (%)	Age-Standardized Rates in China in 2021 (95% UI)	China's Rank* (1990–2021)
Incidence	25,938 (16,243–34,274)	+306.42%	1.42 (0.90–1.86) per 100,000	19th to 1st
Prevalence	166,569 (104,517–219,818)	+300.29%	9.16 (5.82–11.97) per 100,000	20th to 1st
Mortality	18,085 (11,288–24,126)	+241.74%	0.93 (0.58–1.23) per 100,000	13th to 4th
DALYs	527,284 (331,727–699,456)	+142.73%	29.52 (18.92–38.67) per 100,000	16th to 6th

Notes: *"China's Rank" refers to the changes in China's rankings of age-standardized rates of MNBAC incidence, prevalence, mortality, and DALYs among all G20 countries from 1990 to 2021. The complete dataset for all G20 countries is provided in Supplementary Tables S1–S4.
Abbreviations: UI, uncertainty interval; DALYs, disability-adjusted life years.

Results

Overall Burdens of MNBAC in China and Other G20 Countries

In 2021, China reported 25,938 new incident cases (95% UI: 16,243–34,274) of MNBAC, a 306% increase from 1990. China's ASIR ranking among G20 countries rose from 19th to 1st (Table 1). Prevalent cases reached 166,569 (95% UI: 104,517–219,818), a 300% increase, with the ASPR climbing from 20th to 1st (Table 1). Deaths totaled 18,085 (95% UI: 11,288–24,126), a 242% increase, and DALYs were 527,284 (95% UI: 331,727–699,456), a 143% increase. Consequently, China's ASMR ranking increased from 13th to 4th, and its ASDR ranking from 16th to 6th (Table 1). Among the G20 nations, the ASIR and ASPR increased in China, Germany, India, Indonesia, Mexico, Saudi Arabia, the United Kingdom, and the United States, but in other countries, they decreased (Supplementary Tables S1 and S2). In Turkey, there was an increase in the ASPR alone. The ASMR decreased in all countries except China, Indonesia, Mexico, Saudi Arabia, and the United States, whereas the ASDR declined in all nations except China, Indonesia, Mexico, and the United States (Supplementary Tables S3 and S4).

Joinpoint Regression Analysis of the MNBAC Burden in China and the G20 Countries from 1990 to 2021

Joinpoint regression revealed distinct periods of trend change for the ASIR in China (1992, 1998, 2001, 2004, and 2008) and for the G20 countries (1998, 2001, 2005, 2008, 2013, and 2019) (Figure 1A and Supplementary 1A). For ASPR, changes occurred in China (1992, 1998, 2001, 2004, and 2007) and G20 nations (1998, 2001, 2005, 2008, 2012, and 2019) (Figure 1B and Supplementary 1B). Changes in the ASMR were detected in China (1992, 1997, 2000, 2004, and 2007) and G20 nations (2000, 2005, 2013, and 2018) (Figure 1C and Supplementary 1C). For ASDR, changes occurred in China (1992, 1997, 2000, 2004, 2008, and 2013) and the G20 (1997, 2001, 2005, 2013, and 2018) (Figure 1D and Supplementary 1D).

Burden of MNBAC by Age Group and Sex in China and the G20 Countries in 2021

In 2021, the MNBAC burden varied considerably by age and sex in both China and the G20 countries (Figure 2 and Supplementary Figure 2). Compared with females, males consistently exhibited higher incidence, prevalence, mortality, and DALYs. In China, the case counts for all the metrics peaked in the 65–69 age group, except for deaths (70–74 age group). In the G20 countries, case counts peaked at 65–69 years for incidence, prevalence, and mortality, but DALYs peaked in the 15–19 age group. A bimodal distribution was evident, with peaks in adolescence (15–19 years) and older adulthood (65–69 years) for both sexes.

