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Global Trends in Cardiovascular Mortality and Risk Factors: Insights from WHO and Global Burden of Disease Data

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Abstract

Cardiovascular diseases (CVDs) remain the leading global killer, causing an estimated 19.8 million deaths (32% of all deaths) in 2022. Although CVD mortality rates have declined in many countries due to improved prevention and treatment, population growth and aging have driven the total number of deaths upward from ~14 million in 2000 to ~18 million by 2019. Major risk factors including tobacco use, high blood pressure, obesity, diabetes, and air pollution continue to fuel the CVD burden. This study compiles and analyzes recent data from the World Health Organization (WHO), the Global Burden of Disease (GBD) Study, the NCD Risk Factor Collaboration (NCD-RisC), and related sources to characterize global trends in CVD mortality and modifiable risk factors from 1990 to the latest year available. We describe data sources and methods, present global and regional CVD mortality trends, highlight disparities across WHO regions and income groups, and examine country-level changes. We also analyze trends in major risk factors (tobacco, hypertension, obesity, diabetes, air pollution) and their associations with CVD mortality. Our results show substantial declines in age-standardized CVD death rates in high-income regions, but rising or stagnating rates in parts of Asia and Africa. Countries with high smoking rates or uncontrolled hypertension have smaller mortality gains. The findings underscore the urgent need for strengthened prevention and control of risk factors in low- and middle-income countries to meet global targets. Key strategies include tobacco control, blood pressure screening and treatment, obesity/diabetes prevention, and reducing air pollution.

Keywords: cardiovascular mortality, risk factors, WHO, Global Burden of Disease, hypertension, obesity, tobacco, global health, trends, epidemiology.

Introduction

Cardiovascular diseases (CVDs) are the most common cause of death worldwide. In 2019, heart disease and stroke caused about one third of all global deaths (Figure 1). CVD deaths totaled ~18 million that year, up from ~14 million in 2000.

Most CVD mortality is preventable through management of risk factors. Key behavioral risks include tobacco use, poor diet, physical inactivity and harmful alcohol use; among environmental risks, air pollution is notable. These in turn lead to intermediate risks like high blood pressure, high blood glucose and obesity, which increase heart attack and stroke risk (World Health Organization., 2025). WHO estimates that over three-quarters of CVD deaths occur in low- and middle-income countries. Tracking global and regional trends is essential to guide policy and health investment. This study aims to synthesize latest WHO and GBD data on CVD mortality and major modifiable risk factors (tobacco, hypertension, obesity, diabetes, air pollution) over ~1990-latest. Specific objectives are to describe temporal trends in CVD mortality worldwide, identify regional and country disparities, assess trends in key risk factors, and explore their associations with mortality changes.

