1990-2010 Global Cardiovascular Disease Atlas☆

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1990-2010 GLOBAL CVD ATLAS: INTRODUCTION

The global burden of cardiovascular diseases in 2010 and changes between 1990 and 2010

Worldwide, the cardiovascular diseases (CVDs) contributing most to the total global burden of disease in 2010 were ischemic heart disease (5.2% of all disability-adjusted life years [DALYs] lost) and stroke (4.1% of all DALYs). The other major CVDs were hypertensive heart disease, cardiomyopathies, rheumatic heart disease, atrial fibrillation, aortic aneurysm, peripheral vascular disease, and endocarditis. The highest per capita CVD burden fell upon the Eastern Europe and Central Asia regions (Fig. 1). In the large populations of the South Asia and North Africa and Middle East regions, the absolute burden of CVDs is high and more often affects young, working-age adults. CVD burden declined sharply in the world's high-income regions between 1990 and 2010 (Fig. 2). For both stroke and ischemic heart disease, global age-standardized mortality has decreased, but population growth and aging have increased both the absolute number of CVD deaths and survivors suffering with the late effects of stroke or ischemic heart disease [1,2]. About two thirds of new strokes and more than 70% of stroke burden affect people younger than 75 years of age [2]. Even after adjusting for age, the atrial fibrillation prevalence and incidence increased between 1990 and 2010, and atrial fibrillation mortality about doubled over the same interval [3]. About 200 million prevalent peripheral artery disease cases were estimated for 2010: about 70% of them living in low- or middle-income countries and 55 million of them in the South Asia region [4].

Change in CVD burden compared with changes in other major diseases, 1990-2010

During 1990-2010, burden due to human immunodeficiency virus (HIV) increased more than any other single cause. Most noncommunicable diseases decreased. When viewed by proportional change in burden between 1990 and 2010, the 2 CVDs that are among the world's leading causes of death and disability—ischemic heart disease and stroke—both increased in burden (percent increase in absolute numbers of DALYs [Fig. 3]). The biggest relative increases among the CVDs were in atrial fibrillation and peripheral vascular disease burden. In keeping with the International Classification of Diseases system, heart failure was not designated as an underlying cause of disease in this analysis. Heart failure burden was captured indirectly as a sequela of several underlying diseases (including CVDs like ischemic heart disease, hypertensive heart disease, cardiomyopathies, and rheumatic heart disease).

CVD burden attributable to risk factors: Similarities and difference by world region

It comes as no surprise that classic risk factors responsible for global CVD burden—dietary risks, high blood pressure, and tobacco smoking—were leading risk factors across all world regions (Fig. 4). Tobacco smoking was ranked comparatively lower as a CVD risk factor in Australasia, Western Europe, and North America, likely due to both aggressive tobacco control measures and shifts in societal attitudes toward tobacco use in recent decades. Elsewhere, in some of the world's most populous regions like East Asia and Southeast Asia, tobacco is the third leading risk factor behind dietary risks and high blood pressure. Alcohol use ranked as the fifth leading cause of CVD burden in Eastern Europe (likely due to its association there with non-myocardial infarction ischemic heart disease and stroke, and possibly because acute alcoholic deaths were coded as cardiovascular deaths), while alcohol ranked no higher than tenth in all other regions. Ambient (outdoor) particulate matter pollution ranked particularly high (fourth) as a risk factor for CVD in East Asia. Household air pollution ranked high as a cause of CVD burden (third) in South Asia and Sub-Saharan Africa. High body mass index ranked third as a CVD risk factor not only in the Australasia, North America, European, and Central Asia regions, but also in Latin American/Caribbean and North Africa/Middle East.

Demographic drivers of regional CVD burden

Aging of the population has driven up CVD despite decreased age-standardized rates in many regions. It is well known that the populations of high-income regions, Eastern Europe, and Central Europe are aging, with 10% or more of the population aged >65 years (Fig. 5). In 2 regions with a median life expectancy of >70 years—East Asia and Latin American/Caribbean—between 5% and 10% of the population is ≥65 years of age, and these regions will experience a growing per capita burden of CVD. The combination of a young population and an average life expectancy of >70 years of age in North Africa/Middle East may lead to a growing epidemic of CVDs in coming decades in that region.

CVD prevention and control: Do health systems have the capacity to respond?

Even in regions with declining age-standardized CVD rates, the absolute burden of CVD is on the increase due to longer life expectancy and population growth. In low- and middle-income countries, CVD risk factors are often identified late in disease progression, and patients often must bear acute care and prevention costs out-of-pocket, which can be