Long-Term Trends in the MNBAC Burden in China and the G20 Countries from 1990 to 2021

From 1990 to 2021, the MNBAC burden demonstrated consistent sex disparities, with higher case counts and ASRs for males than females in both China and the G20 countries (Figure 3 and Supplementary Figure 3). Incident cases, prevalent cases, deaths, and DALYs increased for both sexes in China and the G20 nations. In China, the ASIR, ASPR, ASMR, and

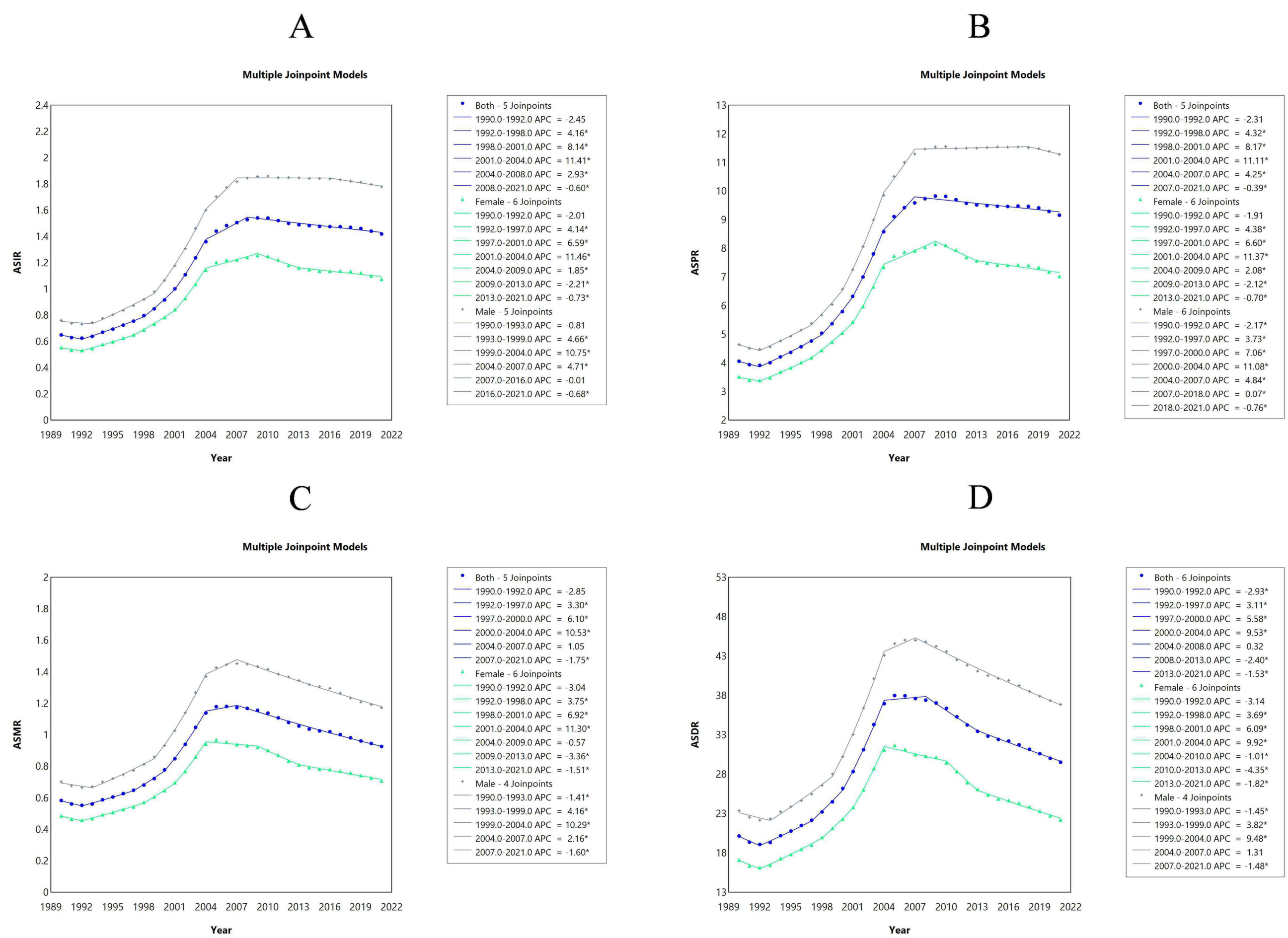

Figure 1 Joinpoint regression analysis of the ASIR, ASPR, ASMR, and ASDR for the MNBAC burden in China for both sexes from 1990 to 2021. (**A**) ASIRs in China. (**B**) ASPRs in China. (**C**) ASMRs in China. (**D**) ASDRs in China. The grey line represents the male trend, the green line represents the female trend, and the blue line represents the overall population trend. The "*" in Figure 1 denotes segments of ASIR, ASPR, ASMR, and ASDR identified by Joinpoint regression analysis, where the magnitude of change (annual percent change, APC) and its precision are assessed via confidence intervals (CI), indicating meaningful variation over time.

