# INTRODUCTION

The United States presents an interesting challenge to policymakers and the scientific research community. It is the engine behind clinical innovations that are reducing health loss worldwide. Its academic centers consistently raise the bar, training generation after generation of physicians, nurses, and other health professionals. Despite this, how health is experienced in the US varies greatly by locale. People who live in San Francisco or Fairfax County, Virginia, or Gunnison, Colorado, are enjoying some of the best life expectancies in the world. In some US counties, however, life expectancies are on par with countries in North Africa and Southeast Asia. This is happening despite the fact that the US spends more per capita on health care than most countries.

We know that the situation can be dramatically improved. The US performs better than its economic peers – on average – in premature deaths from stroke and disease burden attributable to high blood pressure. Also, compared to its peers, the US is more effectively addressing multiple causes of disability, although much work remains to be done.

To see where to focus that work, we need to examine the large health disparities across communities. What can be seen through this analysis are success stories, such as the impressive progress being made in physical activity. Over the last decade, some counties substantially increased the number of people getting the recommended levels of exercise. As a contrast, obesity levels continue to rise in many US counties, as do mortality rates in some counties, particularly for females. Life expectancy for females in 42% of US counties saw no significant improvement between 1985 and 2010. If we can find the keys to the successes we are seeing with stroke, high blood pressure, and physical activity, we may be able to apply similar success strategies to tackle these and other growing areas of concern.

The Global Burden of Disease (GBD) approach helps put these challenges in their proper context. The GBD is a systematic, scientific effort to quantify the comparative magnitude of health loss due to diseases, injuries, and risk factors by age, sex, and geography for specific points in time. Box 1 describes the history of GBD. The global and regional results from the most recent iteration of the GBD enterprise, the Global Burden of Diseases, Injuries, and Risk Factors Study 2010 (GBD 2010), were published as a series of papers in *The Lancet* in December 2012. GBD 2010 estimated premature death and disability due to 291 diseases and injuries, 1,160 sequelae (direct consequences of disease and injury), and 67 risk factors for 20 age groups and both sexes in 1990, 2005, and 2010. GBD 2010 produced estimates for 187 countries and 21 regions. In total, the study generated over 1 billion estimates of health outcomes. GBD results for the US were published in July 2013 in the *Journal of the American Medical Association* (JAMA).

GBD 2010 was a collaborative effort among nearly 500 researchers from 50 countries and 303 institutions. The Institute for Health Metrics and Evaluation (IHME) at the University of Washington acted as the coordinating center for the work. Our intention is to enlarge the network in the years to come and routinely update the GBD estimates, ensuring that policymakers have access to high-quality estimates in the timeliest fashion. Through sound measurement, we can provide the foundational evidence that will lead to improved population health.

GBD found evidence of rapid health transitions in most regions of the world with the exception of sub-Saharan Africa. Diseases of poverty, such as communicable, maternal, nutritional, and newborn causes, have decreased nearly universally while non-communicable conditions traditionally associated with wealthier countries have risen. As people live longer and die at lower rates, the number of years spent living with disability from ailments such as low back pain and depression has increased. Although health progress in sub-Saharan Africa lagged behind much of the world, the region made substantial progress in reducing child deaths and fighting diseases such as HIV/AIDS and malaria.

In the US, we found that life expectancy increased, but the number of years Americans spend living with disability also increased. Ischemic heart disease, lung cancer, stroke, chronic obstructive pulmonary disease (COPD), and road injury were responsible for the greatest number of years of life lost in America in 2010. Musculoskeletal, mental, and behavioral disorders, such as low back and neck pain, depression, and anxiety, were the leading causes of years lived with disability. Looking at risk factors for disease and injury, GBD researchers found that dietary risks, such as eating too little fruit, nuts, and seeds and too much salt, were the largest contributors to disease burden, followed by smoking, high body mass index, high blood pressure, high fasting plasma glucose (high blood sugar), insufficient exercise, and alcohol use. In July 2013, county-level findings on life expectancy, obesity, and physical inactivity were published in two articles in *Population Health Metrics*.

