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### Background

Multiple sclerosis (MS) is a chronic inflammatory neurological disease and a major cause of disability among young adults worldwide.

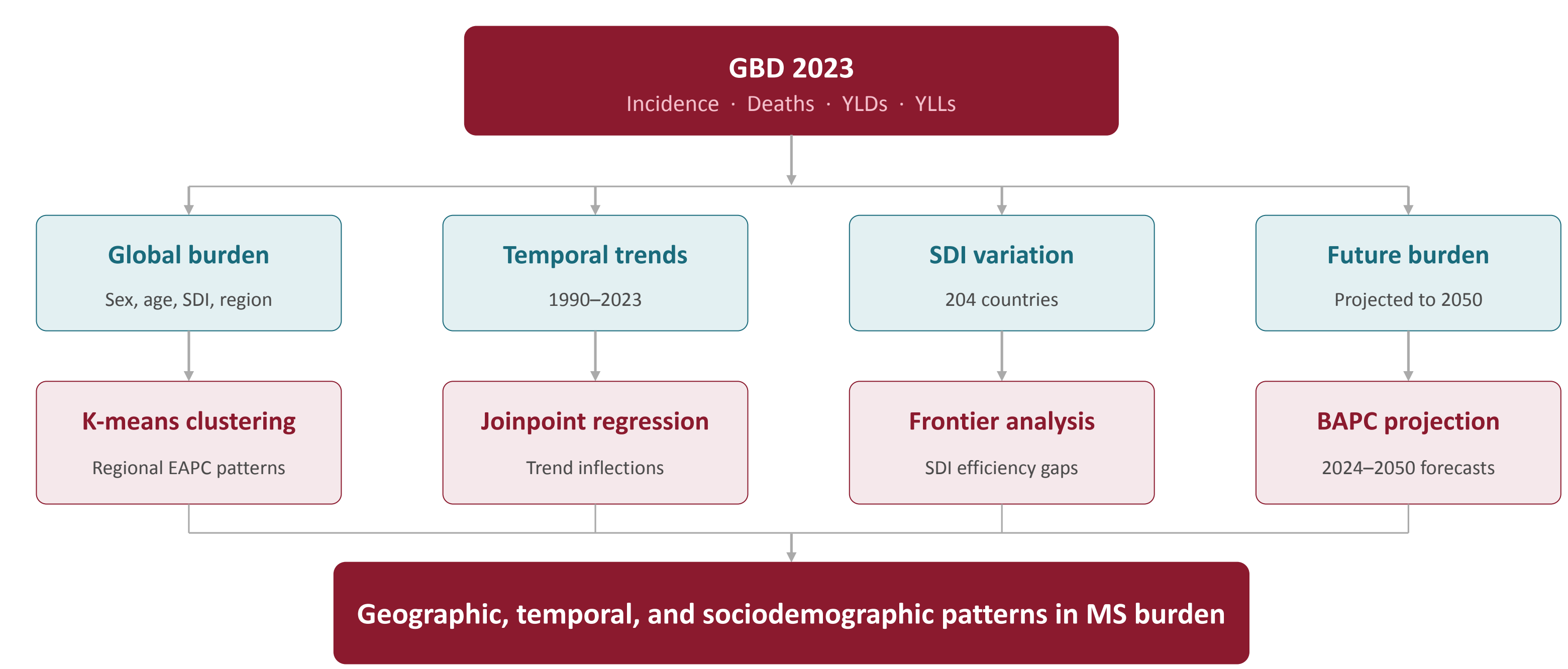
The Global Burden of Disease (GBD) study provides standardized estimates of global and regional disease burden, enabling systematic comparisons of incidence, mortality, years lived with disability (YLDs) and years of life lost (YLLs).

Previous GBD studies have characterized overall MS burden, but fatal and nonfatal burden components may exhibit distinct temporal and geographic patterns.

Understanding long-term trends, future projections, and socioeconomic disparities in MS burden may inform targeted public health and healthcare planning strategies.

**Objective:** The current study aims to characterize temporal, geographic, and sociodemographic variation in MS incidence, deaths, YLDs, and YLLs using GBD 2023 estimates and to project future MS burden through 2050.

### Methods



**Data:** 1) Number and Age-standardized rates (ASRs) of MS incidence, deaths, YLDs and YLLs for 204 countries and 21 GBD regions (1990–2023); 2) Country-level SDI.

**K-means clustering:** Categorized 21 GBD regions based on temporal burden dynamics, as measured by estimated annual percent changes (EAPCs).