ASDR for both sexes initially decreased, then increased, and later decreased again, resulting in an overall net increase over the study period. In contrast, in the G20 countries, there were slight increases in the ASIR and ASPR, alongside modest decreases in the ASMR and ASDR for both sexes.

Decomposition Analysis of the MNBAC Burden in China and the G20 Countries

Decomposition analysis revealed that in China, population aging and epidemiological changes were the primary drivers of increases in incidence, prevalence, mortality, and DALYs, with more pronounced effects in males (Figure 4). For the G20 countries, population growth was the main driver of increases in incidence, prevalence, and DALYs. The effect of aging attenuated the increase in prevalence, and epidemiological changes contributed to a reduction in DALYs, yet the overall trend remained upward. The increase in mortality was primarily due to the combined effects of aging and population growth (Supplementary Figure 4).

Predictions of the ASIR, ASMR, and ASDR of MNBAC in China

The BAPC model projected future trends for the ASIR, ASMR, and ASDR of MNBAC in China by sex until 2030 (Figure 5). The model forecasted a decline in the ASIR for both sexes, indicating a reduction in new cases. Similarly, the ASMR is projected to decline for males and females, suggesting fewer deaths. The ASDR is also expected to decline for both sexes, indicating a reduction in the overall disease burden measured by DALYs.