Because of how the US is positioned as a health innovation leader and the opportunities presented by the rollout of national health care reform, policymakers can take the findings from this report into account as they assess community health status and look for ways to better allocate resources to improve health policy. Within this diverse, dynamic country, we can see models of incredible health progress and examples of persistent health dilemmas. We see pathways forward, too – as we will discuss later in the report – toward a future with Americans seeing health improvement more consistently across communities.

### *Related literature*

Additional information about the research discussed in this report can be found in the following articles:

US Burden of Disease Collaborators. The state of US health, 1990-2010: burden of diseases, injuries, and risk factors [published online July 10, 2013]. *JAMA*. doi:10.1001/jama.2013.13805.

**Box 1: History of the Global Burden of Disease and innovations in GBD 2010**

The first GBD study was published as part of the *World Development Report 1993*. Called GBD 1990, it generated estimates for 107 diseases, 483 sequelae (non-fatal health consequences), eight regions, and five age groups. The authors' inspiration for the study came from the realization that policymakers lacked comprehensive and standardized data on diseases, injuries, and potentially preventable risk factors for decision-making. A second source of inspiration was the fact that disease-specific advocates' estimates of the number of deaths caused by their diseases of interest far exceeded the total number of global deaths in any given year. GBD authors chose to pursue a holistic approach to analyzing disease burden to produce scientifically sound estimates that were independent of the influence of advocates.

GBD 1990 had a profound impact on health policy as it exposed the hidden burden of mental illness around the world. It also shed light on neglected health areas such as the premature death and disability caused by road traffic injuries. Work from this study has been cited over 4,000 times since 1993.

The study also sparked substantial controversy. Many disease-specific advocates argued that the original GBD underestimated burden from the causes they cared about most. The use of age weighting and discounting also caused extensive debates. Age weighting assumed that a year of life increased in value until age 22, and then decreased steadily. Discounting counted years of healthy life saved in the present as more valuable than years of life saved in the future. Also controversial was the use of expert judgment to estimate disability weights (estimations of the severity of non-fatal conditions). As a result of this feedback and consultation with a network of philosophers, ethicists, and economists, GBD no longer uses age weighting and discounting. Also, we have updated our methods for determining disability weights and used data gathered from thousands of respondents from different countries around the world.

While the original study had the participation of 100 collaborators worldwide, GBD 2010 had 488 co-authors. Thanks to that network, the study includes vast amounts of data on health outcomes and risk factors. Researchers also made substantial improvements to the GBD methodology, summarized in Box 2 and described in detail in the Annex of this report and in the published studies. Among these improvements, highlights include using data collected via population surveys to estimate disability weights for the first time, greatly expanding the list of causes and risk factors analyzed in the study, detailed analysis of the effect of different components of diet on health outcomes, and reporting of uncertainty intervals for all metrics. GBD 2010 researchers reported uncertainty intervals to provide full transparency about the weaknesses and strengths of the analysis. Narrow uncertainty intervals indicate that evidence is strong, while wide uncertainty intervals show that evidence is weaker.

Wang H, et al. Left behind: widening disparities for males and females in US county life expectancy, 1985-2010. *Population Health Metrics*. 2013; 11:8.

Dwyer-Lindgren L, et al. Prevalence of physical activity and obesity in US counties, 2001-2011: a road map for action. *Population Health Metrics.* 2013; 11:7.

Lozano R, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet.* 2012 Dec 13; 380: 2095–2128.

Murray CJL, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*. 2012 Dec 13; 380: 2197–2223.

Salomon JA, et al. Common values in assessing health outcomes from disease and injury: disability weights measurement study for the Global Burden of Disease Study 2010. *The Lancet.* 2012 Dec 13; 380: 2129–2143.

Salomon JA, et al. Healthy life expectancy for 187 countries, 1990–2010: a systematic analysis for the Global Burden Disease Study 2010. *The Lancet.* 2012 Dec 13; 380: 2144–2162.

Wang H, et al. Age-specific and sex-specific mortality in 187 countries, 1970–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*. 2012 Dec 13; 380: 2071–2094.

Vos T, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*. 2012 Dec 13; 380: 2163–2196.