**Joinpoint regression:** Identified statistically significant inflection points in ASRs from 1990 to 2023.

**Frontier analysis:** Compared MS burden against SDI-specific frontier across countries and quantified efficiency gaps.

**BAPC modeling:** Projected sex-specific rates of MS incidence and mortality from 2024 to 2050.

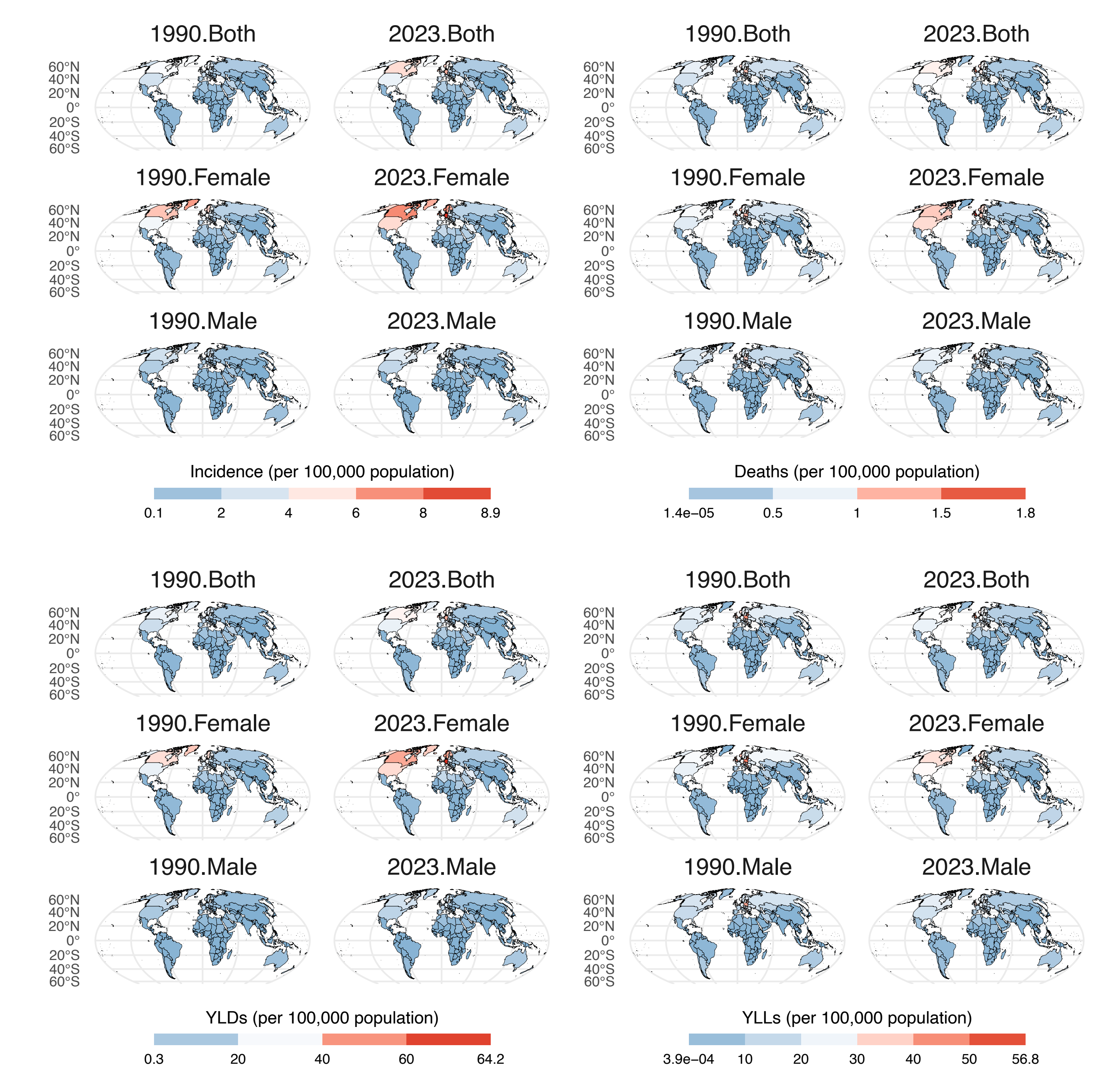
All analyses were conducted in R (v4.5.1). Joinpoint regression was performed using Joinpoint Regression Software (v5.4.0, NCI).

### Results

#### Global MS Burden and Demographic Patterns

In 2023, MS accounted for 62,388 incident cases and 19,070 deaths globally, contributing to 517,323 YLDs and 551,299 YLLs.

Incidence peaked at ages 30–34 years, whereas death burden increased progressively with age. YLD burden plateaued around ages 60–64 years, while YLL burden peaked at ages 65–69 years. Females consistently exhibited higher ASRs than males across all burden measures and age groups.