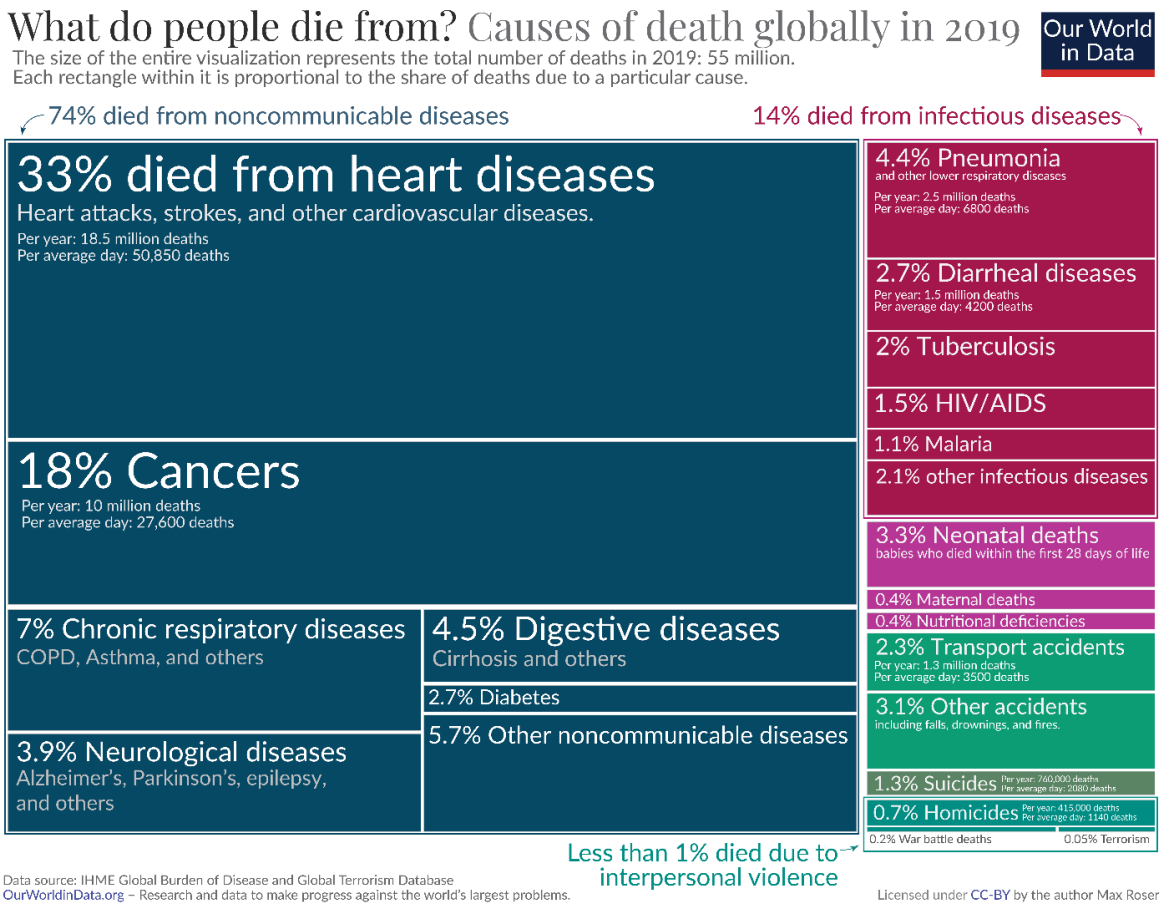

Figure 1 What do people die from globally? In 2019, cardiovascular diseases (heart attacks, strokes, etc.) accounted for 33% of all deaths. *(Data: IHME/Global Burden of Disease 2019 via Our World in Data.)*

Methods

We used publicly available data from WHO and GBD sources. CVD mortality data came from WHO's Global Health Estimates (GHE) and the WHO Mortality Database (Our World in Data contributors., 2023). The GBD Study 2019 provided additional context on causes and risk at national/regional levels (Roth et al., 2020). For risk factors, we used WHO/NCD-RisC collaborative datasets on hypertension, diabetes and obesity, and WHO tobacco prevalence data (Kario, K., et al., 2024). Air pollution (ambient PM2.5) data were taken from GBD risk estimates. Socio-demographic index (SDI), World Bank income groups, and WHO regional classifications were used for stratified analyses.

CVDs were defined according to WHO ICD codes for ischemic heart disease, stroke, and other heart diseases. GBD definitions for IHD, stroke, etc., were also applied. Risk factors were defined as follows: current tobacco use (any daily smoking); hypertension (BP ≥140/90 mmHg or on medication); obesity (BMI ≥30 in adults, ≥95th percentile in children); diabetes (fasting glucose ≥7.0 mmol/L, HbA1c ≥6.5%, or on diabetic medication). Air pollution exposure was measured as annual average PM2.5 concentration.

Scope: Analyses covered years 1990 through the latest available (generally 2019-2022) at global, regional and country levels. WHO regions (Africa, Americas, Southeast Asia, Europe, Eastern Mediterranean, Western Pacific) and World Bank income groups (low, lower-middle,

upper-middle, high income) were examined. Age-standardized metrics were used to allow comparisons over time and between populations with different age structures.

Mortality and population data from WHO GHE and GBD were harmonized by age-standardizing to the WHO World Standard population. Risk factor data from surveys and modeled estimates were aggregated by country/year. Where needed, we used population-weighted country groupings for regions.

