Global Burden of Pediatric Orthopaedic Fractures: An Epidemiological Analysis from 1990 to 2021

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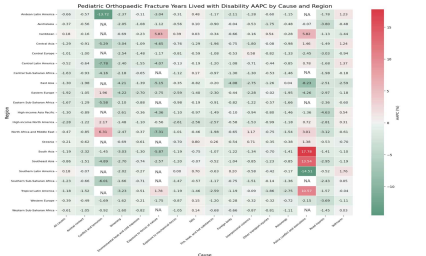
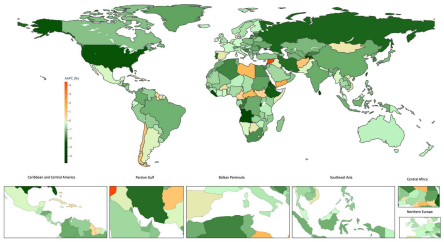
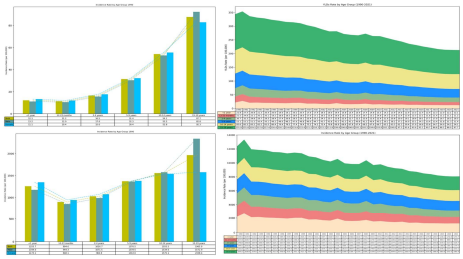
INTRODUCTION:
Pediatric fractures represent a notable portion of childhood injuries globally, contributing to substantial healthcare utilization, long-term morbidity, and surgical interventions. Their incidence and patterns are influenced by a range of factors including age, activity levels, healthcare access, and global disruptions such as the COVID-19 pandemic. Although prior research has addressed regional patterns, there is a lack of comprehensive global data spanning multiple decades. This study uses data from the Global Burden of Disease (GBD) 1990–2021 to answer four key questions: 1) What are the global, regional, and national trends in pediatric fractures, and how were they impacted by the COVID-19 pandemic?; 2) What are the primary causes of pediatric fractures?; 3) Which fracture sites are most common across different pediatric age groups?; and 4) How does socioeconomic development, measured by the Socio-demographic Index (SDI), influence the burden and distribution of pediatric fractures?
METHODS: This study utilized data from the Global Burden of Disease (GBD) 2021, accessed via the Global Health Data Exchange. Coordinated by the Institute for Health Metrics and Evaluation (IHME), the GBD analyzes 371 diseases and injuries across 204 countries from 1990 to 2021. Pediatric orthopaedic fractures were identified by anatomical sites (e.g., clavicle, femur, tibia/fibula), excluding skull, facial, and rib fractures. Children aged 0–19 years were grouped by age, sex, region (21 in total), and SDI, a composite of income, education, and fertility. Incidence and years lived with disability (YLDs) were estimated using DisMod-MR 2.1, a Bayesian meta-regression tool. YLDs were calculated by multiplying prevalence by disability weights. Trends from 1990 to 2021 were evaluated using Average Annual Percent Change (AAPC) via log-linear regression. Associations with SDI were assessed using LOESS regression. The impact of COVID-19 was analyzed by comparing incidence and YLD rate changes between pre-pandemic (2017–2019) and pandemic (2019–2021) periods. Analyses were performed using Python 3.8.
RESULTS: From 1990 to 2021, global pediatric fracture incidence rates declined from 2,125.5 to 1,477.0 per 100,000 children (AAPC: –1.25%; $p<0.001$), with YLD rates dropping from 71.6 to 46.3 (AAPC: –1.53%; $p<0.001$), more prominently in males. In 2021, the highest incidence rates were in Australasia, Central Europe, and Southern Latin America; the lowest were in Sub-Saharan Africa. Central Sub-Saharan Africa showed the largest decline, while the Caribbean had a slight, non-significant increase. During the COVID-19 pandemic (2019–2021), the decline slowed (–0.08%) versus pre-pandemic years (–1.61%), with a small rise among females and fractures from falls. Falls remained the leading cause of fractures and YLDs, followed by mechanical forces and road injuries. The Tibia/fibula/ankle fractures were most common across all age groups; the second most common varied by age, with adolescents (15–19 years) having the highest rates. Fracture and YLD rates rose with SDI up to 0.75, then declined sharply, indicating an inverse relationship between socioeconomic development and fracture burden.
DISCUSSION AND CONCLUSION: While the global burden of pediatric fractures has declined over the past three decades, this trend is not consistent across regions. Fractures remain a notable concern in many parts of the world, with falls and traffic accidents as the leading causes. Geographic, socioeconomic, and demographic factors continue to shape the burden and distribution of fractures in children. These findings highlight the need for region-specific strategies to prevent injuries and reduce long-term disability in pediatric populations.


Pediatric Orthopaedic Fracture Years Lived with Disability AAPC by Cause and Region
Region
Cause
AAPC (%)


AAPC (%)
Caribbean and Central America
Persian Gulf
Balkan Peninsula
Southeast Asia
Central Africa
Northern Europe


Incidence Rate by Age Group (1990-2021)
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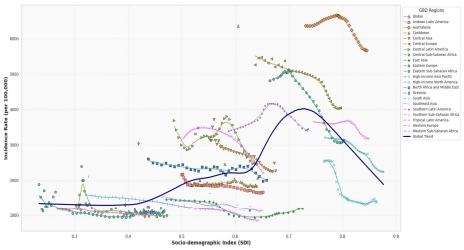
Incidence Rate of Orthopaedic Fractures from 1990 to 2021 by SDI by GBD Regions
Incidence Rate (per 100,000)
Socio-demographic Index (SDI)
GBD Regions
Global
Andean Latin America
Australasia
Caribbean
Central Asia
Central Europe
Central Latin America
Central Sub-Saharan Africa
East Asia
Eastern Europe
Eastern Sub-Saharan Africa
High-income Asia Pacific
High-income North America
North Africa and Middle East
Oceania
South Asia
Southeast Asia
Southern Latin America
Southern Sub-Saharan Africa
Tropical Latin America
Western Europe
Western Sub-Saharan Africa
Global Trend