

The Global Burden of Disease Study and the Preventable Burden of NCD



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ABSTRACT

Noncommunicable diseases (NCD) now account for more than one-half of the global burden of disease. Cardiovascular diseases account for about one-half of NCD deaths, and the majority of cardiovascular disease deaths occur in low- and middle-income countries. The GBD (Global Burden of Disease) study measures and benchmarks health loss from death or disability from more than 300 diseases in over 100 countries. According to GBD analyses, the rise of NCD is in part due to increased life expectancy due to reduced premature mortality from communicable, child, and maternal illnesses, but preventable risk factors also contribute and present targets for NCD control efforts. In addition to traditional NCD risk factors, like tobacco smoking, high blood pressure, and unhealthful diet, nontraditional risk factors like air pollution and unhealthful alcohol consumption also play a role. The GBD study continues to grow by gathering more data from country partners than ever before, and by measuring health at the national and subnational levels and in smaller time increments. The GBD study will continue to provide the data to set priorities for and measure progress in the global effort to control the rising burden of NCD.

The constitution of the World Health Organization (WHO) states that “the highest attainable standard of health is one of the fundamental rights of every human being” [1], a principle shared by all people who care about protecting and maximizing human health, longevity, and well-being. The WHO constitution also states that population health is the responsibility of governments. However, without accurate health data, society may recognize important health threats too late and fail to direct adequate resources toward important causes of death or disability in its population. Without comprehensive health measurement, diseases lacking strong advocacy may be underappreciated and neglected. Since the 1990s, the GBD (Global Burden of Disease) study has aimed to align health systems’ priorities with the health needs of the populations they serve. The GBD measures death and disability from more than 300 diseases and injuries in over 100 countries around the world. The study’s strengths are common health metrics for all diseases; epidemiologic, spatial, and temporal comprehensiveness; corrections for known biases; and transparent reporting on uncertainty and gaps in current knowledge. The GBD primary health metric is the disability-adjusted life year (DALY), which combines health loss due to premature death and health loss due to nonfatal disability from a specific cause into a single number that is comparable across all diseases, countries, and time periods. Starting in 2013, GBD investigators made a commitment

to update global disease burden estimates on an annual basis.

THE GLOBAL BURDEN OF NONCOMMUNICABLE DISEASES

Noncommunicable diseases (NCD) now account for more than one-half of global health loss—fatal and nonfatal conditions combined—with NCD accounting for a larger proportion of health loss compared with 1990 (Fig. 1) [2].

NCD are also an important cause of premature deaths. Of the 54.9 million deaths worldwide in 2013, about 70% (38.3 million) were attributed to NCD, whereas 57% were attributed to NCD in 1990 [3]. NCD are not only a high-income country problem: in fact, about 80% of premature NCD deaths occur in low- and middle-income countries [4].

The GBD has documented that shifts to more NCD deaths and a larger proportion of deaths attributable to NCD are due to an aging world population and to steeper declines in deaths due to communicable, maternal, neonatal, and nutritional causes [3]. Age-standardized rates of cardiovascular disease and cancer deaths have overall decreased in high-income regions, but the number of life-years lost from these causes has grown globally due to population growth and aging. Age-standardized death rates have increased since 1990 for atrial fibrillation and flutter,

