Insights into the influence of income variability on cardiovascular risk in non-elderly adults with type 2 diabetes

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Graphical Abstract

Non-elderly type 2 diabetic patients

Mediators

Obesity

Smoking

Alcohol

Sedentary lifestyle

Cardiovascular risk

Sustained high income over 5 years

Increased risk

Decreased risk

Income decline over 5 years

Increased risk

Income decline to lowest status (regardless of initial income status)

Increased risk

Sustained low income over 5 years

Increased risk

Income variability over 5 years

Increased risk

Non-elderly patients with type 2 diabetes
Type 2 diabetes (T2D) significantly increases the risk of cardiovascular disease (CVD), one of the leading causes of death globally. Previous research has shown that low socioeconomic status (SES), indicated by factors such as income, elevates CVD risk similarly to traditional risk factors such as age, hypertension, and lifestyle behaviours. The implications of low SES on the cardiometabolic health of individuals with T2D are far-reaching. For example, it is associated with challenges in achieving access to and quality of diabetes care, including difficulties in managing glycated haemoglobin (HbA1c) levels and blood pressure, as well as adhering to healthy lifestyles. Socioeconomic challenges, in turn, increase the risk of diabetes complications, leading to increased cardiovascular-related and all-cause mortality. Furthermore, as Park et al. point out in their study published in the current issue of the European Heart Journal, the adverse effects of low SES are particularly significant among non-elderly adults with T2D. Specifically, the authors found that in patients with T2D, greater fluctuations in income were significantly linked to an elevated CVD risk. A persistent low income status was associated with an increased CVD risk. Additionally, a decrease in income, especially falling to the lowest income quartile (Medical Aid beneficiaries), notably increased CVD risk. Conversely, consistently high income levels over time and rises in income corresponded to a reduced CVD risk.

Although existing studies establish a connection between low income and heightened CVD risk in T2D patients, it remains unclear whether low income is a causal factor or merely a driver of other risk-contributing behaviours and clinical characteristics. The authors note that the current literature on the relationship between income and CVD risk in T2D patients has several limitations. Many studies are cross-sectional, which prevents the establishment of causality due to potential reverse causation. They often rely on group- or area-level income data and do not evaluate potential mediating factors such as smoking and/or alcohol consumption, sedentary lifestyles, or obesity. Furthermore, they typically utilize single-point income measures, minimizing the impact of income stability (or variability) over time. This study addresses these gaps. Utilizing data from the Korean National Health Insurance System (NHIS), covering 97% of South Korea’s population, the authors aimed to examine the longitudinal association between sustained low or high income, income variability, and changes in income with incident fatal and non-fatal CVD in non-elderly individuals with T2D. This approach is significant as it offers a more dynamic and complete understanding of how income, a prominent socioeconomic factor, influences CV health in T2D patients.

According to the authors, the NHIS database includes comprehensive claims-based information, patient demographics, and health screening data. The study included 1,909,492 individuals aged 30–64 years with T2D, identified through national health screening examinations between 2009 and 2012. T2D was defined based on medication prescriptions, International Classification of Diseases (ICD)-10 codes, or high fasting glucose levels, excluding those with type 1 or gestational diabetes. The NHIS does not record household income, so the authors used monthly health insurance premiums, determined by wage income and household property value, as a proxy. These premiums, reflecting 20 quintiles of income, were used to categorize annual income into four levels (quartiles). The study tracked income status for 4 years before the baseline year, calculating the cumulative years in low or high income and the intra-individual standard deviation (SD) of percentage income change to assess income variability. The primary outcome was the composite event of fatal and non-fatal CVD, identified using specific ICD-10 codes. Covariates included sociodemographic factors, CV risk factors, health behaviours, and T2D treatments. Individuals with missing income data, prior history of CVD, missing covariates, or CVD diagnosis in the first follow-up year were excluded, resulting in 1,528,108 participants. Cox proportional hazards models estimated hazard ratios (HRs) and confidence intervals (CIs) for income–CVD associations, adjusting for potential confounders such as age, sex, sociodemographic characteristics, comorbidities, and diabetes management. Sensitivity analyses were conducted, including adjustments for obesity and lifestyle characteristics.