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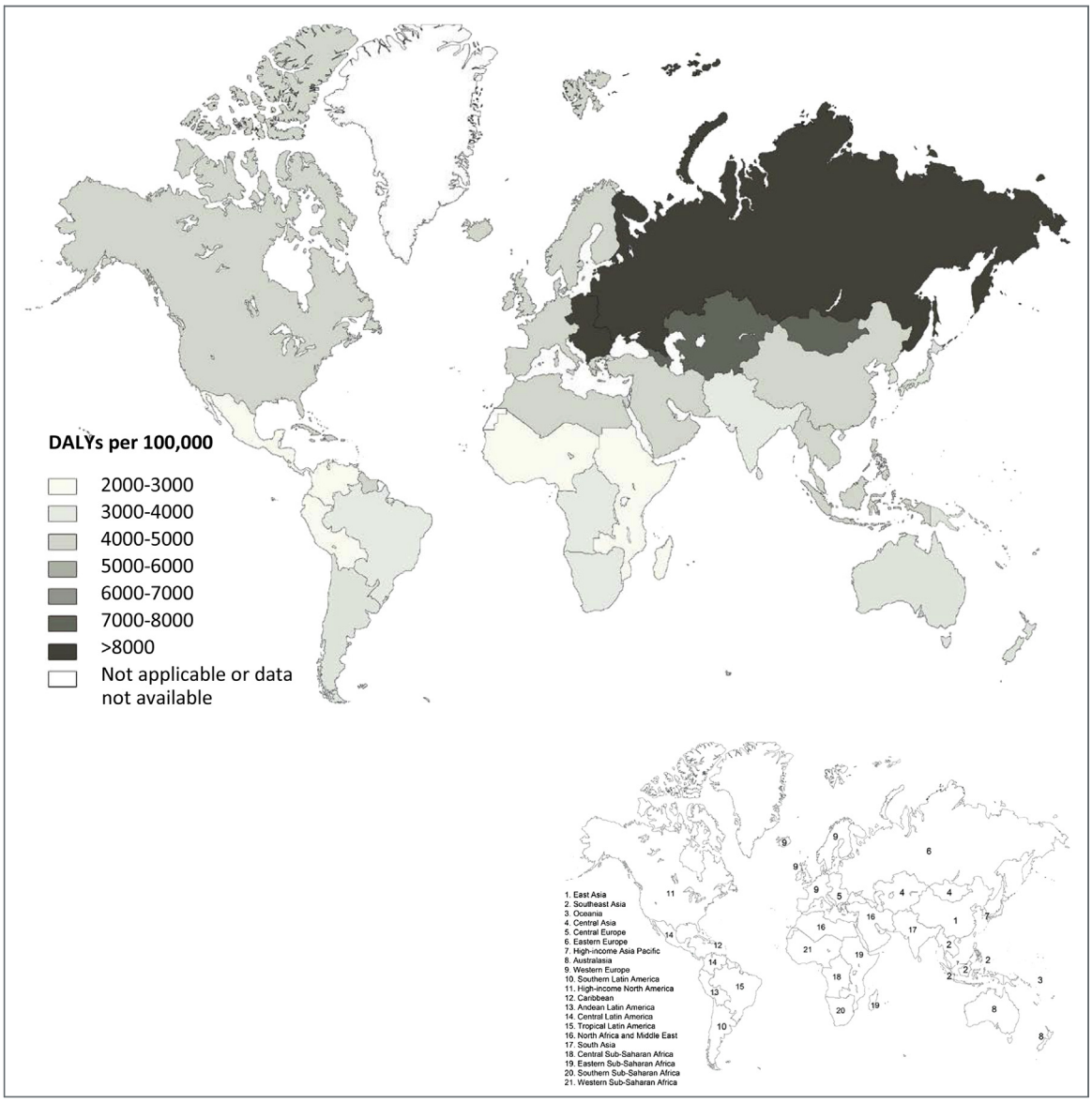

FIGURE 1. Age standardized cardiovascular disease disability-adjusted life years (DALYs) lost per 100,000, 2010.

impoverishing for the household [5]. Health systems in the low- and middle-income countries with high CVD burden are challenged by the significant investments required to adequately prevent and treat CVD [6]. There are numerous measures of current national health system capacity, including proportion of national income devoted to health care, per capita health care spending, and number of hospital beds and clinics. For the Global CVD Atlas, we present a simple measure of health system capacity: medical professionals (physicians, nurses, and midwives) per 10,000 people (Fig. 6). Though even this indicator is not a direct measure of countries' capacity for or quality of prevention and treatment, there are substantial differences in health care provider capacity among regions. In South Asia and East Asia, the number of nurses and midwives is roughly the same as the number of physicians. Numerous countries increase the health system's reach by engaging the efforts of nonprofessional, lay health workers, who facilitate health education, screening, monitoring, and adherence programs [7]. Multiple approaches to improving health system capacity, including health insurance schemes, essential medicines and quality improvement programs, and programs aiming to improve the contribution of private sector capacity, have the potential to improve CVD prevention and control in lower-resourced regions [8].

Global CVD surveillance: Past and present

Reliable surveillance data are a necessary component of assessing population health and prioritizing prevention and control efforts. Systematic surveillance began with registering births and deaths, later progressing to cause-specific