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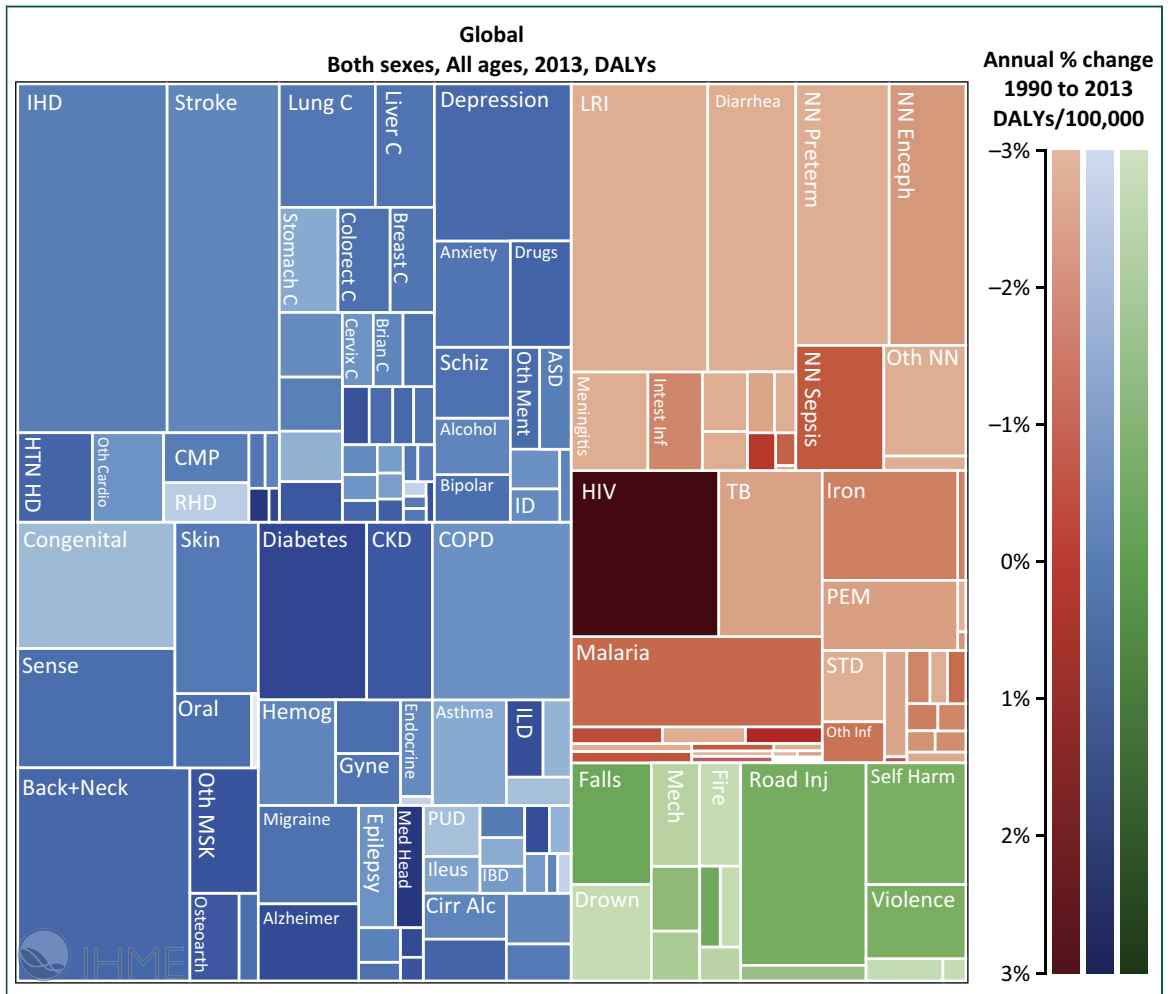