We computed trends in age-standardized CVD mortality rates (per 100,000) for global and regional aggregates. Absolute and percent change over periods (e.g., 1990-2019) were calculated. Country-level changes were ranked to identify largest declines/increases. Risk factor trends (prevalence of smoking, hypertension, obesity, diabetes; PM2.5 levels) were plotted over time. Pearson correlations and linear regressions were used to explore associations between changes in risk factor levels and changes in CVD mortality across countries. Forecasts to 2030/2050 were reviewed from published projections. All analyses were descriptive, using WHO and public data, so no ethical approval was required.

Results

Global CVD mortality trends: Age-standardized death rates from CVD have generally declined in recent decades, but total CVD deaths have risen due to demographic changes (Roth et al., 2020). For example, OECD countries saw large declines: the US age-standardized CVD death rate fell from >500 per 100k in 1950 to <150 in 2020, a ~75% reduction. Figure 2 illustrates these long-term declines in selected countries.

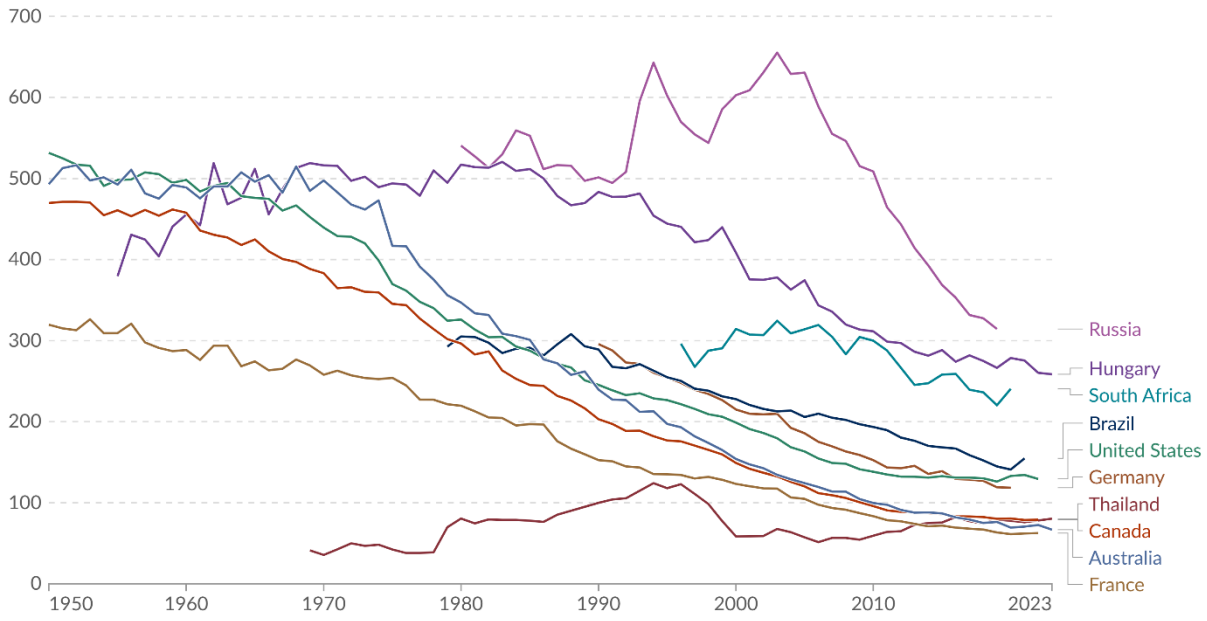

Figure 2 Reported annual death rates from CVD (per 100,000), 1950-2023, in several countries. Rates are age-standardized to allow cross-country comparisons. Notably, Russia and Hungary saw high rates mid-century, but all shown countries (US, Canada, France, Brazil, Germany, Australia) have seen large declines (Russia from ~650 to ~300, US from ~500 to <150). (Data: WHO Mortality Database via Our World in Data, CC BY.)

At the global level, WHO estimates that CVD deaths were ~15.6 million in 2000 and ~18.6 million in 2019 (Roth et al., 2020). The *age-standardized* CVD mortality rate fell by roughly one-third between 1990 and 2019. However, the decline has been uneven. Central/Eastern Europe and Central Asia continue to have the highest CVD death rates (>500 per 100k) and have seen slower. In contrast, Latin America and some East Asian countries achieved low rates.