Lim SS, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*. 2012 Dec 13; 380: 2224–2260.

## MAIN FINDINGS FOR THE UNITED STATES

### GBD results for the United States

- In the US, life expectancy for both sexes combined increased from 75.2 in 1990 to 78.2 in 2010; over the same period, healthy life expectancy (HALE) rose from 65.8 to 68.1. HALE is the number of years that a person at a given age can expect to live in good health, taking into account mortality and disability.

- Life expectancies for both males and females in the US lagged behind the median life expectancies for their counterparts in Organisation for Economic Co-Operation and Development (OECD) countries. The leading causes of premature death in the US were ischemic heart disease, lung cancer, stroke, COPD, and road injury.

- As people in the US live longer, the number of years the average person lives with disability has increased. The major causes of years lived with disability in the US were major depressive disorder, anxiety disorder, low back and neck pain, and other musculoskeletal disorders.

- Potentially avoidable risk factors contributed to rising disease burden in the US. Dietary risks such as diets low in fruits, nuts, and seeds and high in sodium were the most important risk factor for premature death and disability. After dietary risks, tobacco smoking, high body mass index (BMI), high blood pressure, high fasting plasma glucose, physical inactivity, and alcohol use were responsible for the largest numbers of healthy years of life lost in the US.

- Compared to its economic peers, the US performed better than or as well as these countries for different causes of disability. On the other hand, the US ranked poorly compared to peer countries in terms of preventing premature mortality from most leading causes with one key exception: stroke. When evaluating disease burden attributable to different risk factors, the US did a better job than other countries of addressing high blood pressure, but ranked worse for many other risk factors.

### *Analysis of health in US counties*

- In the US, females are making less progress than males when it comes to extending life expectancy. As a result, males are catching up to females. The gap between male life expectancy and female life expectancy shrank from 7.0 years in 1985 to 4.6 years in 2010.

- Drilling down to the county level reveals stark differences in improvement in life expectancy for men and women. Between 1985 and 2010, there were no improvements in female life expectancy in 1,405 counties compared to just 154 counties for males.

- Across US counties, disparities in life expectancy increased for both males and females between 1985 and 2010. In the highest-performing counties, life expectancy rivaled countries with the highest life expectancy in the world, such as Switzerland and Japan. In the lowest-performing counties, life expectancy was lower than the life expectancy of countries receiving foreign aid such as Algeria and Bangladesh. The lowest life expectancies in the US remained around 73 years for females and below 65 for males between 1985 and 2010.

- Levels of sufficient physical activity, defined as 150 minutes of moderate physical activity, 75 minutes of vigorous physical activity, or equivalent combination per week, increased in US counties between 2001 and 2009. The percentage of people getting the recommended amounts of exercise rose by as much as 17% for males and 18% for females in the highest-performing counties. These increases have the potential to reduce death and disability from causes such as ischemic heart disease and stroke.

- Despite progress in sufficient physical activity, obesity rates increased between 2001 and 2009. During this period, only nine US counties experienced a decrease in obesity rates, but none of these reductions were statistically significant.

- Rising levels of sufficient physical activity across US counties appear to have had limited impact on obesity. For every one percentage point increase in sufficient physical activity, obesity prevalence decreased by 0.11 percentage points.

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**Box 2: Global Burden of Disease methodology**

GBD uses thousands of data sources from around the world to estimate disease burden. As a first step, GBD researchers estimate child and adult mortality using data sources such as vital and sample registration systems, censuses, and household surveys. Years lost due to premature death from different causes are calculated using data from vital registration with medical certification of causes of death when available, and sources such as verbal autopsies in countries where medical certification of causes of death is lacking. Years lived with disability are estimated using sources such as cancer registries, data from outpatient and inpatient facilities, and direct measurements of hearing, vision, and lung function testing. Once they have estimated years lost due to premature death and years lived with disability, GBD researchers sum the two estimates to obtain disability-adjusted life years. Finally, researchers quantify the amount of premature death and disability attributable to different risk factors using data on exposure to, and the effects of, the different risk factors. For more information about the GBD methods, see the Annex of this report as well as the published papers.

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