

The Global Burden of Cardiovascular Diseases, 1990–2010

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Cardiovascular diseases (CVD), principally ischemic heart disease and stroke, remain the leading cause of mortality worldwide and a major contributor to disability and rising healthcare costs [1–4]. In 2010 alone, CVD was a primary cause of 15.6 million global deaths [1] and an estimated US\$863 billion in direct healthcare costs and productivity losses worldwide [5]. In fact, these costs are projected to reach US\$20 trillion by the year 2030 [5]. In spite of this huge toll on global health and development, reports from the Institute of Medicine, the World Heart Federation, and the World Health Organization state that CVD is rarely on the global health agenda and is not highly prioritized by policy makers, development aid agencies, and leading foundations, especially in reference to health in low- and middle-income countries (LMIC) [6–9].

An important first step in tackling this global CVD epidemic is to determine the magnitude of the disease and risk factor burden at the regional and local population levels and to inform strategies for CVD and CVD risk factor prevention, treatment, and control [8,9]. Publication of the GBD (Global Burden of Diseases, Injuries, and Risk Factors) 2010 study findings in 2012 provided a consistent and comparable methodology for assessing disease burden from 235 causes of death (including 9 CVD causes) for 20 age groups in 1990 and 2010 [1,2,10]. Since that time, the GBD 2010 Cardiovascular Diseases Expert Groups have published the methodology for systematic reviews and epidemiological estimates of disease incidence, prevalence, case fatality, as well as mortality and disability-adjusted life years (DALY) for several CVD causes of disease burden [11–18]. In this issue of *Global Heart*, we extend this work by presenting together in one issue additional details and analyses on ischemic heart disease (IHD) [19], hemorrhagic stroke [20], ischemic stroke [21], atrial fibrillation [22], myocarditis [23], infective endocarditis [24], abdominal aortic aneurysm [25,26], and peripheral arterial disease [27].

For IHD, Moran et al. [19] demonstrate that in 2010, nearly two-thirds of global IHD DALY occurred in middle-income countries. In the North Africa/Middle East and South Asia regions, the mean age at onset of IHD events was <50 years old in more than 29% of male and 24% of female subjects. Although age-standardized IHD DALY decreased in most countries between 1990 and 2010, they increased in the Eastern Europe/Central Asia and South Asia regions. Importantly, age-standardized DALY varied substantially by country within regions, especially among middle-income countries. This variation in IHD DALY was highest—up to 8-fold—in middle-income countries, and was lowest in high-income countries.

Krishnamurthi et al. [20] examined trends in hemorrhagic stroke and showed a 47% increase in the absolute number of cases worldwide from 1990 to 2010. The LMIC contributed 80% of incident cases, 63% of deaths, and 86% of DALY lost. The highest rates of incident hemorrhagic stroke were seen in LMIC regions, especially in Sub-Saharan Africa and East Asia, whereas the lowest rates occurred in High-Income North America and Western Europe [20]. The findings for ischemic stroke in LMIC were just as ominous as those for hemorrhagic stroke [21]. Overall, the LMIC contributed 63% of incident cases, 57% of deaths, and 64% of DALY lost worldwide. Tobacco use was an important risk factor for ischemic stroke, and China, Russia, and India ranked highest in both 1990 and 2010 for ischemic stroke deaths attributable to tobacco consumption [21].

Chugh et al. [22] explored the differences in atrial fibrillation burden between developing and developed countries and showed that overall, the burden of atrial fibrillation is greater in the high-income countries; however, the mortality associated with atrial fibrillation in women is higher in LMIC. Sampson et al. [27] also showed that the global burden of lower extremity peripheral arterial disease has increased over the last 20 years, especially among women, and that the disease is increasingly being seen in younger age groups. Additionally, the increases in peripheral arterial disease burden in LMIC exceed the increases in developed countries [27]. In contrast, global prevalence, incidence, and mortality rates for abdominal aortic aneurysm have decreased consistently over the last 20 years [26]. However, these global trends mask important regional trends as seen in the Asia Pacific High-Income region where mortality for abdominal aortic aneurysm rose significantly and was largely driven by rising rates in women [26]. The substantial degree of heterogeneity within regions highlights the need for investing in and improving regional as well as country- and local-level CVD surveillance.

Cooper et al. [23] and Abdulhak et al. [24] provide the systematic review findings for myocarditis and infective endocarditis, respectively, as a basis for future global burden of disease assessments. In particular, they highlight the significant lack of ideal population-based epidemiological data in LMIC for these conditions.

The series of articles presented in this issue of *Global Heart* provides an important focus on the magnitude and trends in the global burden of CVD over the last 20 years. The findings presented here can help inform clinical and public health strategies for the prevention, treatment, and control of CVD. However, they also highlight substantial heterogeneity of findings within regions, highlighting the

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need for renewed investments in surveillance at the national and local levels to better tailor intervention strategies to the local disease burden and trends. These articles confirm that there is a disproportionate and rising burden of CVD in LMIC; that the burden is particularly prominent in MIC; and that CVD are increasingly affecting younger age groups. These patterns reflect highly complex interactions between development, demographic change, and disparities in exposures to risk factors and access to high-quality health care. These articles also provide further support for the current global call for CVD and other chronic noncommunicable diseases to be considered important developmental challenges ripe for inclusion in the post-2015 global health agenda [28].

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