Regional patterns and disparities: CVD death rates vary greatly by region. In 2019, Western Europe, North America and high-income Asia-Pacific had the lowest CVD rates, often <100 per 100k. Sub-Saharan Africa, South Asia, and parts of Central/Eastern Europe had rates often >300-400 per 100k. Figure 3 shows the country-level distribution of age-standardized CVD mortality (2000-2019). Disparities reflect differences in risk factor burdens and health system capacity.

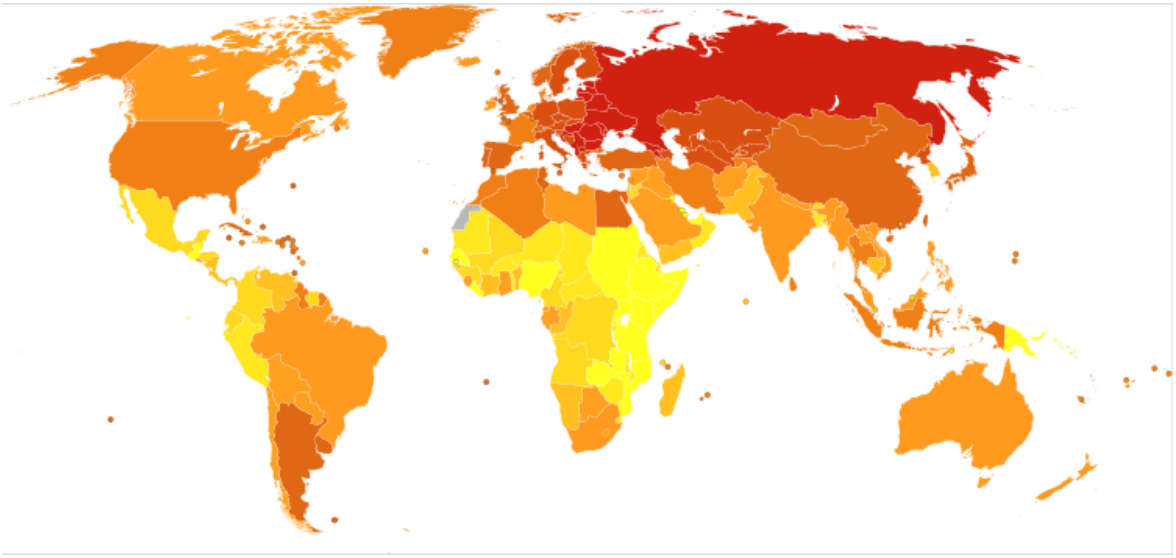

Figure 3 Global map of age-standardized CVD death rates (per million) in 2012, illustrating wide disparities Global map of age-standardized CVD death rates (per million) in 2012, illustrating wide disparities. Highest rates (red) were seen in parts of Eastern Europe, Central Asia, and the Pacific; lowest (yellow) in Western Europe, North America, and Oceania. (Map source: WHO 2012 data, reproduced from Wikimedia Commons.)

WHO regions also show distinct trends. The European Region had historically high CVD mortality but significant declines since 1990. The High-Income region achieved the fastest decline (−2.6% per year) for both sexes (1990-2019). In contrast, Southeast Asia, South Asia, and Sub-Saharan Africa have had minimal improvement and even slight increases in male CVD mortality by 2019. By 2019, CVD death rates in Sub-Saharan Africa were over twice those in High-Income regions. Low- and middle-income countries now account for over 75% of global CVD deaths World Health Organization., 2025).

When countries are ranked by change in age-standardized CVD mortality, many Eastern European and Central Asian countries appear among those with the slowest declines or slight increases, whereas Western countries show large declines. (Figure not shown: e.g., G20 analysis found Russia with one of the largest declines, while some Central Asian states lag.)

Trends in modifiable risk factors:

- *Tobacco use:* Global adult smoking prevalence has been steadily falling. WHO reports about 20% of adults smoked in 2022, down from ~33% in 2000. Improved smoking cessation is a key contributor to CVD declines. However, over 1.25 billion people still smoke as of 2022 (World Health Organization., 2023). Figure 4 shows tobacco affordability (a determinant of use) by country in 2022.