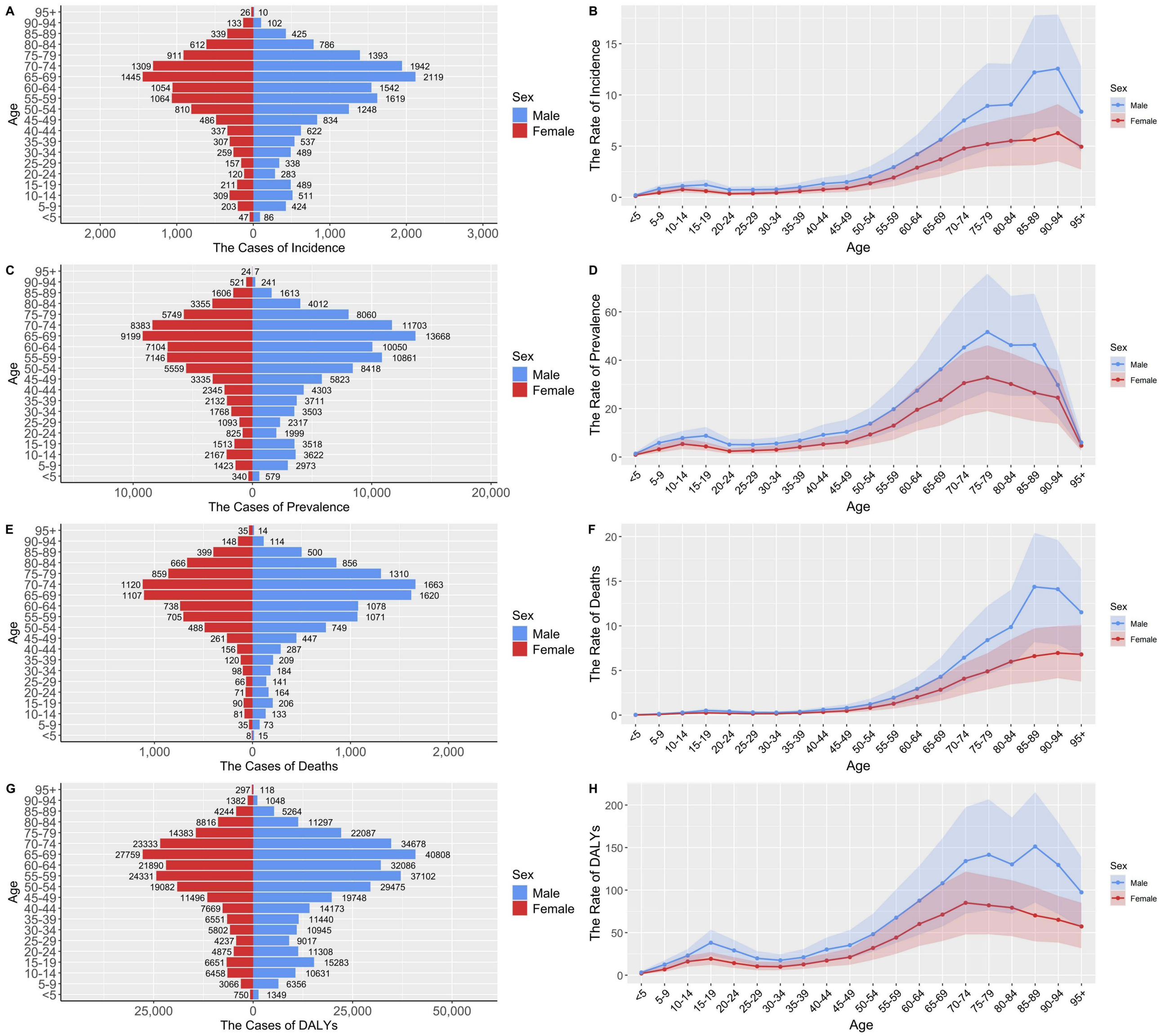

Figure 2 Cases and rates of incidence, prevalence, mortality, and DALYs of MNBAC in China by age group and sex in 2021. (**A**) Total incident cases. (**B**) Incidence rate. (**C**) Total prevalent cases. (**D**) Prevalence rate. (**E**) Total deaths. (**F**) Mortality rate. (**G**) Total DALY cases. (**H**) Rate of DALYs. Males are represented in blue, and females are represented in red. The bar chart represents the number of cases, and the line chart represents the crude rates.

Discussion

By leveraging the GBD 2021 database, this study provides a comprehensive analysis of the incidence, prevalence, mortality, and DALYs associated with MNBAC in China and other G20 countries from 1990 to 2021. Our findings offer robust evidence to support the formulation of targeted measures for MNBAC prevention and management in China.

Between 1990 and 2021, the absolute number of MNBAC cases increased significantly in China and several other G20 countries, a trend driven by global population growth and advancements in cancer diagnostic technologies.[25,26] Over the past three decades, China has experienced notable increases in the MNBAC-related ASIR, ASPR, ASMR, and ASDR. The contributing factors may include population growth and aging, unhealthy lifestyles, inequitable distribution of medical resources, and environmental exposures (such as to heavy metals and toxic chemicals).[12,27,28] Among other G20 nations, MNBAC-related ASRs declined overall, except in some low- to middle-income countries. These nations face challenges similar to China's, including rapid population growth and aging, high-risk factors, and limited healthcare