The study yielded interesting findings on how sustained income levels and income variability correlate with CVD incidence in individuals with T2D. Compared with those who never experience low income, the authors characterized individuals with sustained low incomes as being predominantly female, older, more likely to be non-smokers and non-drinkers, physically inactive, and living in rural areas. These individuals also had higher rates of central obesity, hypertension, dyslipidaemia, chronic kidney disease, and depression. They had longer durations of T2D and were more likely to use multiple antidiabetic medications. Conversely, those with sustained high incomes displayed contrasting characteristics compared with those who never experienced high income. Individuals with lower variability in income tended to have higher incomes, whereas those with higher variability in income often experienced low incomes. During the follow-up period, 109,319 (7.2%) participants experienced a CVD event. Those with a sustained low income over 5 years had a significantly higher risk of CVD (HR 1.38, 95% CI 1.35–1.41). Similarly, higher income variability (comparing the highest vs. the lowest quartile) was associated with an increased CVD risk (HR 1.25, 95% CI 1.22–1.27). The strength of these associations was more pronounced with five cumulative years of very low or high income. Changes in income status also correlated with CVD risk. A greater increase in income over time was associated with a decreased risk of CVD, while a decline in income, especially to the lowest level (Medical Aid beneficiaries), significantly increased CVD risk more than two-fold. The association of low income and high income variability with CVD risk was stronger in younger individuals, males, the self-employed insured, and non-rural residents. The trends remained consistent (P < .0001), even after adjusting for factors such as smoking, alcohol consumption, physical activity, and initial income quintile. This interesting aspect of variation in participant risk sheds light on the relationship between income stability and SES. Moreover, these findings underscore the significant impact of socioeconomic factors on health outcomes, expanding on the existing literature that often focuses on static income measures or group-level data. By analysing individual income dynamics, not mere income level, the study highlights the subtle effects of income variability, irrespective of a participant’s initial income status, and its key role in CVD risk in T2D patients. These results elucidate how socioeconomic disparities translate into health inequalities, particularly in chronic conditions such as diabetes.

Prior research often involves longer income change periods influenced by macroeconomic factors. A strength of this study is that it focuses on short-term income variability and relative income change, providing a more refined understanding of how income dynamics over a shorter period affect health. High income variability and declines, particularly to very low levels, create additional vulnerabilities and exacerbate existing ones. These vulnerabilities include increased stress, poorer health behaviours, and less effective management of comorbidities. Low-income individuals have poorer access to the best medications and less knowledge of the importance of medication adherence, leading to suboptimal control of T2D and CV risk factors.

Conversely, high income levels or increases in income over time are
associated with better healthcare utilization and quality, leading to reduced CVD risk.

There are several public health implications of income declines and variability impacting CVD risk. This study highlights the need for a more comprehensive approach that includes both clinical and public health strategies to reduce health disparities among low-income groups. These strategies should not only include access to medical services but also address broader socioeconomic factors that contribute to health disparities. For example, by adopting a broader strategy of patient assessment through the integration of socioeconomic questions alongside traditional health measures into patient evaluations, clinicians and policymakers will gain a more robust understanding of a patient’s income stability. In turn, this collaborative approach can offer a more complete view of their health risks and needs.

Despite its comprehensive nature, the study appropriately acknowledges key limitations, namely lack of data on food security, medication adherence, and educational attainment, and that its findings are specific to the Korean context, limiting its generalizability to populations with different ethnic, socioeconomic, and cultural backgrounds or public health needs.

In summary, higher income variability, sustained low income status, and a decline in income, particularly to the lowest income levels, led to a heightened risk of CVD. In contrast, individuals who maintained a high income status over time or who experienced an increase in income exhibited a reduced risk of CVD. The study opens up new possibilities for understanding how socioeconomic factors, particularly income dynamics, influence health outcomes in chronic diseases such as T2D. However, there is an urgent need for continued research in this area, including exploring the specific social and biological mechanisms through which income variability and changes impact CV health and other CV-related chronic diseases. These findings not only contribute to the scientific understanding of the socioeconomic determinants of health but also highlight the importance of integrated public policy interventions aimed at stabilizing income to improve health outcomes and reduce health disparities.

Declarations

Disclosure of Interest

The author declares no disclosure of interest for this contribution.

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References