FIGURE 1. Global DALYs for GBD level 3 causes from 2013. Within this tree map, the size of the rectangle for each cause is proportional to the magnitude of the DALYs for each cause. Dark shading shows statistically significant changes, and light shading shows changes that are not significant. Alcohol, alcohol use disorders; Alzheimer’s, Alzheimer disease and other dementias; Anxiety, anxiety disorders; Back and neck, low back and neck pain; Bipolar, bipolar disorder; Breast C, breast cancer; Cirr alc, cirrhosis due to alcohol use; Cirr hep C, cirrhosis due to hepatitis C; CKD, chronic kidney disease; CMP, cardiomyopathy and myocarditis; Colorectal C, colon and rectum cancer; Congenital, congenital anomalies; COPD, chronic obstructive pulmonary disease; DALY, disability-adjusted life-years; Depression, depressive disorders; Diabetes, diabetes mellitus; Diarrhea, diarrheal diseases; Disaster, exposure to forces of nature; Drugs, drug use disorders; Fire, fire, heat, and hot substances; GBD, Global Burden of Disease; Haemog, hemoglobinopathies and hemolytic anemias; HTN HD, hypertensive heart disease; IHD, ischemic heart disease; ILD, interstitial lung disease and pulmonary sarcoidosis; Iron, iron-deficiency anemia; Liver C, liver cancer; LRI, lower respiratory infections; Lung C, tracheal, bronchus, and lung cancer; Mech, exposure to mechanical forces; Nematode, intestinal nematode infections; NN enceph, neonatal encephalopathy due to birth asphyxia and trauma; NN haemol, hemolytic disease and other neonatal jaundice; NN preterm, pre-term birth complications; NN sepsis, neonatal sepsis and other neonatal infections; Oral, oral disorders; Other MSK, other musculoskeletal disorders; Other NN, other neonatal disorders; PEM, protein-energy malnutrition; RHD, rheumatic heart disease; Road inj, road injuries; Sense, sense organ diseases; Skin, skin and subcutaneous diseases; STD, sexually transmitted diseases excluding human immunodeficiency virus; Stroke, cerebrovascular disease; TB, tuberculosis; Violence, interpersonal violence; War, collective violence and legal intervention; Whooping, whooping cough. Reproduced with permission from Murray CJ, Barber RM, Foreman KJ, et al., for the GBD 2013 DALYs and HALE Collaborators. Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990–2013: quantifying the epidemiological transition. Reproduced with permission from Institute for Health Metrics and Evaluation (IHME). GBD Compare Data Visualization. Seattle, WA: IHME, University of Washington, 2016. Available at: <http://vizhub.healthdata.org/gbd-compare>.