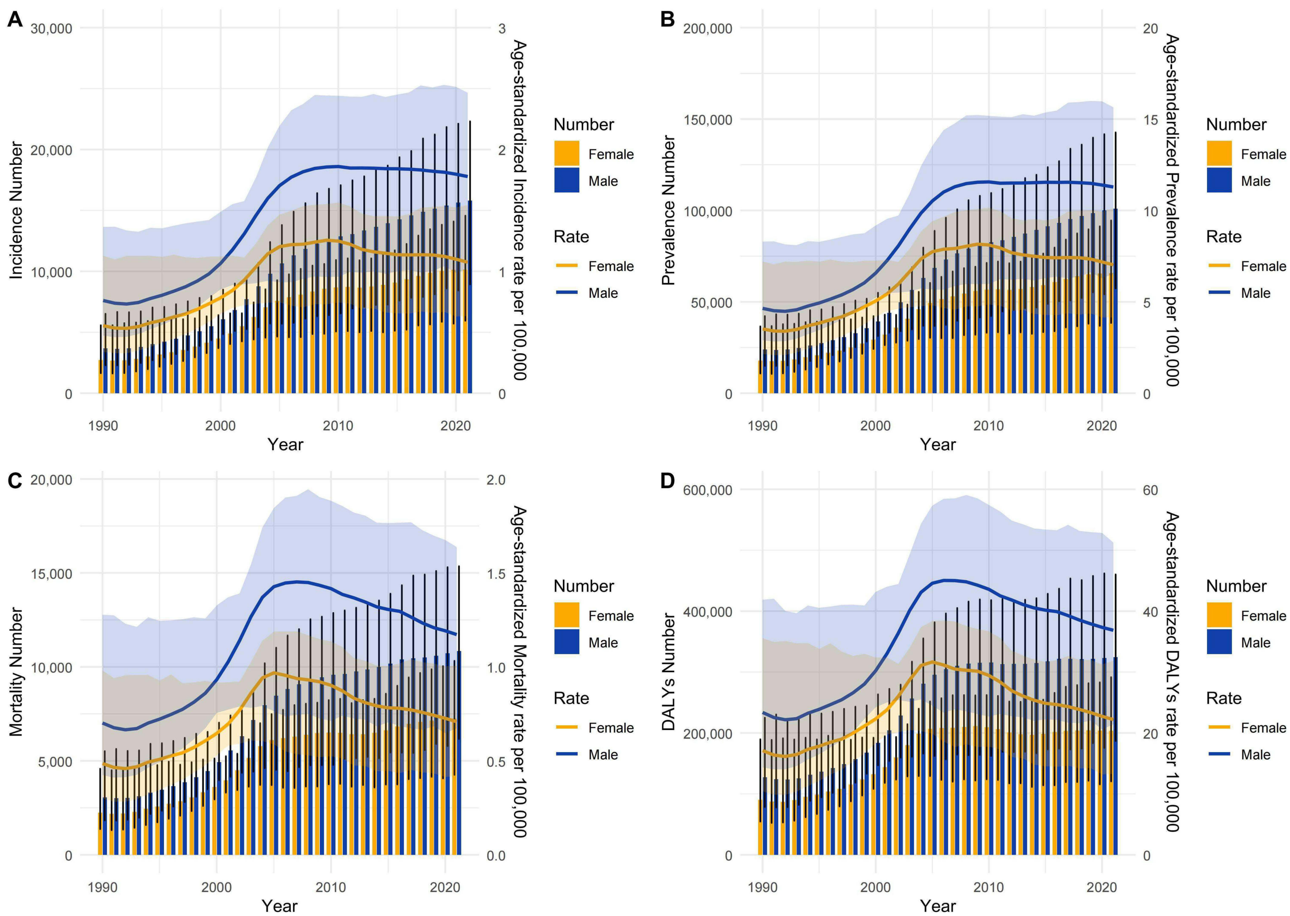

Figure 3 Trends in the MNBAC burden in China from 1990 to 2021 for both sexes. (**A**) Cases and ASIRs in China. (**B**) Cases and ASPRs in China. (**C**) Cases and ASMRs in China. (**D**) Cases and ASDRs in China. Males are shown in blue, and females are shown in Orange. The bar chart represents the number of cases, and the line chart represents the age-standardized rates. The shaded area in the figure represents the 95% uncertainty interval.

resources. In contrast, developed G20 countries, with higher socioeconomic status, advanced healthcare technologies, and robust resources, have more effectively mitigated the MNBAC burden.[29]

Consistent with previous research, our study revealed a greater MNBAC burden for males than for females.[7,10] Multiple factors may underlie this sex disparity. First, carcinogenic behaviors such as smoking and alcohol consumption are generally more prevalent among males.[30] Second, male workers are overrepresented in industries such as construction and chemicals, where prolonged exposure to occupational hazards may increase the risk of developing malignant bone tumors.[31,32] Third, male-specific growth patterns, including faster bone growth and longer growth cycles during adolescence (often resulting in a taller stature), may contribute to a greater susceptibility to malignancies such as osteosarcoma.[33,34] Notably, the MNBAC burden peaked among older adults, which is closely associated with age-related decreases in DNA repair efficiency and the accumulation of oncogenic mutations.[35] Additionally, we observed a secondary peak in the 15–19 age group, reflecting a characteristic bimodal distribution. This pattern is highly consistent with the epidemiological profile of osteosarcoma, whose incidence peaks in both adolescence and old age.[36,37] Given the large population in China, the development of specific intervention strategies for adolescents and older adults is urgently needed. Decomposition analysis revealed that aging and epidemiological changes are the main drivers of the increasing MNBAC burden in China, whereas population growth is the dominant factor in the G20 nations. China's aging population is expanding significantly, a phenomenon largely driven by the impending retirement of the large 1962–1975 birth cohort (the "second-born baby boomer").[38]

Our BAPC model indicated that the ASIR, ASMR, and ASDR for MNBAC in China are projected to continue declining from 2022 to 2030, extending the downward trend observed from 2008 to 2021. These projections align with