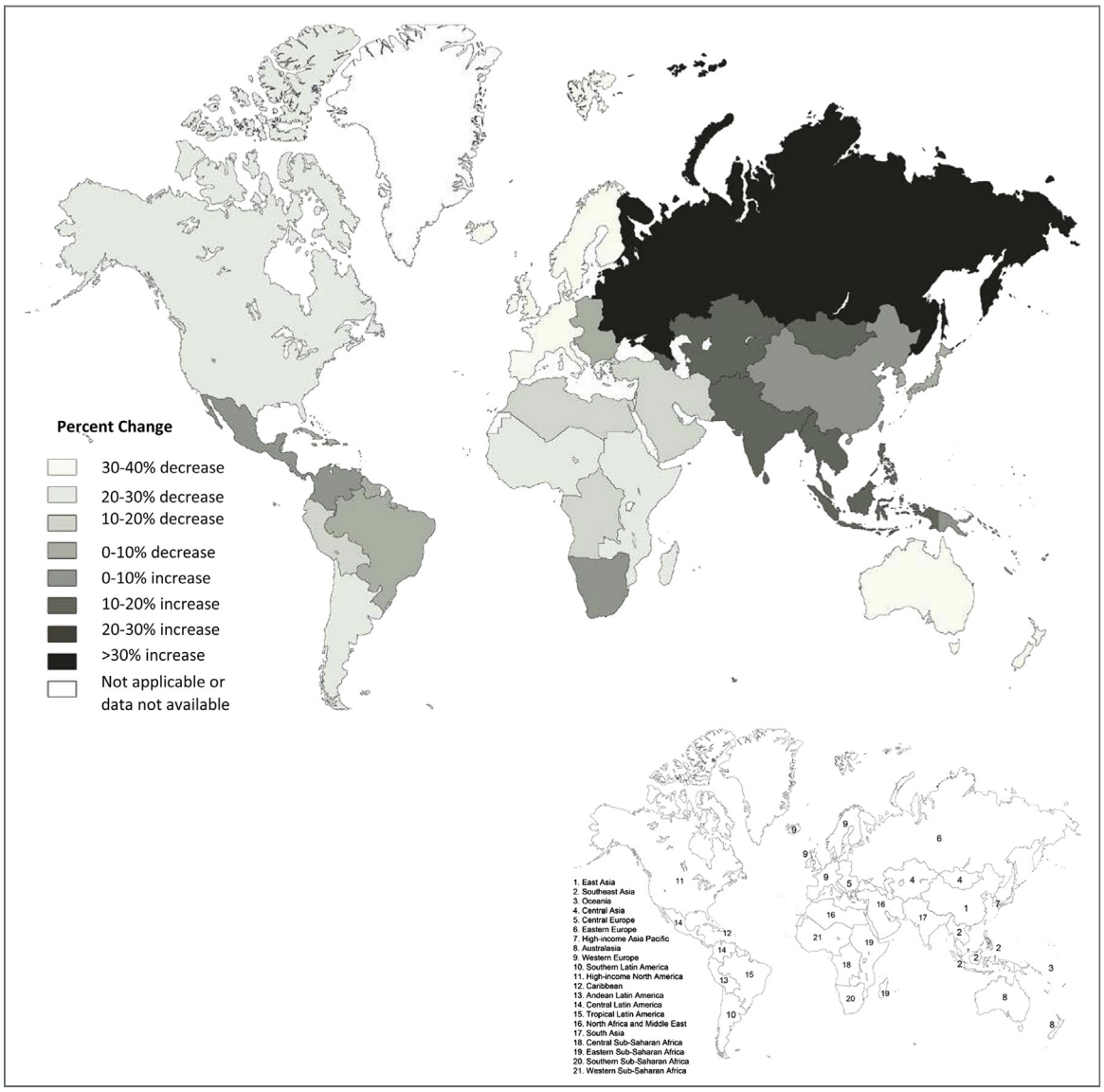

FIGURE 2. Change in age standardized cardiovascular disease disability-adjusted life years (DALYs) lost per 100,000, 2010.

deaths (Table 1). Population demographic, risk factor, and prevalence surveys and nonfatal event registration were added to mortality registration, but on a national scale, these surveillance methods were often pursued independently. It was integration of upstream characteristics and downstream events in landmark, population-based, cardiovascular disease cohort studies that led to the development of risk factor epidemiology. The Framingham Study first, then the World Health Organization (WHO) MONICA (monitoring trends and determinants in cardiovascular disease) Study (as well as the Atherosclerosis in Communities [ARIC] Study and Rochester Epidemiology Study in the United States) developed advanced and standardized surveillance methods aimed at capturing all CVD events in large, defined, subnational populations that could be translated to changes in CVD event rates over time [9]. Until the 1990s, almost all comprehensive surveillance was pursued in North America, Australasia, and Europe—for example, in MONICA, China was the only country outside of these regions to participate. In addition, while a number of countries have a broad range of CVD surveillance methods, few, even among high-income countries, have achieved complete linkage of community, outpatient, inpatient, and mortality data registries. In many low-resource regions, national all-cause and cause-specific deaths registration remains incomplete (Fig. 7).

The future of global CVD surveillance

Recent efforts in CVD surveillance have focused on the creation of comprehensive and comparable population-level