#### Geographic Heterogeneity

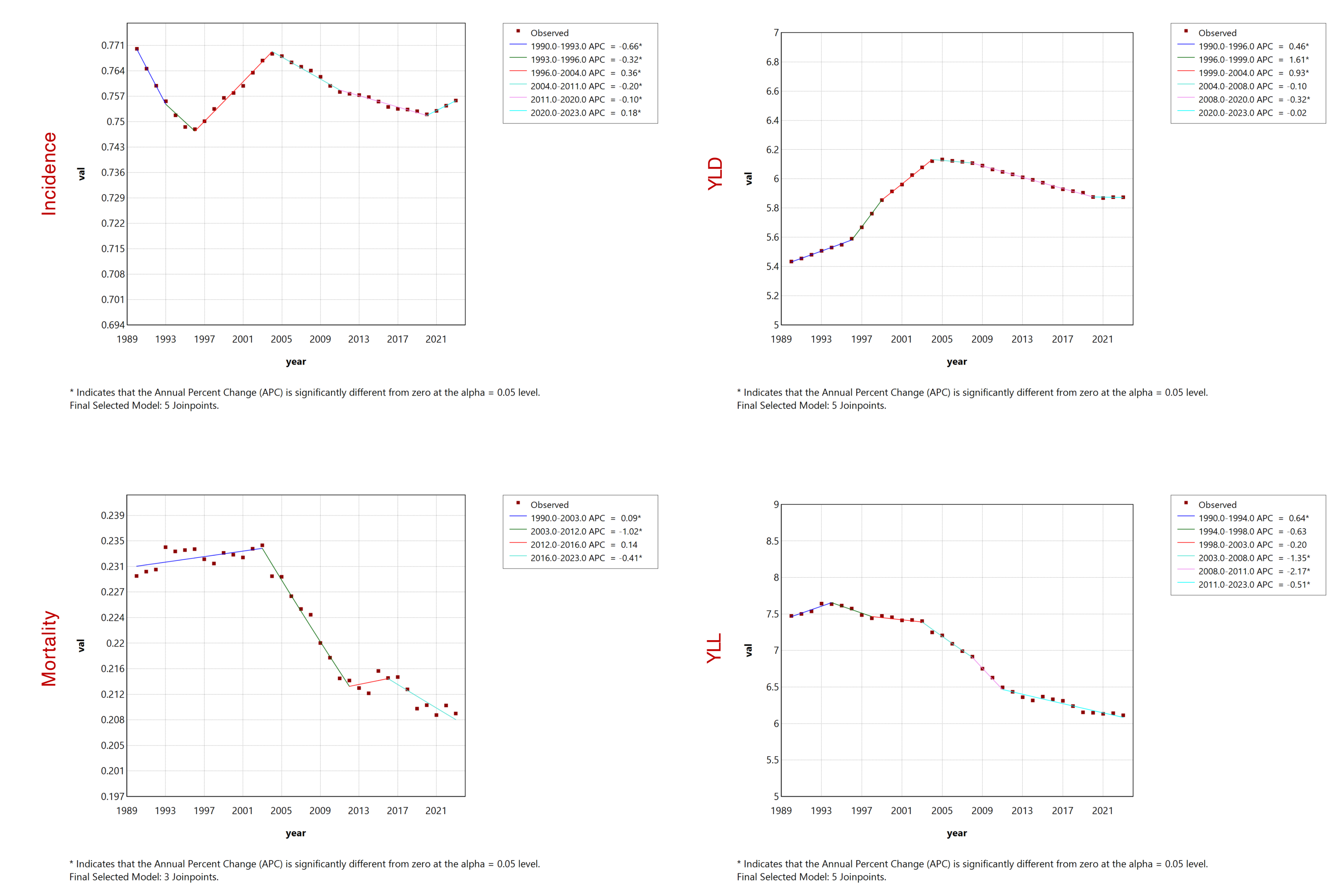
**Western Europe:** Highest incidence, YLDs, and YLLs;  
**High-income North America:** Highest mortality.

K-means clustering identified 3 clusters for each measure. Incidence and YLD clusters were highly similar, with Australasia, East Asia, and Western Europe forming the high-increase cluster. For death and YLL, low-SDI regions showed increases while high-SDI regions experiencing declines.

### Conclusion

Fatal and nonfatal MS burden components demonstrated distinct demographic, geographic, and temporal patterns. Increasing incidence and disability burden alongside declining mortality suggest a transition toward greater long-term chronic disease burden. Persistent regional and socioeconomic disparities highlight substantial unrealized potential for improved MS prevention, diagnosis, and long-term disease management.