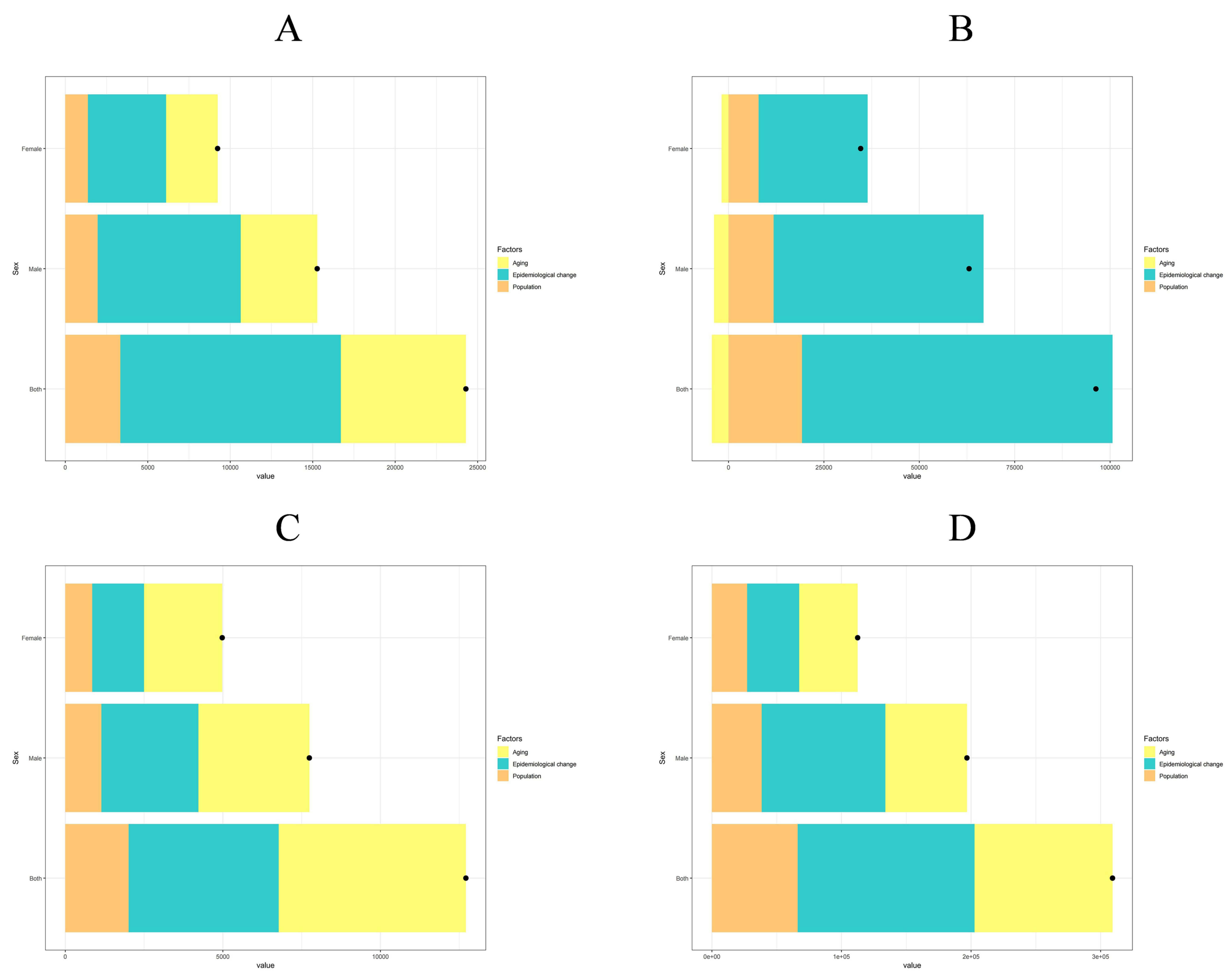

Figure 4 Decomposition analysis of aging, epidemiological changes, and population factors related to the incidence, prevalence, mortality, and DALYs of MNBAC in China (each of the three factors is indicated by different colors). The black dots represent the cumulative effects of these three factors. (**A**) Incidence analysis in China. (**B**) Prevalence analysis in China. (**C**) Mortality analysis in China. (**D**) DALYs analysis in China.

long-term data from the NCCRC. A previous study based on NCCRC data[9] showed that between 2000 and 2015, the ASIR of primary malignant bone tumors in China decreased by an average of 2.2% per year, and the ASMR decreased by an average of 4.8% per year, with greater reductions among males. These findings suggest that despite the aging population in China, the ASRs of MNBAC are declining. This favorable trend may be closely related to improvements in the national cancer registration system, the widespread adoption of cancer screening, and the implementation of public health initiatives such as "Healthy China 2030".[27,39,40] However, given the continuous increase in the proportion of elderly individuals in China, dynamic assessments of the MNBAC burden remain necessary. We recommend that future studies further integrate national cancer registry data and strengthen sensitivity analyses to account for demographic aging, thereby improving the credibility of predictions and their value for policy guidance.