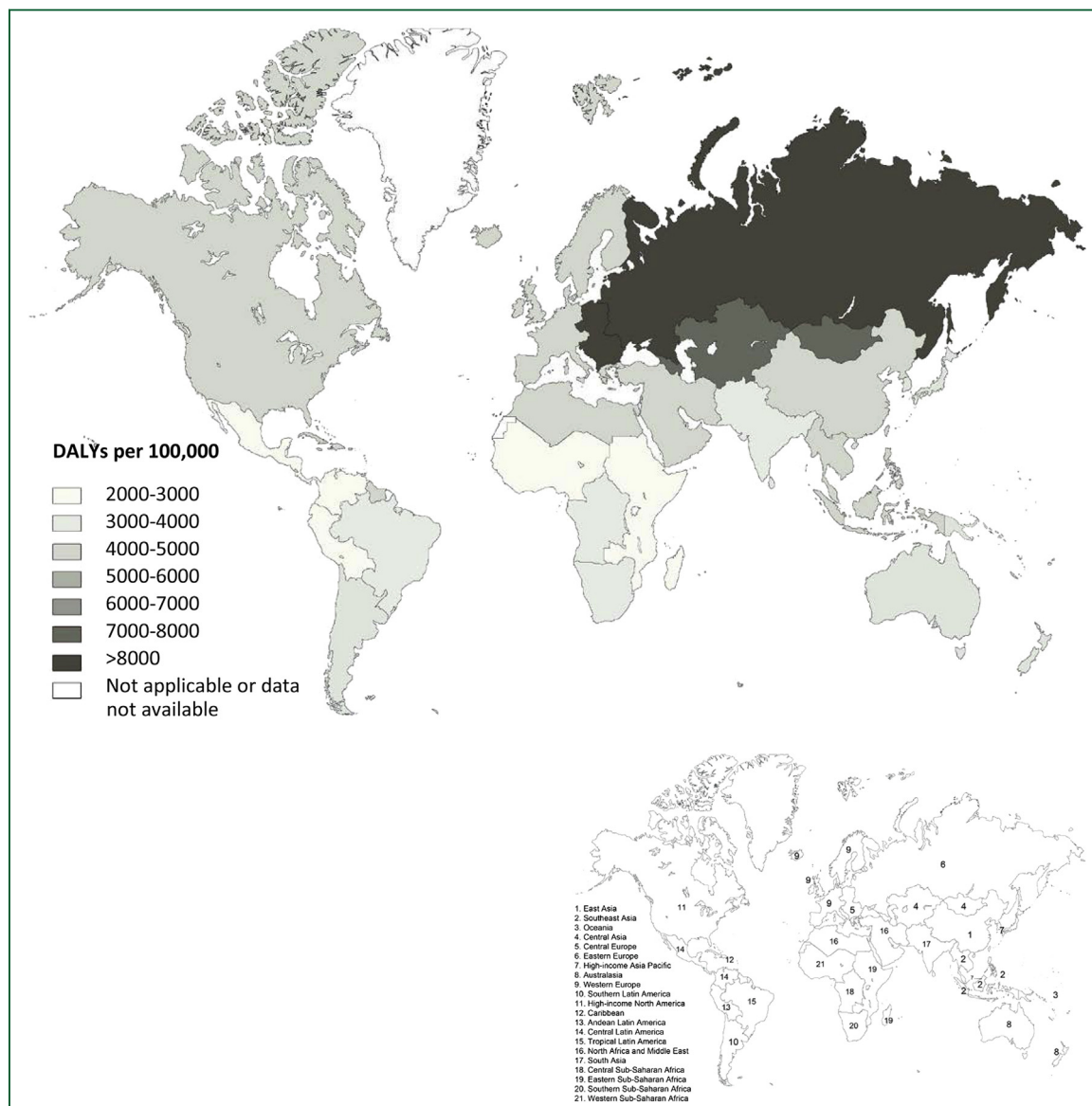


FIGURE 2. Age standardized cardiovascular disease disability-adjusted life years (DALYs) lost per 100,000 in 21 Global Burden of Disease study regions, 2010. Reproduced with permission from the *Global Heart Atlas of CVDs*, March 2014.

diabetes, and chronic kidney disease, which may represent improved awareness and case-finding for these often occult conditions.

THE GLOBAL BURDEN OF CARDIOVASCULAR DISEASES AND THEIR RISK FACTORS

Cardiovascular diseases account for one-half of all NCD deaths in the world, and nearly 70% of cardiovascular disease deaths occur in low- and middle-income countries. Cardiovascular diseases are the leading cause of death in every region of the world, with the exceptions of sub-Saharan Africa—where infectious diseases are still the leading cause

of death—and South Korea and Japan, where cancers cause more deaths. The highest per capita cardiovascular disease burden falls upon the Eastern Europe and Central Asia regions (Fig. 2). In South Asia, North Africa, and the Middle East, the absolute burden of cardiovascular diseases is high and more often affects young, working-age adults.

With the exception of human immunodeficiency virus disease, the burden of most communicable diseases has decreased since 1990. By contrast, the burden due to NCD, and in particular cardiovascular diseases, has increased (Fig. 3).

Traditional risk factors responsible for global cardiovascular disease burden—dietary risks, high blood