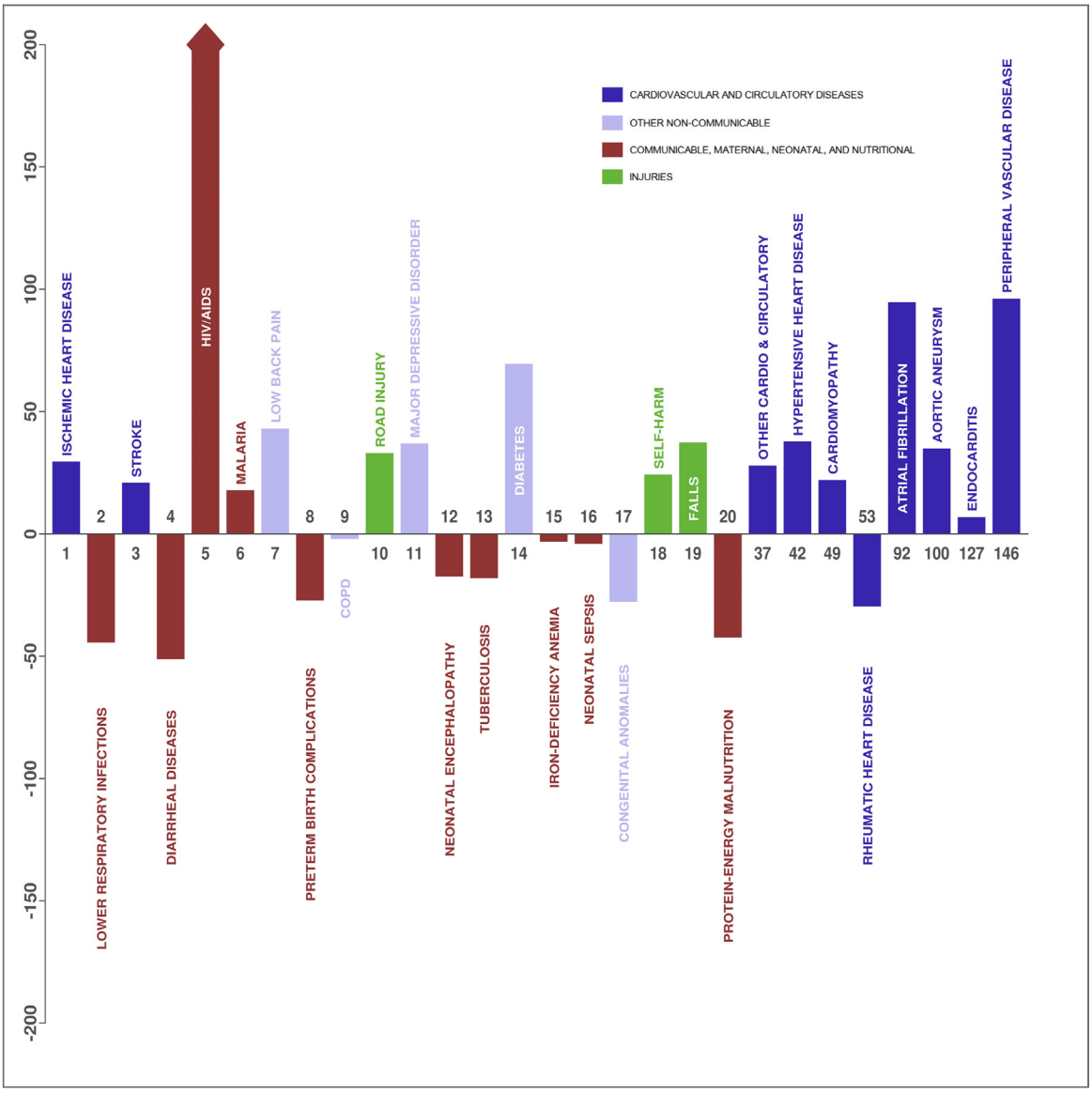

FIGURE 3. Cardiovascular diseases in comparison with other leading causes of loss of disability-adjusted life years (DALYs), global percent change, 1990-2010.

	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	5	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) attributed to each risk factor.

data about cardiovascular diseases. One example is the Global Burden of Disease (GBD) 2010 study, a systematic effort to quantify the comparative magnitude of death and disability in 187 countries by age and sex for the years 1990-2010 [10]. GBD 2010 developed uniform methods for modeling cause-specific mortality and disease prevalence across 291 diseases and 1160 health conditions, including 10 cardiovascular diseases and more than 50 cardiovascular health states. This kind of large-scale effort involved a network of hundreds of clinical and public health scientists in more than 50 countries.

Spurred by GBD 2010, efforts continue to improve measurement of the global burden of disease. In 2013, the Global Burden Study will begin releasing estimates annually. In addition, there will be increased efforts to measure disease burden at the subnational level. Future estimates will also include the tracking of disease-specific health expenditures by country. Increased sharing of administrative data among countries will lead to a global collection of hospital data and surgical procedures. This will contribute to an increasingly integrated framework for understanding the changing contribution of health care to population health.

Large meta-analytic efforts like GBD would not be possible without ongoing, high-quality surveillance across many countries. The WHO STEPwise approach to Surveillance program has made standardized survey instruments available in many countries where little was previously know about cardiovascular disease burden [7]. Increasingly, developing low-income regions conduct cardiovascular disease epidemiology studies, as with the Dhulikel Heart Study in Nepal, and work on stroke in urban and rural Tanzania [11,12]. Large multinational efforts led by the Population Health Research Institute at McMaster University have continued to expand on the work of past epidemiology studies, producing landmark studies such as InterHeart, InterStroke, and PURE [13–15]. In high-income countries, traditional epidemiologic methods such as survey, registry, and case-control studies are increasingly being supplemented with large-scale data linkage studies. These efforts make use of large administrative data sets and unique identifiers to track hospital and pharmacy care among patients with key cardiovascular conditions [16,17].

An ideal system for cardiovascular surveillance does not yet exist, but it is useful to consider the attributes that such a system might have. To remain patient focused, it will need to collect data across multiple points of care rather than just hospital discharge. To be useful at the level of health systems, it will necessarily track efficiency by collecting information on cost inputs and health outputs. It will allow the measurement of the effective coverage of interventions. Effective coverage has been defined as the proportion with a health condition that receives the expected benefit of an intervention [18]. A flexible surveillance system will be able to rapidly adopt new metrics and indicators. Most importantly, an ideal system for cardiovascular surveillance will need to be population focused, which will require investment in

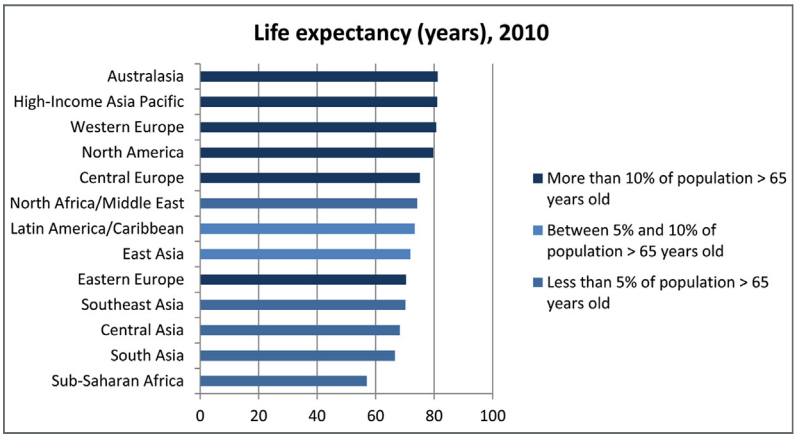

FIGURE 5. Median life expectancy (years) and percent of population aged 65 years or older, by world region, 2010.

surveys that sample at the levels of schools, employers, institutions, and households.

