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Global inequalities in female breast cancer burden by decomposition and age-period-cohort analysis, 1990-2021

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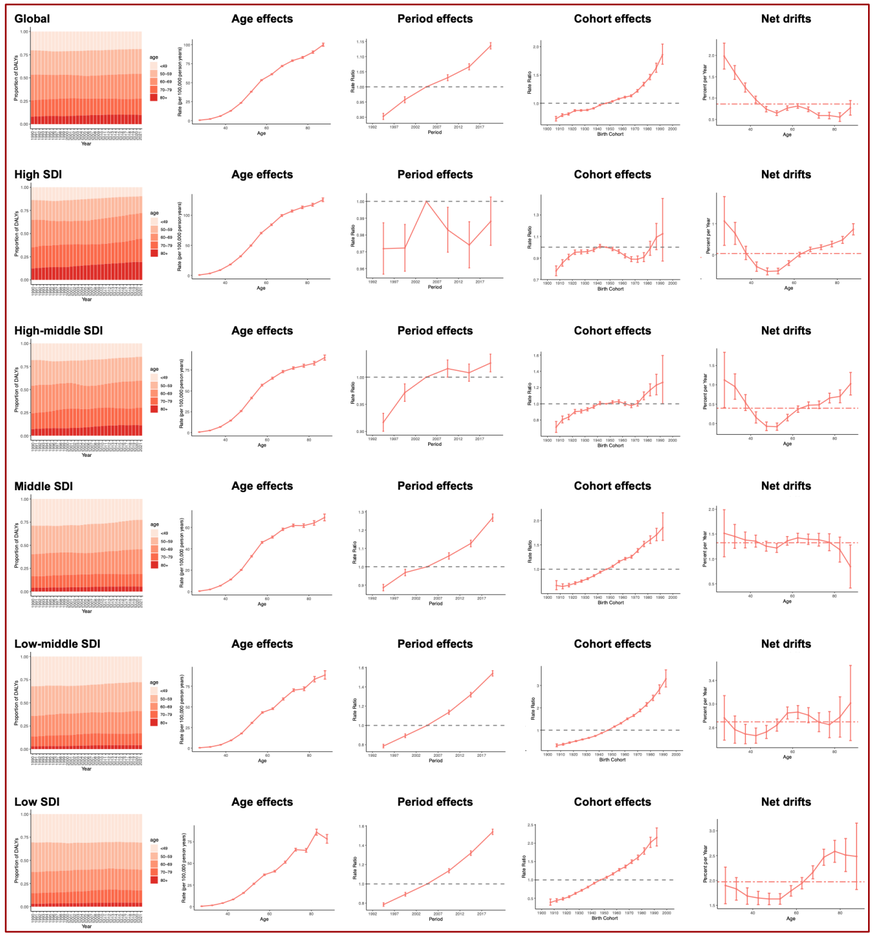


Figure 1. Age-period-cohort effects on all-age DALYs rate across SDI quintiles.

♦ Introduction

Breast cancer is the most common cancer among women globally, accounting for 25% of all female cancer cases and is the fourth leading cause of cancer-related deaths. It is influenced by a complex interplay of reproductive, lifestyle, genetic, and environmental factors, with early diagnosis significantly improving prognosis and survival rates. However, disparities in disease burden persist between high- and low-income regions, highlighting the need for tailored regional strategies to address these inequities and improve outcomes.

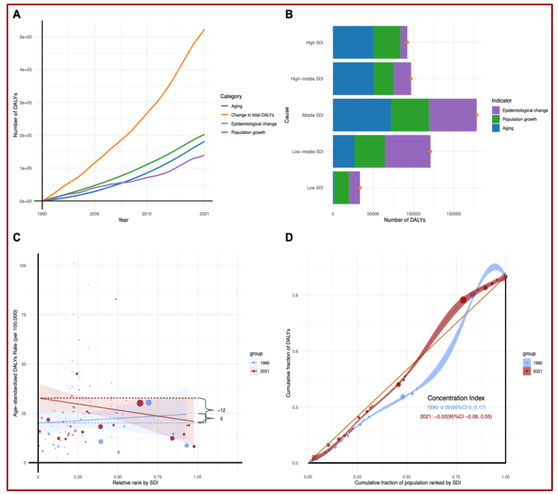
♦ Methods

Comprehensive data on female breast cancer were extracted from the Global Burden of Disease (GBD) 2021 study. All-age rate and age-standardized rate (ASR) of Disability-adjusted life years (DALYs) were quantified from 1990 to 2021, through socio-demographic index (SDI) stratification. The age-period-cohort (APC) model was used to elucidate the effects of age, period and cohort, and to estimate overall annual percentage changes in DALYs (net drifts). Decomposition analysis further attributed changes in disease burden to epidemiologic trends, population growth, and aging. The slope index of inequality (SII) and the concentration index (CI) were calculated to quantify the absolute and relative cross-country inequalities in the burden of female breast cancer.

♦ Results

From 1990 to 2021, APC models showed elevated risk in postmenopausal women and period-related declines in high SDI countries. In contrast, risks rose or plateaued in low SDI regions. Cohort analysis revealed decreasing risks in high SDI countries but rising risks in younger cohorts elsewhere. Age-specific net-drifts showed declining DALY rates overall, but varied by SDI level. High and high-middle SDI regions peaked in early adulthood and post-menopause, with lower risks at ages 40–60. Middle SDI areas had gradual changes, while low-middle and low SDI regions had the highest DALY rates after 60 and 80, with sharp rises in the oldest groups. Decomposition analyses showed population growth as the primary driver of increasing DALYs globally, with ageing overtaking epidemiologic change around 2005. Ageing was dominant in high and high-middle SDI countries by 2021, while population growth was more important in low SDI countries, where ageing had minimal impact. Inequality shifted, from 1990 to 2021, the SII shifted from 5 to −12 and CI from 0.09 to −0.02, indicating a reversal of the breast cancer burden toward disadvantaged populations. These findings highlight persistent inequities and resource constraints in low and middle SDI regions.

Figure 2. Decomposition analysis and inequality analysis.
(A) Changes in global DALYs of female breast cancer according to ageing, population growth and epidemiological change from 1990 to 2019.
(B) Decomposition analysis for female breast cancer DALYs by SDI quintiles.
(C) Absolute income-related healthy inequality in ASR of DALYs burden, presented using SII, 1990 vs. 2021.
(D) Relative income-related healthy inequality in ASR of DALYs burden, presented using CI, 1990 vs. 2021.



♦ Conclusion

The global burden of female breast cancer continues to rise with marked regional and age disparities, highlighting the urgent need for region-specific interventions. High SDI regions should enhance early detection and care, while middle and low SDI countries need to improve access to screening and health system capacity to mitigate disparities.