The rising burden of MNBAC in China, particularly among males and older adults, calls for targeted public health interventions. To effectively mitigate this burden, a multi-pronged strategy integrating prevention, early detection, and equitable access to specialized care is essential. First, enhancing early detection pathways should be prioritized, especially in regions with a limited diagnostic capacity. This enhancement includes training primary healthcare professionals to recognize early symptoms of bone tumors, such as localized pain, tenderness, swelling, and reduced range of motion.[5] For high-risk groups, including adolescents and elderly individuals, opportunistic screening during routine health check-ups could facilitate early diagnosis. Second, strengthening specialized oncology services is critical. Given

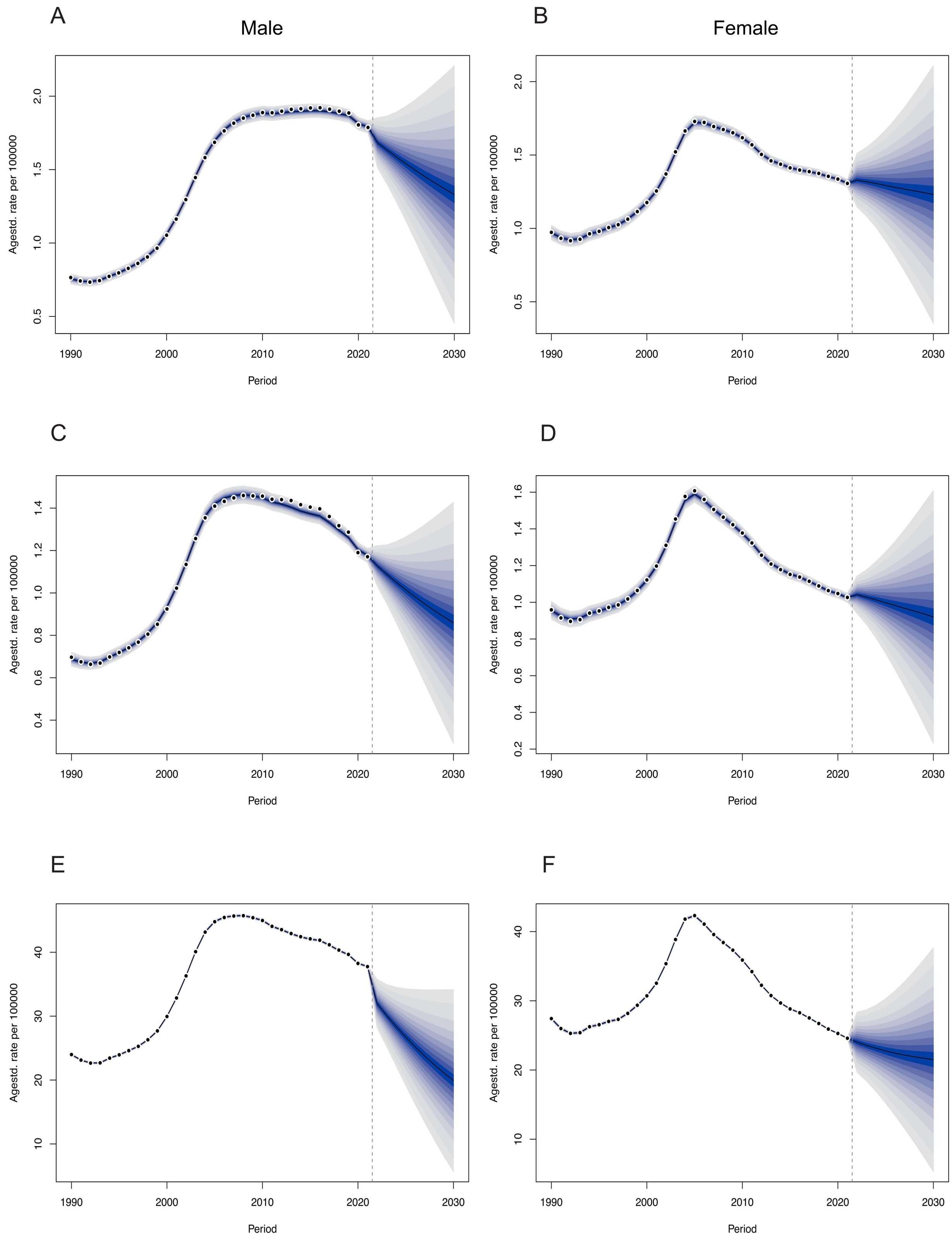

Figure 5 BAPC model projecting future trends of the ASIR, ASMR, and ASDR in China up to 2030 by sex. (**A**) ASIR for males. (**B**) ASIR for females. (**C**) ASMR for males. (**D**) ASMR for females. (**E**) ASDR for males. (**F**) ASDR for females.