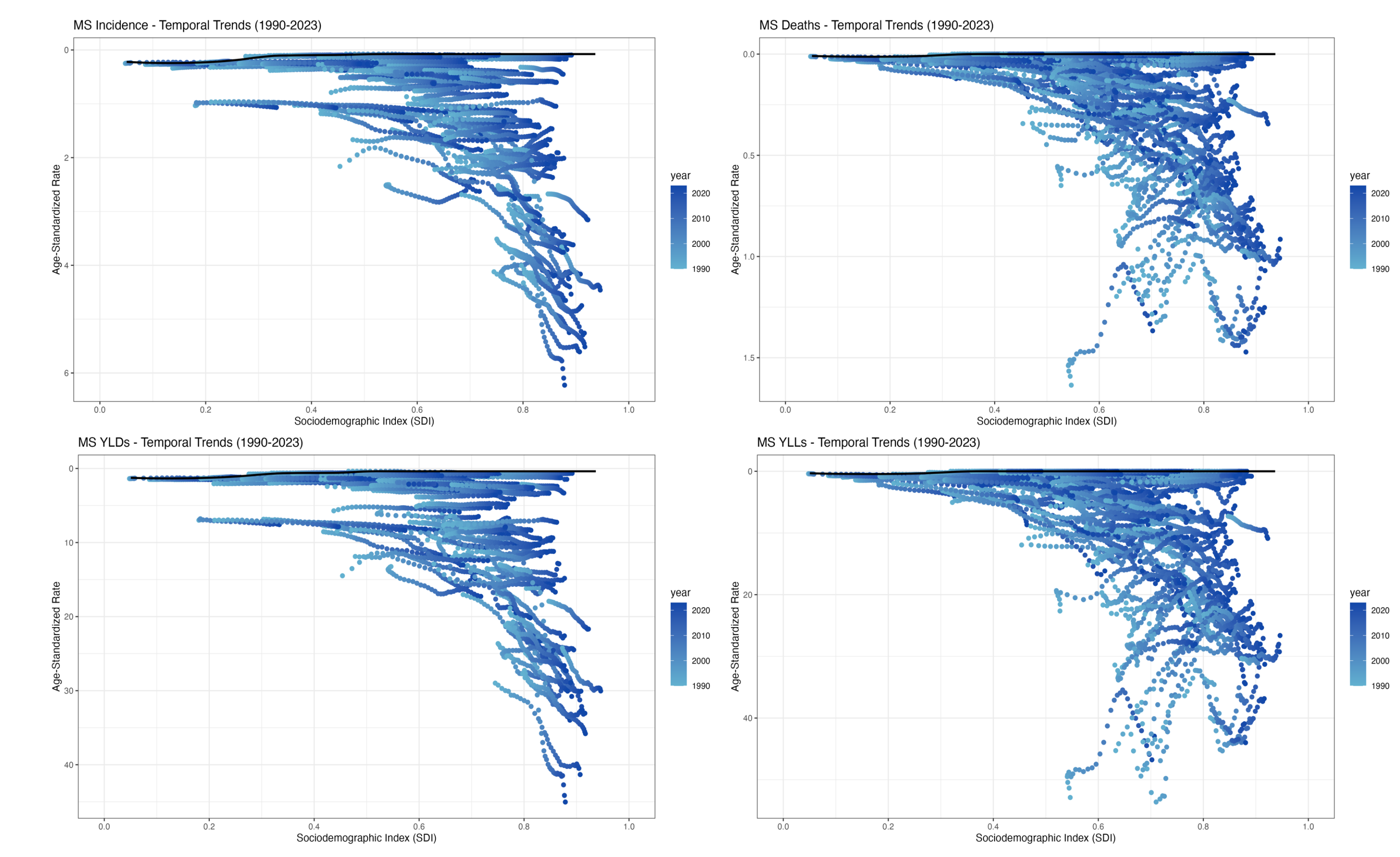
### Results cont.



#### Temporal Dynamics

MS incidence, YLDs, and female-specific YLLs showed inflections toward increasing / stable trends around 2020–2021, consistent with COVID-19-related disruptions to MS diagnosis and care. MS mortality demonstrated a sustained decreasing trend since 2003, reflecting improvements in disease-modifying therapy.

Global MS incidence is projected to increase gradually through 2050, while mortality rates are expected to continue declining in both sexes, reflecting a long-term shift toward MS as a predominantly nonfatal chronic condition.



#### Socioeconomic Disparities

Frontier analyses demonstrated substantial variability in MS burden relative to sociodemographic development. Germany, Ireland, and Norway exhibited the largest efficiency gaps for incidence and YLDs, whereas the United Kingdom, Albania, and Denmark showed the largest gaps for deaths and YLLs.