There remain significant challenges to CVD surveillance. Data sources remain sparse in some regions of the world, notably sub-Saharan Africa and small countries in Oceania. Less developed systems require ongoing investments if they are to improve beyond more than limited efforts at tracking mortality. It remains challenging to collect the full range of behavioral and environmental risk factors that lead to cardiovascular diseases. Significant variation exists in the way that data are collected on even the best know exposures, such as tobacco. Biomarkers are still only measured in a handful of WHO STEPs surveys, and additional resources will be necessary to expand this important component of surveillance. Additionally, some diseases remain extremely difficult

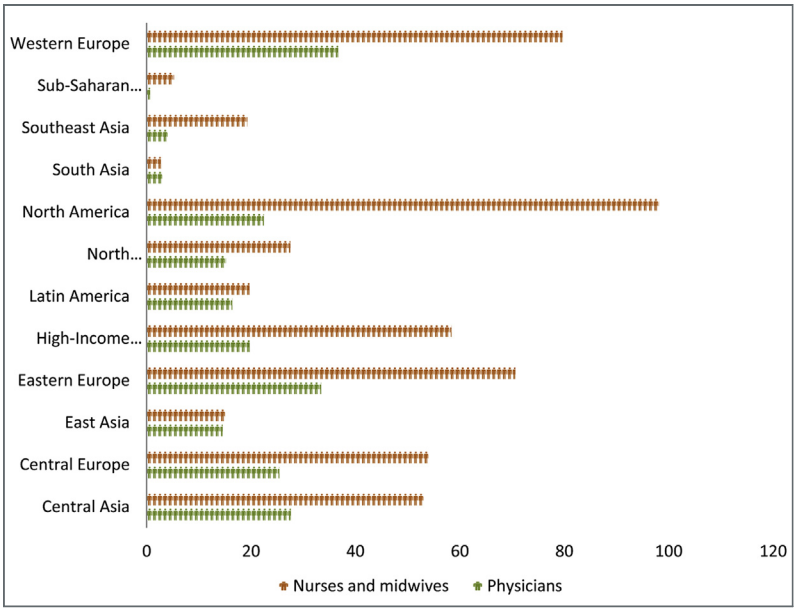

FIGURE 6. Median medical professionals per 10,000 population by world region, 2010.

TABLE 1. Components of cardiovascular disease surveillance

Types of CVD surveillance programs	Purposes	Challenges and pitfalls
National or subnational any-cause mortality registration	Tracking age and place of death allows for basic demographic trend projections and identification of highest mortality groups	Requires infrastructure
National or subnational CVD and other cause-specific mortality registry or verbal autopsy system	Complete counts of fatal cases; tracking specific causes is more informative regarding prevention and control	Following sophisticated ICD rules is difficult and cause misclassification is common Causes of unwitnessed sudden deaths are difficult to identify
Hospital-based and clinic-based event registration	Allows tracking of temporal trends in acute cases, tracking the number of patients under treatment, and planning hospital and clinic capacity needs	Out-of-hospital events and out-of-clinic cases are missed Spectrum bias may lead to biased estimates of total case fatality and severity
National risk factor and prevalence surveys	Necessary for quantifying risk factor exposure levels and monitoring effects of prevention programs	Self-reported measures (e.g., in telephone surveys) are economical but sometimes unreliable
Population-based cohort studies	Overcomes the limitations of ecological analysis by linking risk factors and outcomes at the individual level	Selection bias; observations may not be generalizable to the general population
National or subnational capture of all fatal and nonfatal CVD cases	Complete counts of fatal and nonfatal cases, captures full spectrum of case fatality and severity	If subnational, may not be generalizable Active surveillance for cases occurring in the community is resource intensive and requires extensive infrastructure and training
Individual-level linkage of outpatient characteristics and risk factors, inpatient events, and cause-of-death registries	Complete counts of fatal and nonfatal cases, ability to quantify upstream risk factors, downstream events and deaths at the level of the individual, integrated with monitoring of clinical practice and quality of care, allows monitoring effects of prevention and control policies	Use of coded data leading to misclassification bias Need for propensity score adjustment Electronic medical record keeping is an advantage and not universally available

CVD, cardiovascular disease; ICD, International Classification of Diseases.

to track in the community, such as atrial fibrillation and stable coronary artery disease. New methods will be needed to integrate multiple data sources, correct bias, and calculate uncertainty. These efforts will go a long way to assuring that cardiovascular surveillance efforts remain timely and policy-relevant well into this new century.