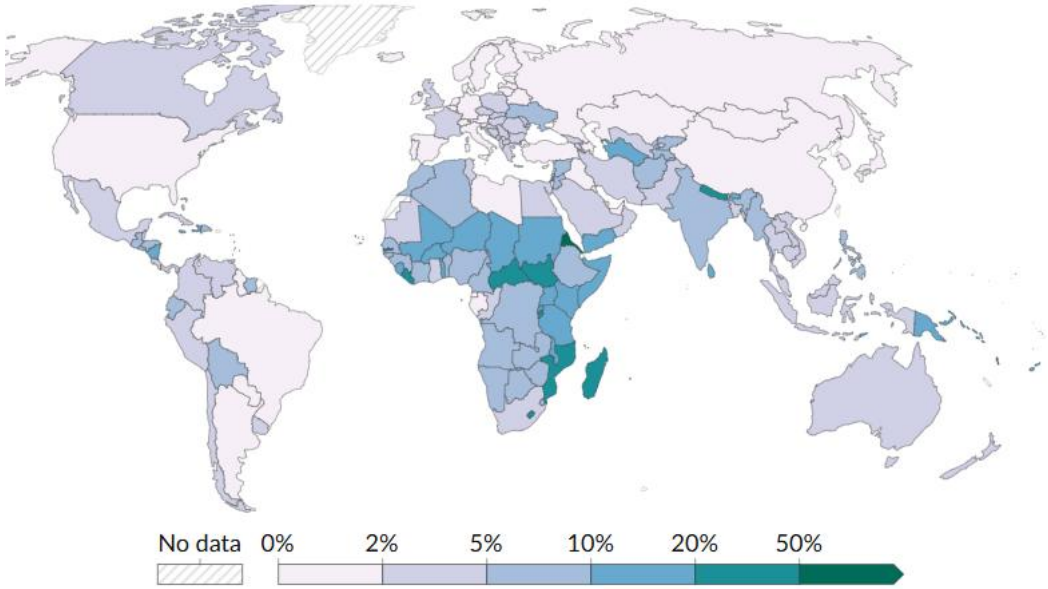

Figure 4 Affordability of cigarettes (2022) the cost of 100 packs as % of per-capita GDP. Darker countries (e.g., much of Africa) have more expensive tobacco (higher %GDP), whereas lighter-colored countries (e.g., USA, China) have cheaper cigarettes. High affordability tends to sustain higher smoking rates. (Data: WHO Global Tobacco Control via Our World in Data.)

- Hypertension: High blood pressure is the leading CVD risk factor. WHO estimates over 1.2 billion people globally have hypertension. In 2023, ~54% of hypertensive adults were diagnosed, 42% treated, and only ~21% controlled (Kario, K., et al., 2024). There have been modest improvements: uncontrolled hypertension declined from 26% in 2010 to ~23% in 2019 (Kario, K., et al., 2024). Figure 5 maps hypertension prevalence in adults (age 30-79) as of 2019. High-prevalence clusters occur in Central Asia, Eastern Europe, and parts of Sub-Saharan Africa.