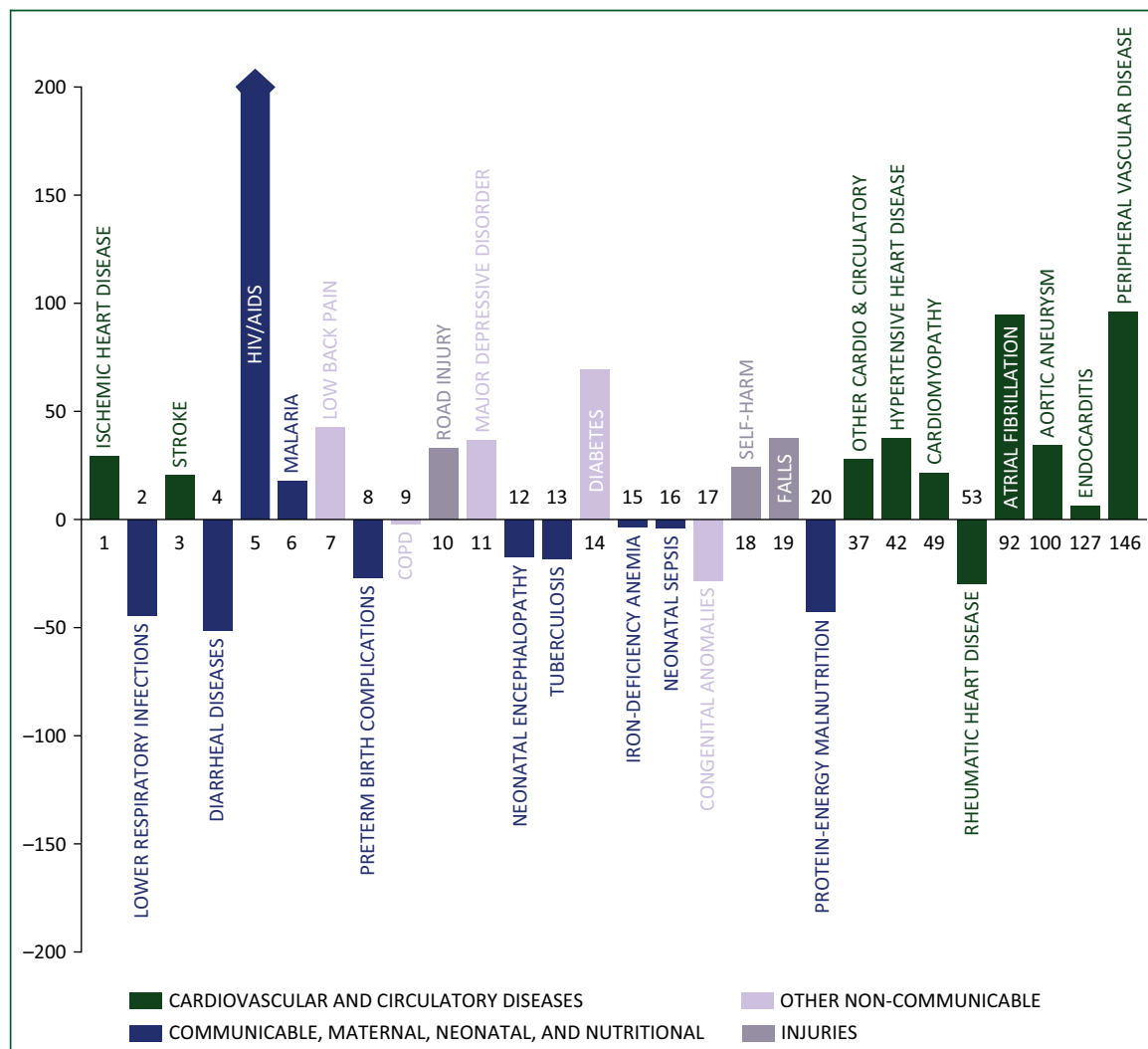


FIGURE 3. Cardiovascular diseases in comparison with other leading causes of loss of disability-adjusted life years (DALYs), global percent change, 1990 to 2010. COPD, chronic obstructive pulmonary disease; HIV/AIDS, human immunodeficiency virus/acquired immunodeficiency syndrome. Reproduced with permission from the *Global Heart Atlas of CVDs*, March 2014.

pressure, and tobacco smoking—are leading risk factors across all world regions (Fig. 4). Certain risk factors emerge as significant causes of disease burden only in particular regions. Outdoor (ambient) and indoor air pollution are important causes of cardiovascular disease burden in East and South Asia. Unhealthy alcohol consumption appears to contribute significantly to cardiovascular disease burden in Eastern Europe.

POLICY IMPLICATIONS OF THE GROWING NCD BURDEN

The GBD study harnesses a growing body of historical and real-time health data and analytic innovations that represent more efficient and accurate worldwide disease surveillance than ever before. The hope underlying the GBD

enterprise is that if governments and nongovernmental organizations have comprehensive data on all diseases, they will prioritize policies so as to extend healthful years of life for their population and eliminate inequities in health and access to quality health care and prevention. The majority of preventable NCD burden falls on low- and middle-income countries; at the same time, NCD are increasingly diseases of low-income individuals living in high-income countries, who are more often exposed to unhealthful diets and alcohol consumption, tobacco smoke, indoor and ambient air pollution, and environments that discourage physical activity.