1990-2010 GLOBAL CVD ATLAS: METHODS

The Global Burden of Diseases, Injuries, and Risk Factors 2010 Study (GBD 2010)

The Global Burden of Diseases, Injuries, and Risk Factors 2010 Study (GBD 2010) used standardized methods to estimate the burden of fatal and nonfatal CVDs and noncardiovascular disease in the years 1990 and 2010. The GBD included 187 countries and 291 diseases and injuries, including 9 distinct major cardiovascular conditions as well as a combined category for other minor, less common cardiovascular and circulatory conditions. GBD 2010 Study methods have been reported in detail elsewhere for the overall study and for major CVDs [1—3,10]. The core summary measurement of population health in the GBD 2010 Study was DALYs in the years 1990 and 2010. DALYs represent the "health gap" between a population's actual health and an ideal standard. DALYs are composed of years of life lost (YLL) to premature deaths and years lived with nonfatal disease disability (YLD). In order to capture the combined fatal and nonfatal burden of CVDs around the world, the global CVD atlas reports DALYs.

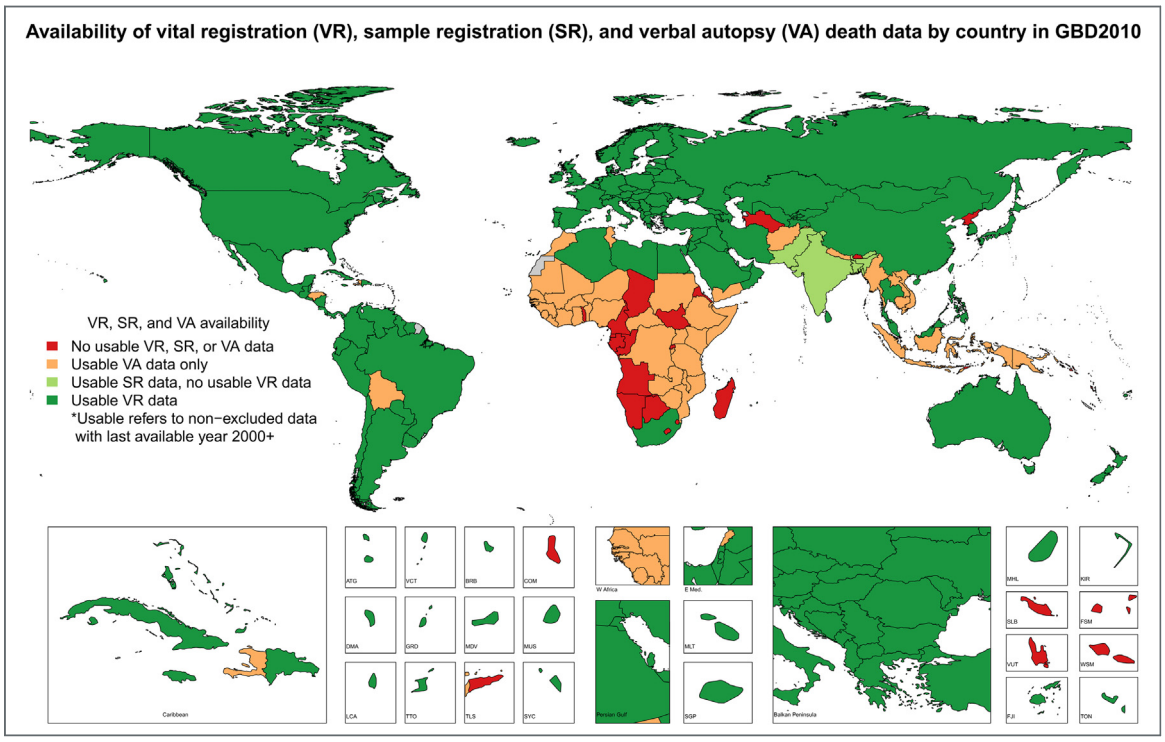

FIGURE 7. Last year of vital registration ([VR] systematic registration of all births and deaths in the population) by country, from 1980-2008.

Absolute numbers of DALYs lost and DALYs per 100,000 are the main outcomes reported in the tables and figures of the global CVD atlas. Absolute numbers of DALYs reflect the magnitude of burden, that is, lives and life years lost due to CVD deaths, and the number of chronic CVD survivors. Absolute numbers of DALYs are important for health-system planners who need to provide the health system with the capacity to care for CVD victims, assess economic and social impact, or compare the urgency of CVD control priorities with priorities for controlling non-CVD diseases. Because population size differs among countries and changes over time in the same country, we allow comparisons among countries and over time by reporting DALYs per 100,000 people in atlas maps. Age-standardized DALYs per 100,000 are reported in the atlas text in selected instances in order to evaluate changes in CVD burden over time in a region or country once both the impacts of aging and population growth have been removed. For those specific estimates, age standardization was performed using the direct method and the World Health Organization standard world population.

The GBD 2010 Study estimated mortality and burden of disease for 187 countries nested within 21 world regions. The 21 regions were in turn nested within 7 "super regions." Regions and super regions almost always consisted of geographically contiguous countries, though countries were also grouped into regions based on epidemiologic characteristics (e.g., relative proportion of communicable/maternal and noncommunicable disease mortality). Based on the availability of CVD epidemiology data, 12 world regions were used for the global CVD atlas. Atlas regions generally followed the geographical structure of the GBD 2010 Study, but in some cases, GBD regions were collapsed into a super region (e.g., Sub-Saharan Africa), and in other cases, a super region was split into its component GBD regions (splitting of High Income into North America, Western Europe, Asia Pacific High Income, and Australasia; Fig. 8, Table 2).

