

Global, Regional, and National Burden of Bone Fractures in 204 Countries and Territories, 1990-2021: A Systematic Analysis from the Global Burden of Disease Study 2021

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INTRODUCTION: Fractures represent a major global health burden with age, sex, and geographic differences influencing their patterns. Since the last global report in 2019, fracture trends may have shifted significantly due to the COVID-19 pandemic. However, recent findings on fracture incidence, particularly in older adults and by fracture type, remain inconsistent. This study aims to address these gaps using the most recent Global Burden of Disease (GBD) data. The aim of the study is to determine, How have global trends in fracture incidence and disability changed from 1990 to 2021? What is the age and sex-specific burden of fractures? How do fracture patterns vary by anatomical site and geography? How did the COVID-19 pandemic impact recent trends in global fracture incidence and causes?

METHODS: We conducted a comprehensive analysis of the global, regional, and national burden of bone fractures from 1990 to 2021 using data from the GBD Study. Fracture incidence and years lived with disability (YLDs) were estimated for 204 countries and territories. Age-standardized incidence rates (ASIRs) and YLD rates (ASYRs) were calculated per 100,000 population. Trends were assessed using average annual percent change (AAPC), stratified by age, sex, region, fracture type, and sociodemographic index (SDI). Uncertainty intervals (UIs) were generated for all estimates. Analyses were performed in accordance with GBD methodologies using DisMod-MR 2.1 and CODEm modeling frameworks.

RESULTS: Globally, the ASIR of bone fractures declined by 20.2% from 2,723.1 [2,490.5–2,906.8] in 1990 to 2,172.5 [1,995.2–2,364.5] in 2021 (AAPC: -0.8%, $p < 0.001$). The ASYR showed a similar reduction of 23.1% (AAPC: -0.8%, $p < 0.001$) (Table 1). While most age groups showed declining trends, the incidence and YLD rates increased among those aged ≥ 95 years (ASIR: 18,064.1; AAPC: +0.9%, $p < 0.001$). Males had higher ASIRs overall, but women surpassed men in fracture burden after age 60. The patella/tibia/fibula/ankle group had the highest ASIR (439.7), followed by radius/ulna fractures. Hip fractures were the only type that did not show significant decrease (AAPC 0%). Regionally, Australasia and Central Europe had the highest ASIRs, while Western Sub-Saharan Africa had the lowest. Nationally, New Zealand reported the highest ASIR and ASYR (Figure 1). Falls were the leading global cause of fractures, accounting for 57.7% of all cases and 61.0% of global YLDs (Table 1). Notably, fracture burden showed a nonlinear relationship with SDI, peaking in countries with mid-to-high SDI values. The global ASIR of bone fractures showed a minimal change of -0.02% during the COVID-19 pandemic (2019–2021), much smaller than the decline seen in the pre-pandemic period (2017–2019; -1.4%). Notably, fracture incidence decreased in males (-0.48%) but increased in females (0.6%). Fractures from self-harm rose by 6.3%, while those due to police conflict and executions saw the largest drop (-33.2%) during the pandemic.

DISCUSSION AND CONCLUSION: In conclusion, this study shows the evolving burden of fractures globally, marked by overall declines but persistent regional and demographic disparities. The rising impact among older populations and in low-resource settings highlights the need for targeted strategies. Strengthening osteoporosis care, enhancing prevention, and addressing health inequities are essential steps forward. The influence of global disruptions like the COVID-19 pandemic further emphasizes the need for resilient healthcare systems. Policymakers should prioritize resource allocation to aging populations and mid-to-high SDI regions where the fracture burden is highest, while also supporting injury surveillance and prevention efforts in underserved areas. Orthopaedic surgeons must remain vigilant to shifting fracture patterns, particularly among the elderly and female populations, and adapt management strategies to evolving causes such as falls and self-harm-related injuries. Continued research and updated surveillance are crucial to guide effective, data-driven interventions in fracture prevention and management.