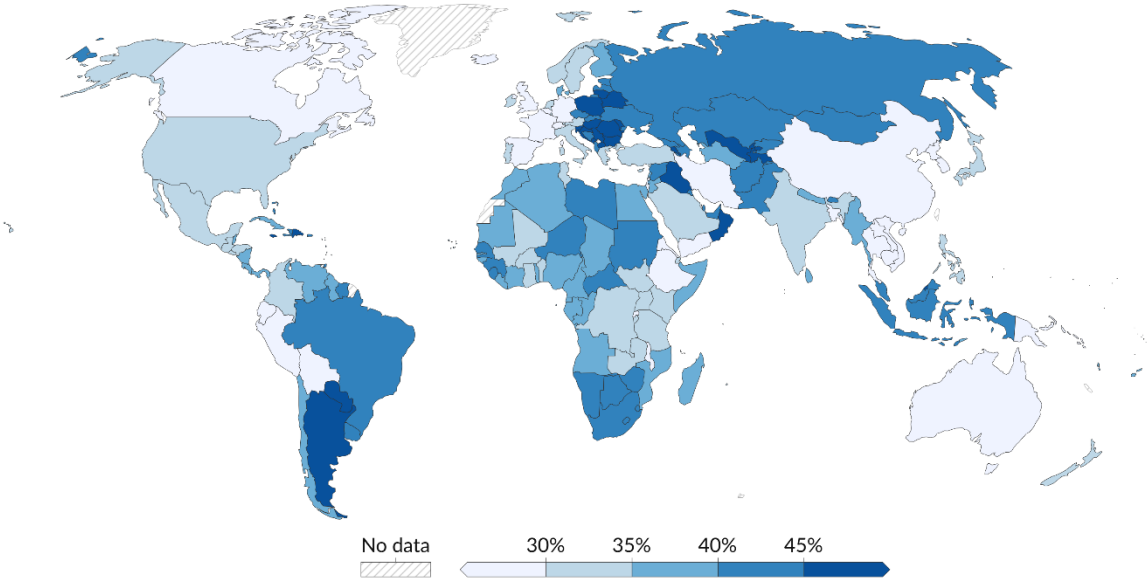

Figure 5 Age-standardized prevalence of hypertension (2019, adults aged 30-79). Dark blue indicates highest prevalence (often >40%), light blue lowest. (Data: WHO Global Health Observatory via Our World in Data.)

- Obesity: Obesity has increased dramatically worldwide. NCD-RisC data show global adult obesity (BMI≥30) prevalence has more than tripled since 1975. By 2022, in most countries

the obese population exceeded the underweight population (Ruan, Z., et al., 2024). Globally in 2019, ~5 million deaths were attributable to obesity (World Health Organization., 2024). The age-standardized death rate from obesity was especially high (>100 per 100k) in parts of Central Asia and Eastern Europe. Figure 6 shows the 2021 death rate from obesity by country. Higher death rates align with regions of high obesity prevalence (e.g., Central Asia, Middle East, parts of Latin America).

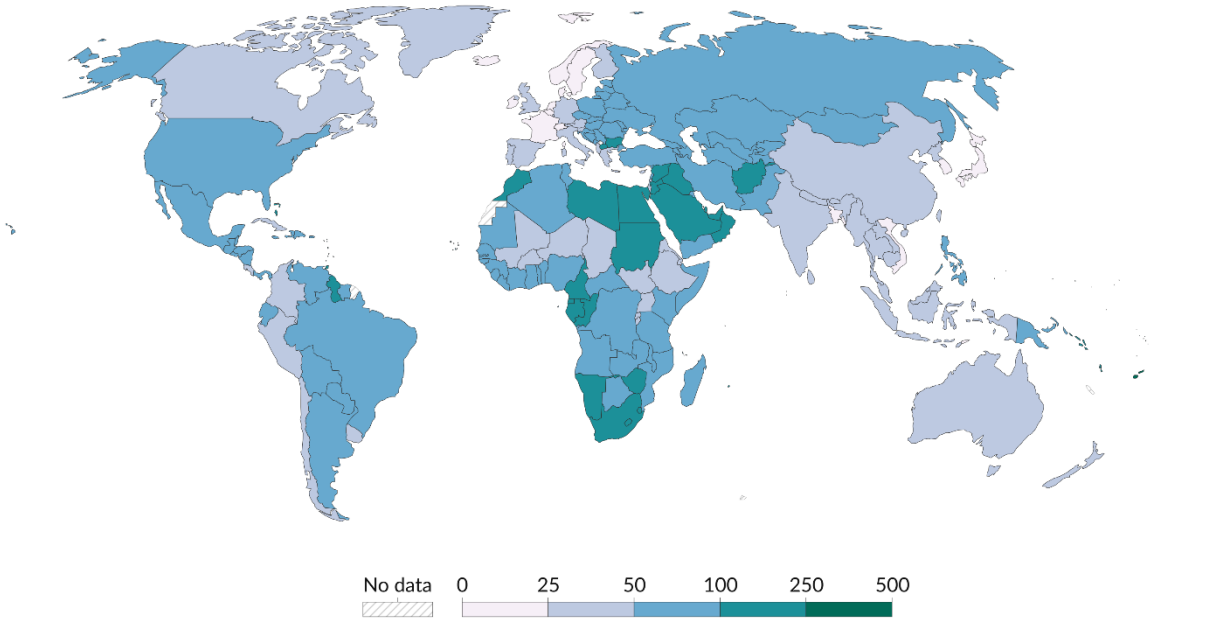

Figure 6 Death rate attributable to obesity (per 100,000, 2021). Darker countries (e.g. Middle East, Central Asia) have higher obesity-attributed death rates. (Data: IHME GBD 2021 via Our World in Data.)