Defining CVDs

Ten major CVD cause categories were defined based on International Classification of Disease (ICD) classifications: stroke, ischemic heart disease, cardiomyopathy, rheumatic heart disease, hypertensive heart disease, endocarditis, atrial fibrillation, aortic aneurysm, peripheral arterial disease, and "other cardiovascular and circulatory." The last "other" category included cardiopulmonary disease (ICD-10 I27, I28), non-rheumatic valvular disease (I34, I35, I36, I37), disorders of the arteries, capillaries, or veins (I72, I77, I78, I83, I84, I87, I88, I89), venous embolism and thrombosis (I82), hypotension (I95), postprocedural disorders (I97), and cardiovascular disorders in syphilis and other diseases (I98) . Because heart failure is not defined as an underlying cause of death in the ICD, separate methods were developed in order to distribute heart failure deaths and nonfatal disability to upstream CVDs and other causes of heart failure.

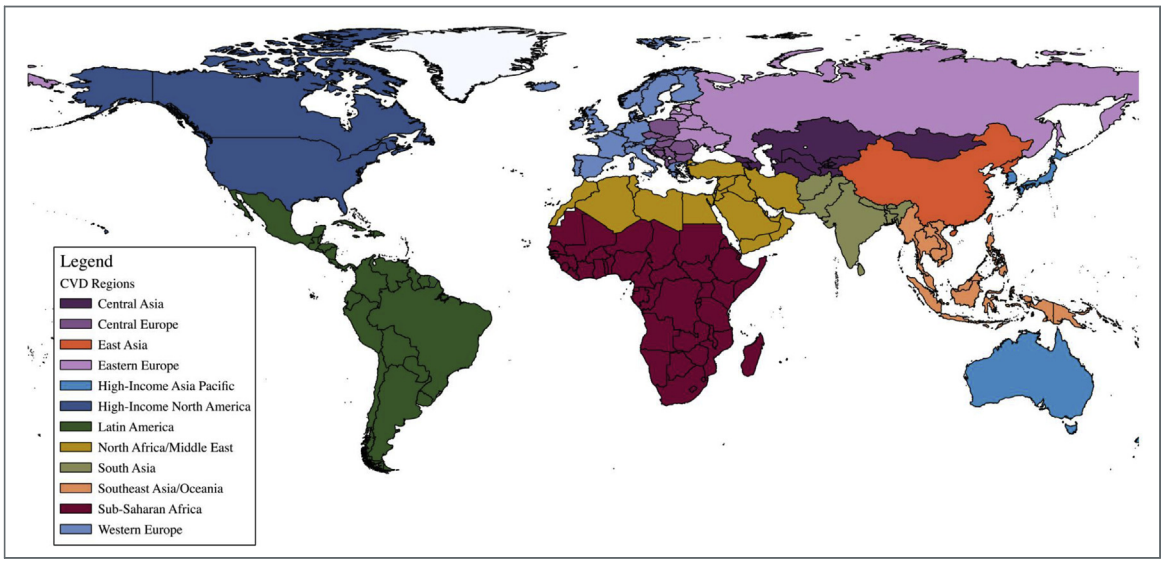

FIGURE 8. The world regions of the Global Cardiovascular Disease Atlas, based on the availability of CVD epidemiology data. The atlas reports data for Eastern Europe and Central Asia in a single section.

Measuring fatal CVD

The GBD 2010 Study collected all available global mortality data, including vital registration, sample registration, verbal autopsy, burial and mortuary data, in-hospital death data, police reports, national census, and relevant surveys. Nonspecific conditions reported as an underlying cause of death were redistributed using expert consensus and statistical methods [19]. Differences over time in international classification of disease systems were mapped to a uniform system. An ensemble model (Cause of Death ensemble model, or CODem) was used to estimate cause-specific mortality by age and sex across all 187 countries in the GBD study using the collected mortality data and a large set of country-level, cause-of-death-specific covariates. Out-of-sample validity testing was performed for each model, and uncertainty was determined using 1,000 draws taken from the posterior distribution of CODem. An algorithm (CODCorrect) adjusted these estimates for consistency with global estimates of all-cause mortality.

Measuring nonfatal CVD

Nonfatal CVD prevalence was estimated from data gathered in systematic reviews of epidemiologic data using a Bayesian meta-regression method (DisMod-MR) [10]. Disability from each case of CVD and other diseases or injuries was estimated in a household survey of lay people in Bangladesh, Indonesia, Peru, Tanzania, and the U.S.A., and an international Web-based survey of health professionals [20]. Distribution of disability severity (mild, moderate, or severe) was based on either studies of specific CVDs that used a disease-specific symptom scale (e.g., Rankin scale for stroke, New York State Heart Association classification for heart failure) or by using the distribution of Short Form 15 quality-of-life scores among patients living with CVDs that were measured in the U.S. Medical Expenditure Panel Survey.

Measuring the burden of CVD attributable to risk factors

The Comparative Risk Assessment arm of the GBD 2010 Study estimated the burden of cardiovascular diseases attributable to risk factors [21]. National and subnational risk factor surveys were analyzed in order to estimate for each risk factor a mean exposure. An optimal, minimum risk exposure and relative risk per unit of risk factor exposure were obtained from the literature. Attributable burden was calculated using the population attributable fraction method, assuming independent effects from each risk factor. The main risk factor clusters were tobacco consumption, alcohol consumption, physiologic factors (high fasting plasma glucose, high total cholesterol, high blood pressure, high body mass index), diet (diet low in fruits, diet low in vegetables, diet low in whole grains, diet low in nuts and seeds, diet high in processed meat, diet high in sugar-sweetened beverages, diet low in fiber, diet low in seafood omega-3 fatty acids, diet low in polyunsaturated fatty acids, diet high in trans fatty acids, diet high in sodium), air pollution (ambient particulate matter pollution or household air pollution from solid fuels), and other environmental risks (lead exposure).