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the complex management of MNBAC, which often requires multidisciplinary care involving orthopedic oncology, radiology, pathology, and rehabilitation, regional cancer centers must be equipped with the necessary expertise and technology. Telemedicine platforms could extend specialist support to underserved areas, improving equity in care delivery. Third, public awareness campaigns focusing on reducing bone cancer risk factors, such as the avoidance of occupational carcinogens, smoking cessation, and alcohol abstinence, should be integrated into existing non-communicable disease (NCD) prevention programs. These efforts should be tailored to reach male-dominated industries and older populations. Fourth, policy alignment with national health initiatives such as "Healthy China 2030" is crucial.[40] This alignment includes incorporating MNBAC into the national cancer control plan, strengthening cancer registry systems for real-time monitoring, and promoting research into subtype-specific trends and interventions.[41] Finally, international collaboration with other G20 countries, particularly those with declining MNBAC burdens, is crucial. Exploring the adoption of targeted screening protocols from high-income G20 nations and adapting them to China's specific national conditions represent pivotal measures. Implementing these strategies could alter China's MNBAC disease trajectory, leading to earlier diagnosis and improved survival, thereby accelerating the reduction in MNBAC burden. Such cooperation is key to making this scenario a reality.

This study has several inherent limitations. First, the analysis relied entirely on modeled estimates from the GBD 2021 database, which are subject to variations in data quality and potential underreporting across different regions, particularly in low-resource nations. Such limitations may affect the accuracy of cross-country comparisons and trend interpretations. Second, the MNBAC data were analyzed in aggregate and not stratified by specific histological subtypes. This approach limits the clinical relevance of our findings, as different subtypes exhibit distinct epidemiological and clinical characteristics. Third, temporal trends in incidence and prevalence may have been influenced by improvements in diagnostic technologies and evolving ICD coding practices over the 32-year study period, which could contribute to an apparent increase in disease burden that does not necessarily reflect true epidemiological changes. Additionally, our analysis did not account for potential confounding factors such as environmental exposure, healthcare accessibility, or socioeconomic disparities, which may also influence the observed burden trends. Future studies should aim to incorporate real-world data from national cancer registries, conduct subtype-specific analyses, and adjust for relevant confounders to provide a more accurate and clinically actionable assessment of the MNBAC burden.

Conclusions

This study reveals that in China, there is a distinct evolutionary trajectory of the MNBAC burden compared with other G20 nations. While both the absolute number of cases and the ASRs rose substantially from 1990 to 2021, projections from the BAPC model indicate a forthcoming decline in the ASIR, ASMR, and ASDR from 2022 to 2030, underscoring the potential effectiveness of sustained public health investment. Our findings highlight a characteristic bimodal age distribution and a disproportionately higher burden in the male population, thereby identifying key demographics for targeted intervention. Despite these encouraging trends, the continued progression of population aging foreshadows a growing absolute demand for specialized oncology services, necessitating proactive healthcare planning. To consolidate gains and mitigate future burden, we recommend implementing stratified public health strategies, enhancing early detection pathways within primary care, and fostering international collaboration. Finally, the interpretations of these findings should be contextualized within the limitations inherent to the GBD database, including the aggregation of histological subtypes and potential reporting biases.

Abbreviations

MNBAC, malignant neoplasm of bone and articular cartilage; GBD, Global Burden of Disease; NCCRC, National Central Cancer Registry of China; DALYs, disability-adjusted life years; ASR, age-standardized rate; ASIR, age-standardized incidence rate; ASPR, age-standardized prevalence rate; ASMR, age-standardized mortality rate; ASDR, age-standardized DALY rate; APC, annual percent change; AAPC, average annual percent change; BAPC, Bayesian age–period–cohort; UI, uncertainty interval; CI, confidence interval; NCD, non-communicable disease.

Date Sharing Statement

The data that were generated and analyzed during this study are publicly available. (https://www.healthdata.org/research-analysis/gbd)

Ethics Approval and Informed Consent

For this study, we used publicly available data from GBD 2021, and therefore, this study was exempt from ethical approval according to Article 32, Items 1 and 2 of the Measures for Ethical Review of Life Science and Medical Research Involving Human Subjects of the People's Republic of China (https://www.gov.cn/zhengce/zhengceku/2023-02/28/content_5743658.htm).

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests.

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