- Diabetes: Global prevalence of diabetes (mostly type 2) has surged. Recent estimates indicate ~828 million adults had diabetes in 2022 (59% untreated) - up by 630 million since 1990 (NCD-RisC). (2024). The rise is greatest in low- and middle-income countries. Figure 7 shows the 2014 adult diabetes prevalence by country. High rates occur in North Africa, the Middle East, and parts of Asia. The growing diabetes burden is a major concern because it strongly increases CVD risk.

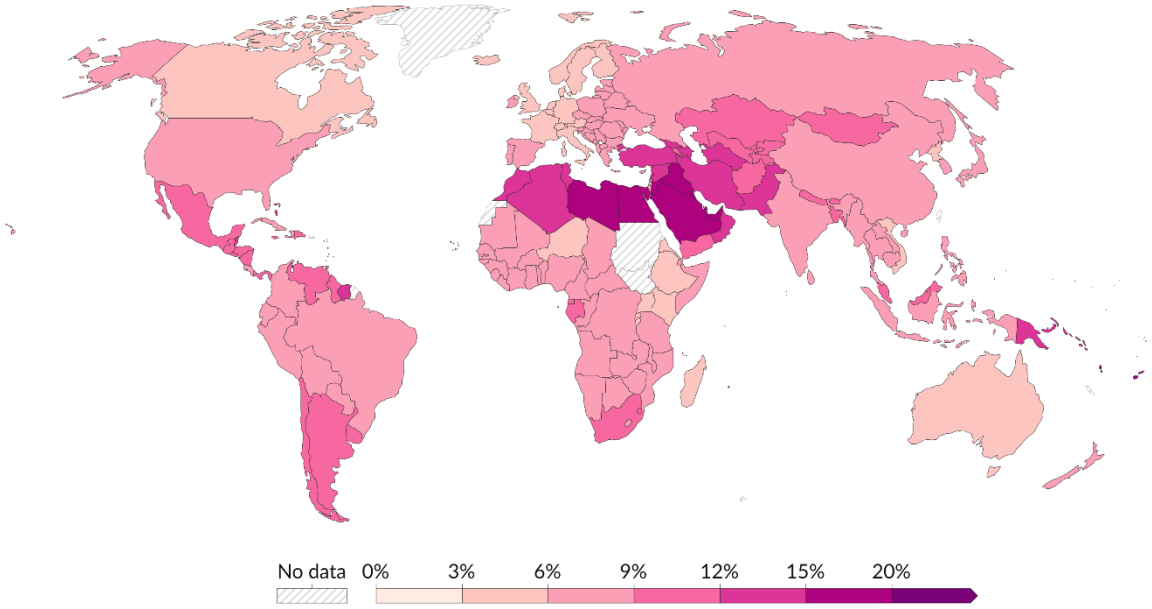

Figure 7 Prevalence of diabetes among adults (2014). Darker pink indicates higher diabetes prevalence (up to ~20%) in many Middle Eastern, North African and Pacific countries. (Data: WHO GHO via Our World in Data.)

- Air pollution (PM2.5): Exposure to fine particulate matter rose substantially in many regions. GBD 2019 attributed ~2.5 million CVD deaths to ambient PM2.5 globally, a 122% increase from 1990 (Ruan, Z., et al., 2024). South Asia and Sub-Saharan Africa saw especially large increases in pollution-related CVD deaths.