Regional demographic and health system indicators

In order to place the global CVD atlas burden of disease findings in context, demographic and health system indicators were selected from a public-access World Bank data Website for each country in an atlas region [22]. Indicator selection was based on consensus among the atlas editors. Country-level mean life expectancy, proportion of the population aged 65 years or older, proportion urban population, physicians per 1,000 people, and nurses per 1,000 people were the indicators selected. Because country indicators were not normally distributed, medians of indicators among the countries in a region are reported.

TABLE 2. Global Atlas of Cardiovascular Disease 1990-2010 regions and GBD 2010 super-regions, regions, and countries

Global CVD Atlas Region	GBD Super Region	GBD Region	Country
	East Asia/Pacific		
East Asia		Asia, East	China
			Korea, Democratic People's Republic of
			Taiwan
Southeast Asia		Asia, Southeast	Cambodia
			Indonesia
			Lao People's Democratic Republic
			Malaysia
			Maldives
			Myanmar
			Philippines
			Sri Lanka
			Thailand
			Timor-Leste
			Viet Nam
		Oceania	Fiji
			Kiribati
			Marshall Islands
			Micronesia, Federated States of
			Papua New Guinea
			Samoa
			Solomon Islands
			Tonga
			Vanuatu
	Eastern Europe/ Central Asia		
Central Europe		Europe, Central	Bosnia and Herzegovina
			Bulgaria
			Croatia
			Czech Republic
			Hungary
			Macedonia, the Former Yugoslav Republic of
			Montenegro
			Poland
			Romania
			Serbia
			Slovakia
			Slovenia

(Continued)

TABLE 2 Continued

Global CVD Atlas Region	GBD Super Region	GBD Region	Country
Eastern Europe and Central Asia		Europe, Eastern	Belarus
			Estonia
			Latvia
			Lithuania
			Moldova
			Russian Federation
			Ukraine
		Asia, Central	Albania
			Armenia
			Azerbaijan
			Georgia
			Kazakhstan
			Kyrgyzstan
			Mongolia
			Tajikistan
			Turkmenistan
			Uzbekistan
	High Income		
Asia Pacific, High Income		Asia Pacific, High Income	Brunei Darussalam
			Japan
			Korea, Republic of
			Singapore
Australasia		Australasia	Australia
			New Zealand
Western Europe		Europe, Western	Andorra
			Austria
			Belgium
			Cyprus
			Denmark
			Finland
			France
			Germany
			Greece
			Iceland
			Ireland
			Israel
			Italy
			Luxembourg
			Malta
			Netherlands
			Norway
			Portugal
			Spain

(Continued)

TABLE 2 Continued

Global CVD Atlas Region	GBD Super Region	GBD Region	Country
			Sweden
			Switzerland
			United Kingdom
North America		North America, High Income	Canada
			United States
Latin America and Caribbean	Note: these three countries were included in the GBD 2010 High Income category	Latin America, Southern	Argentina
			Chile
			Uruguay
	Latin America/ Caribbean		
Latin American and Caribbean		Caribbean	Antigua and Barbuda
			Bahamas
			Barbados
			Belize
			Cuba
			Dominica
			Dominican Republic
			Grenada
			Guyana
			Haiti
			Jamaica
			Saint Lucia
			Saint Vincent and the Grenadines
			Suriname
			Trinidad and Tobago
		Latin America, Andean	Bolivia
			Ecuador
			Peru
		Latin America, Central	Colombia
			Costa Rica
			El Salvador
			Guatemala
			Honduras
			Mexico
			Nicaragua
			Panama
			Venezuela
		Latin America, Tropical	Brazil
			Paraguay

(Continued)

TABLE 2 Continued

Global CVD Atlas Region	GBD Super Region	GBD Region	Country
	North Africa/ Middle East		
North Africa/ Middle East		North Africa/ Middle East	Algeria
			Bahrain
			Egypt
			Iran, Islamic Republic of
			Iraq
			Jordan
			Kuwait
			Lebanon
			Libyan Arab Jamahiriya
			Morocco
			Occupied Palestinian Territory
			Oman
			Qatar
			Saudi Arabia
			Syrian Arab Republic
			Tunisia
			Turkey
			United Arab Emirates
			Yemen
	South Asia		
South Asia		Asia, South	Afghanistan
			Bangladesh
			Bhutan
			India
			Nepal
			Pakistan
	Sub-Saharan Africa		
Sub-Saharan Africa		Sub-Saharan Africa, Central	Angola
			Central African Republic
			Congo
			Congo, the Democratic Republic of the
			Equatorial Guinea
			Gabon
		Sub-Saharan Africa, East	Burundi
			Comoros
			Djibouti
			Eritrea
			Ethiopia

(Continued)

TABLE 2 Continued

Global CVD Atlas Region	GBD Super Region	GBD Region	Country
			Kenya
			Madagascar
			Malawi
			Mauritius
			Mozambique
			Rwanda
			Seychelles
			Somalia
			Sudan
			Tanzania, United Republic of
			Uganda
			Zambia
		Sub-Saharan Africa, Southern	Botswana
			Lesotho
			Namibia
			South Africa
			Swaziland
			Zimbabwe
		Sub-Saharan Africa, West	Benin
			Burkina Faso
			Cameroon
			Cape Verde
			Chad
			Cote d'Ivoire
			Gambia
			Ghana
			Guinea
			Guinea-Bissau
			Liberia
			Mali
			Mauritania
			Niger
			Nigeria
			Sao Tome and Principe
			Senegal
			Sierra Leone
			Togo

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