

Socioeconomic inequality in cardiovascular disease risk in low- and middle-income countries

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Motivation

Cardiovascular disease (CVD) places a large and increasing burden on low- and middle-income countries (LMICs). Theories of epidemiological transition and the ‘reversal hypothesis’ suggest that economic and sociocultural development will progressively shift the prevalence of CVD and its risk factors towards low socioeconomic status (SES) individuals as countries grow richer. Understanding how socioeconomic gradients change in LMICs is essential for targeting those with greatest need and mitigating the rising burden of CVD.

Methods

We conducted a cross-sectional analysis of 61 nationally representative household surveys from 49 LMICs using WHO Stepwise Approach to Surveillance (STEPS) surveys between 2000 and 2020. We used the lab-based WHO CVD risk algorithm to predict 10-year risk of a CVD event (fatal or non-fatal heart attack or stroke) for 79,689 individuals aged 40-80 with observations for education and biomarkers for systolic blood pressure (SBP), total cholesterol (TC), diabetes (DM), and smoking (SMK). We measured socioeconomic inequality in CVD risk using a concentration index, then performed a Shapley value decomposition to obtain the contributions to inequality of the risk factors that predict CVD risk. We also conducted a regression analysis to investigate the associations between economic development, CVD risk and CVD inequalities. Finally, we analyzed within-country trends of CVD risk inequality for 9 countries with two or more surveys.