GBD findings of a shift toward more health loss due to NCD should sound an alarm for health system planners, especially in countries and regions that have focused predominantly on communicable, maternal, child, and

Risk factors for cardiovascular and circulatory diseases, ranked by DALYs, 2010, both sexes

	Global	Asia Pacific/ High Income	Asia, Central	Asia East	Asia Southeast	Australasia	Europe, Central	Europe, Eastern	Europe, Western	Latin America/ Caribbean	North Africa/ Middle East	North America, High Income	South Asia	Sub-Saharan Africa
Dietary risks	1	1	1	1	1	1	2	1	1	1	1	1	1	2
High blood pressure	2	2	2	2	2	2	1	2	2	2	2	2	2	1
Tobacco smoking	3	3	4	3	3	6	4	4	5	4	4	6	4	4
Ambient particulate matter pollution	4	3	6	4	5	9	7	9	7	10	6	8	5	6
High body mass index	5	7	3	9	8	3	3	3	3	3	3	3	10	5
Physical inactivity and low physical activity	6	4	5	6	6	4	5	7	6	5	5	4	6	7
Household air pollution from solid fuels	7	10	9	5	4	N/A	8	11	N/A	8	10	N/A	3	3
High total cholesterol	8	6	8	8	7	5	6	6	4	6	7	5	8	10
High fasting plasma glucose	9	8	7	7	9	7	9	8	8	7	8	7	7	8
Alcohol use	10	11	11	10	11	10	11	5	10	11	11	10	11	11
Lead exposure	11	9	10	11	10	8	10	10	9	9	9	9	9	9

FIGURE 4. Risk factors for cardiovascular and circulatory diseases, ranked by disability-adjusted life years (DALYs), 2010. DALY, disability-adjusted life year. Reproduced with permission from the *Global Heart Atlas of CVDs*, March 2014.

nutritional diseases. The future burden of NCD will not be reversed unless inequities in life-style habits and health care access within country borders are remedied. Addressing the NCD burden will require countries to train or retrain health care providers to prevent and treat NCD; educate the public about causes, signs, and symptoms of NCD; work across government agencies and industry to minimize nutritional and environmental risks; provide infrastructure for screening of pre-clinical and treatment of acute and chronic phase NCD; ensure financial protection for patients through universal health insurance; and negotiate for low-cost essential treatments. With strategic reallocation of resources, implementation and enforcement of government regulations, holding to a high quality standard for clinical care, and ensuring equitable distribution of these measures, meeting the challenge of the growing burden of NCD need not place overwhelming demands on health care spending.

The WHO Global Action Plan for the Prevention and Control of NCD (2013 to 2020) (resolution WHA66.10), described in other papers in this issue of *Global Heart*, marks the world's first coordinated global effort to reduce global NCD burden, including cardiovascular diseases, cancer, chronic lung disease, and diabetes mellitus. The Action Plan's targets include a reduction in premature mortality from each NCD by 25% by 2025 as well as implementation of a monitoring framework with 25 indicators to track mortality and morbidity, assess progress in addressing risk factors, and evaluate the implementation of national strategies and plans [5]. The GBD investigators projected that controlling tobacco use, diabetes, and obesity, and lowering blood pressure according to WHO targets would achieve the 25% NCD premature mortality reduction target by 2025 [6].

THE GLOBAL BURDEN OF DISEASE STUDY AND THE FUTURE OF GLOBAL NCD CONTROL

At the inception of the GBD study, critics decried the study's willingness to estimate disease burden for world regions with sparse epidemiological data, a consequence of

fulfilling its mandate to measure health loss in all regions worldwide [7]. In the over 2 decades since, health data have improved, as have GBD methods, including a determination to describe uncertainty and knowledge gaps explicitly [8]. Ending health inequities requires spatial specificity, so the GBD has progressed toward measuring health in small areas and populations: by now, GBD estimates burden at the national, and in some cases, subnational levels. The future GBD study has the potential to link epidemiological surveillance with health program evaluation, first projecting possible health gains with "scaling up" promising policies and interventions, then assessing health gains of programs implemented in populations. The GBD study serves as a global health observatory, and will mark the world's progress in implementing NCD control programs over time and by region, country, and community.

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