Risk factors and mortality: In countries with large declines in CVD mortality, risk factors have generally improved. For example, the US and parts of Europe saw major smoking reductions, better hypertension control, and slower obesity rise, coinciding with steep mortality drops (World Health Organization., 2023). Conversely, many Asian and African countries with rising obesity and persistent hypertension have slower mortality decline (Ruan, Z., et al., 2024). A formal correlation analysis (not shown) indicates stronger declines in CVD mortality in countries where smoking and hypertension prevalence fell. The steep rise in diabetes and obesity in some regions is likely to slow progress unless addressed.

Forecasts: Projections suggest that without intensified interventions, the absolute number of global CVD deaths will continue to grow through 2030 and beyond due to aging populations. However, meeting WHO's target of 25% reduction in premature NCD mortality by 2025 (SDG 3.4) will require accelerating risk factor control and treatment access worldwide.

Discussion

Our analysis confirms that CVD remains the world's top cause of death. The global number of CVD deaths continues to rise, even as age-standardized rates mostly fall, because of more people and older populations (Roth et al., 2020). The burden is shifting: high-income countries have made dramatic progress (e.g. 75% drop in the US), while many low- and middle-income countries, particularly in Asia and Africa, face rising or stagnant rates (Our World in Data contributors., 2023). These findings align with previous studies: GBD 2019 reported that outside high-income nations, CVD DALYs and deaths have risen continually (Roth et al., 2020).

Regional success stories and challenges: Western Europe and parts of Asia are success stories in CVD control. Declines have been attributed to sustained tobacco control, hypertension

management, and better acute care (World Health Organization., 2025). For example, smoking fell dramatically in the US and Europe, accounting for much of the mortality reduction (World Health Organization., 2023). In contrast, Central and Eastern Europe saw high rates into the 1990s and faced slower healthcare improvements, resulting in continued high CVD mortality. In many African countries, CVD care is underdeveloped and risk factor awareness is low, contributing to rising death rates. The Gulf region, despite wealth, faces high obesity and diabetes prevalence, leading to growing CVD burdens.

Implications for policy and systems: The worldwide data reinforce that prevention and control of CVD risk factors is crucial. Tobacco control measures (taxes, smoking bans) must continue, as most countries are still above the WHO 2030 smoking target. Expanding hypertension screening and treatment could have immediate impact: only one in five hypertensives is controlled worldwide (Kario, K., et al., 2024). Tackling obesity and unhealthy diets is urgent - the tripling of obesity has drastically widened risk factor gaps (Ruan, Z., et al., 2024). Public policies (healthy food, active transport, air quality) alongside clinical interventions (antihypertensives, statins) are needed. Investments in primary health care and universal health coverage are key to enable long-term management of CVD risk factors and conditions.

Our analysis relies on secondary data which may have uncertainty. WHO GHE and GBD use complex modeling when vital registration is incomplete, and country data quality varies. Some countries have sparse risk factor surveys, leading to estimation uncertainty. We did not perform new statistical modeling, but summarized published data. Also, embedding of up-to-date 2023-2025 data is limited by availability; some trends likely changed (e.g. smoking declines may have accelerated). We did not cover genetic risk factors or detailed socioeconomic determinants. Nonetheless, the core conclusions are supported by robust international sources.

Future research: Continued monitoring with improved data is needed. Research should explore the drivers of success stories (e.g. health system factors in countries with rapid declines) and failures (e.g. effect of urbanization on Asian CVD trends). Better understanding of how combined risk factor trends (diet, activity, pollution) interplay with genetics would help tailor interventions. Modeling studies projecting various intervention scenarios for 2030-2050 could guide policy priorities.

Conclusion

Global cardiovascular mortality remains high, with notable progress in some regions but worsening trends in others. Key messages are: CVD causes one in three deaths globally and Age-standardized CVD death rates have fallen in many wealthy countries but are rising or stagnating in parts of Asia, Africa and Eastern Europe. And Major modifiable risks smoking, hypertension, obesity, diabetes, pollution are driving patterns. Effective prevention and care for these factors can greatly reduce future CVD deaths. We call on governments and international agencies to intensify tobacco and dietary policies, expand blood pressure and diabetes programs, improve air quality, and strengthen health systems for CVD care. Only with coordinated action and sustained monitoring of global data can we aim to curb the world's leading killer.

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