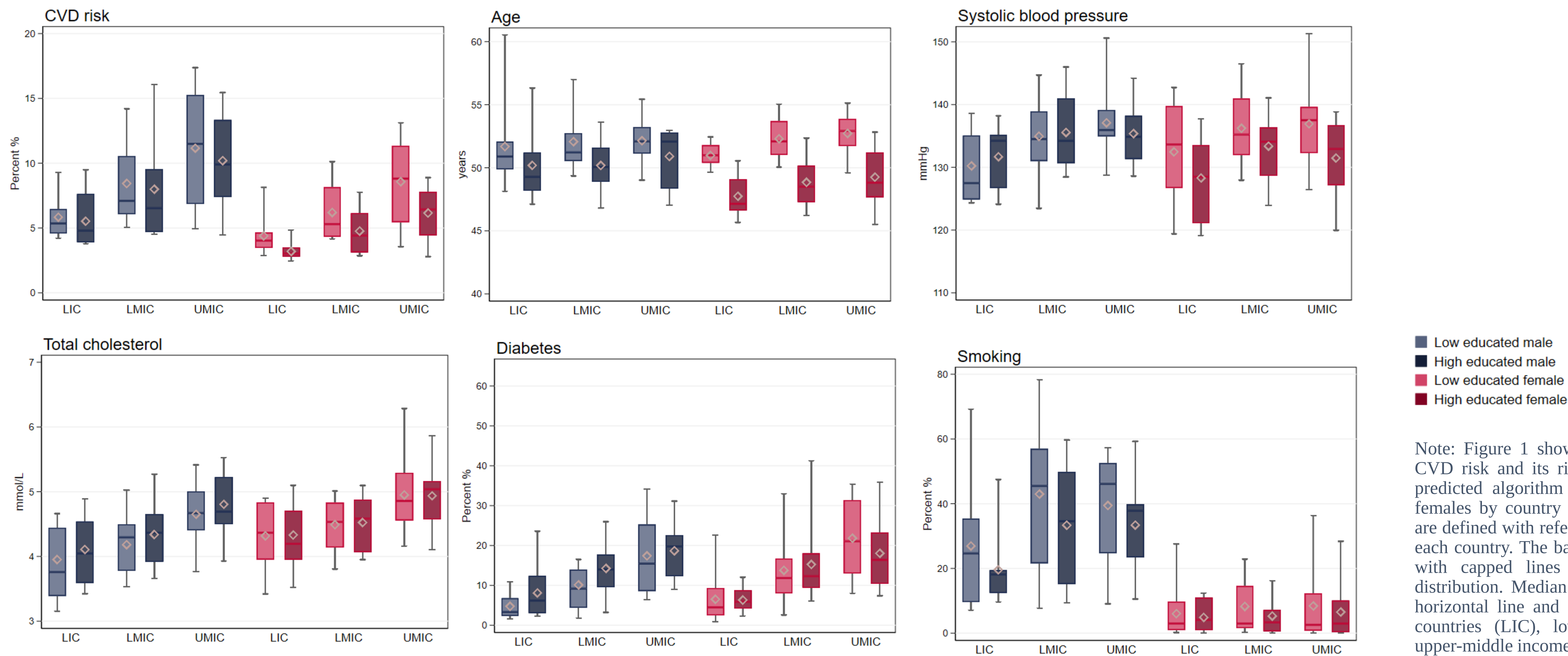
Results

CVD risk tends to be higher among less educated individuals with a stronger gradient for females than males. After adjusting for differences in age across education levels, inequalities in CVD risk cease to be pronounced. Thus, age accounts for almost all of the education-related inequality in CVD risk. The other risk factors (SBP, TC, DM, SMK) have varied, offsetting effects on inequality in CVD risk. Inequalities in CVD have only a weak inverse association with economic development implying that CVD risk tends to become more concentrated among the less educated but there is considerable variation. The majority of countries with repeated cross-sectional surveys show inequalities increasing to the disadvantage of the less educated, especially for women.

Conclusion

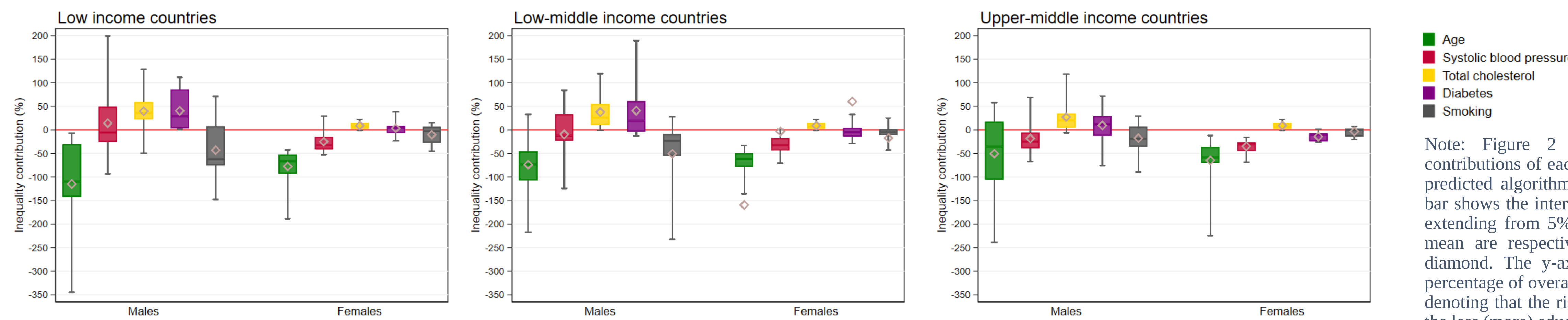
There is some evidence for the ‘reversal hypothesis’ but large-scale longitudinal studies in LMICs are needed to determine if socioeconomic gradients in CVD and its risk factors are changing with economic development. CVD prevention strategies should nevertheless target the less educated, particularly women to reduce inequalities in CVD risk. With the cohort effects of increasing access to education, age as a risk factor will progressively contribute less to CVD risk inequalities; interventions that target SBP and smoking among the less educated will have large impacts.

Figure 1 – Education-related inequality in CVD risk and its risk factors



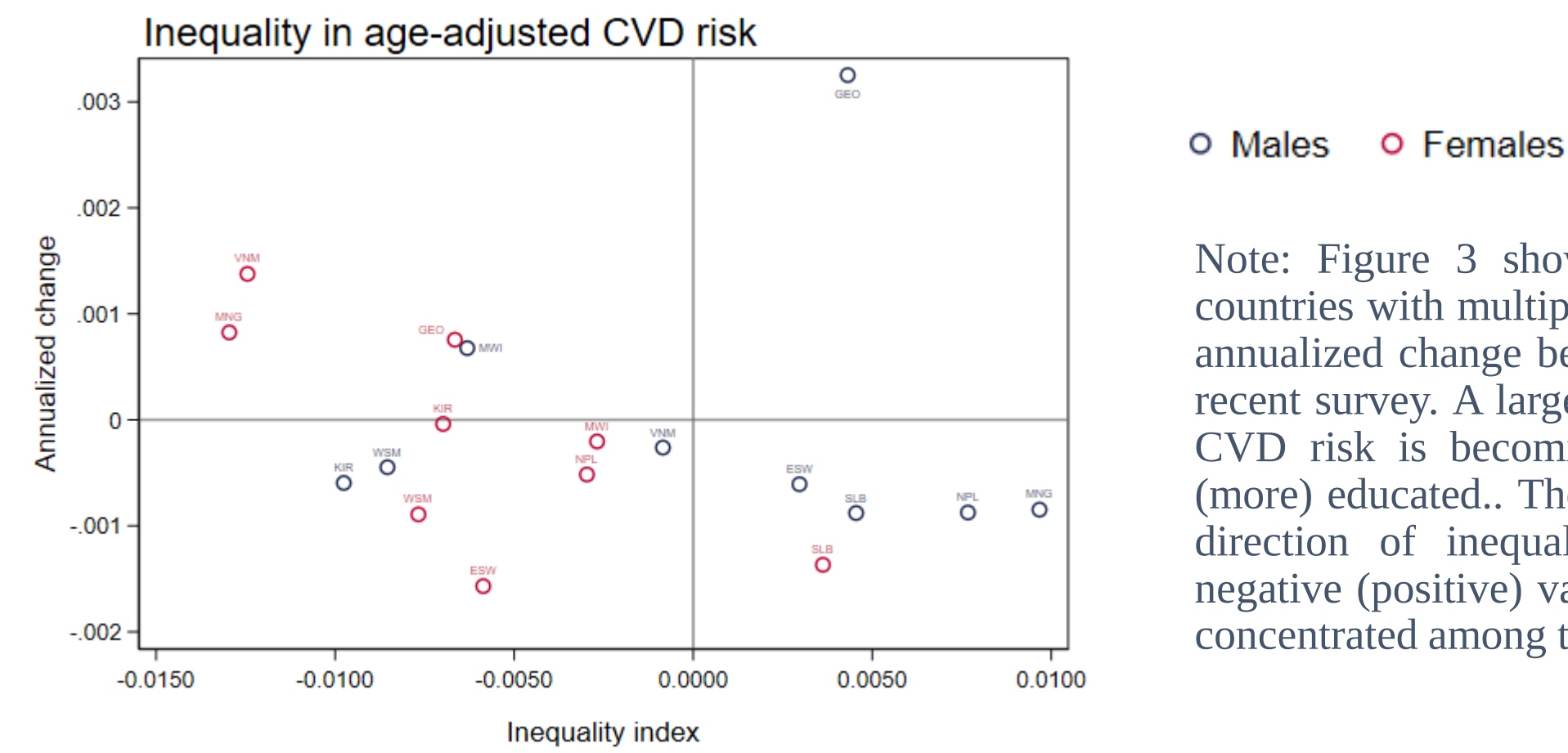
Note: Figure 1 shows the distribution of country means of CVD risk and its risk factors used in the WHO CVD risk predicted algorithm for less and high educated males and females by country income group. Low and high education are defined with reference to the median years of education in each country. The bar shows the interquartile range of values with capped lines extending from 5% to 95% of the distribution. Median and mean are respectively shown by a horizontal line and a diamond. Abbreviations: Low-income countries (LIC), lower-middle income countries (LMIC), upper-middle income countries (UMIC)

Figure 2 – Risk factor contributions to CVD risk inequality



Note: Figure 2 shows the distribution of inequality contributions of each risk factors used in the WHO CVD risk predicted algorithm by sex and country income group. The bar shows the interquartile range of values with capped lines extending from 5% to 95% of the distribution. Median and mean are respectively shown by a horizontal line and a diamond. The y-axis shows the relative contribution as a percentage of overall inequality with a negative (positive) sign denoting that the risk factor increases CVD risk more among the less (more) educated.

Figure 3 – Within-country trends of CVD risk inequality



Note: Figure 3 shows trends in CVD risk inequality for countries with multiple STEPS surveys. The y-axis shows the annualized change between the baseline survey and the most recent survey. A larger negative (positive) value signifies that CVD risk is becoming more concentrated among the less (more) educated. The x-axis shows the initial magnitude and direction of inequality in the baseline survey. A larger negative (positive) value signifies that that CVD risk is more concentrated among the less (more) educated.



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