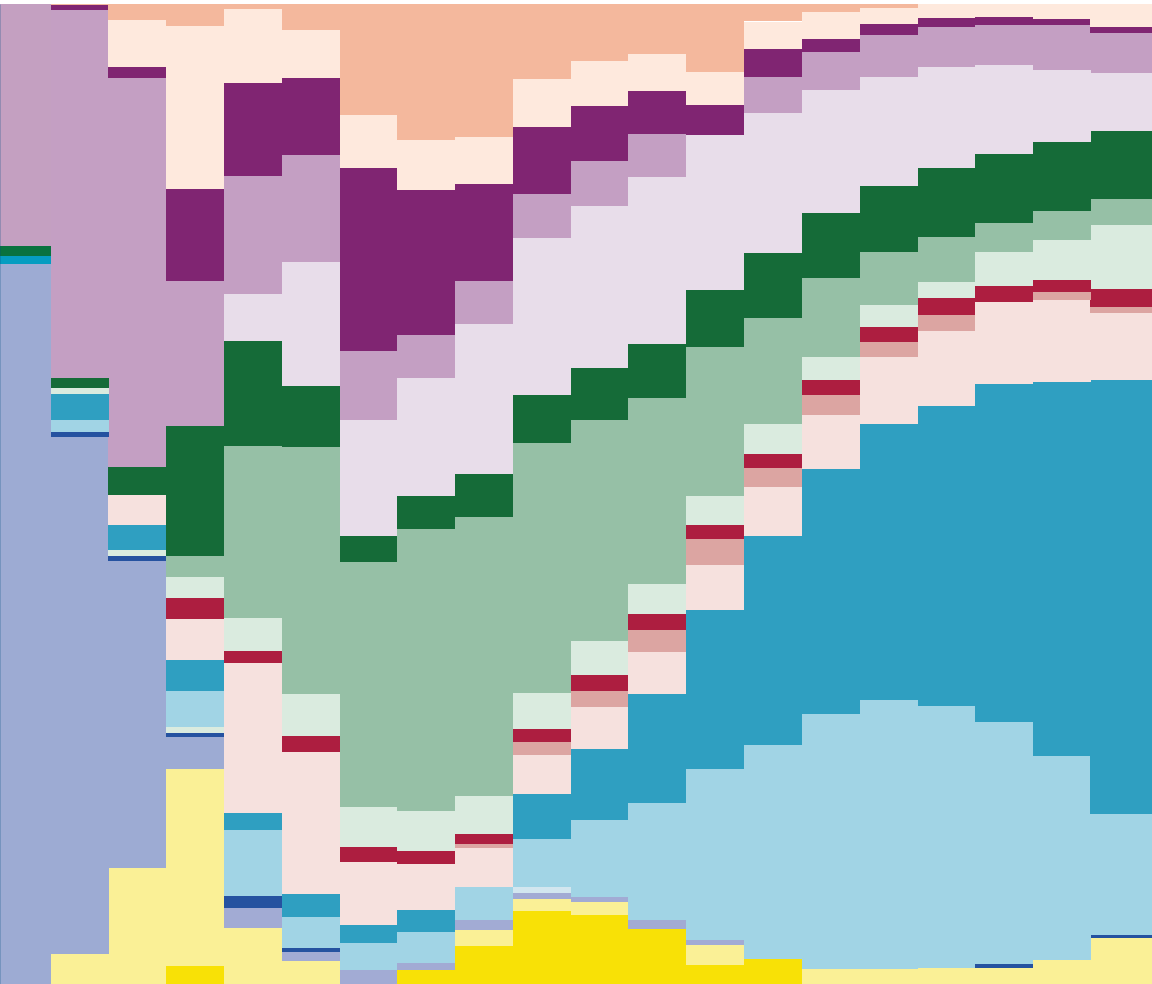
THE GLOBAL BURDEN OF DISEASE: GENERATING EVIDENCE, GUIDING POLICY

EUROPE AND CENTRAL ASIA REGIONAL EDITION

INSTITUTE FOR HEALTH METRICS AND EVALUATION
UNIVERSITY OF WASHINGTON

HUMAN DEVELOPMENT NETWORK
THE WORLD BANK



THE GLOBAL BURDEN OF DISEASE: GENERATING EVIDENCE, GUIDING POLICY

EUROPE AND CENTRAL ASIA REGIONAL EDITION

INSTITUTE FOR HEALTH METRICS AND EVALUATION
UNIVERSITY OF WASHINGTON

HUMAN DEVELOPMENT NETWORK
THE WORLD BANK

This report was prepared by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington and the Human Development Network at the World Bank based on seven papers for the Global Burden of Disease Study 2010 (GBD 2010) published in *The Lancet* (2012 Dec 13; 380). GBD 2010 had 488 co-authors from 303 institutions in 50 countries. The work was made possible through core funding from the Bill & Melinda Gates Foundation. The views expressed are those of the authors.

Citation: Institute for Health Metrics and Evaluation, Human Development Network, The World Bank. *The Global Burden of Disease: Generating Evidence, Guiding Policy – Europe and Central Asia Regional Edition*. Seattle, WA: IHME, 2013.

Institute for Health Metrics and Evaluation
2301 Fifth Ave., Suite 600
Seattle, WA 98121
USA
www.healthmetricsandevaluation.org

Contact:
Katherine Leach-Kemon
Policy Translation Specialist
katielk@uw.edu

Human Development Network
The World Bank
1818 H St., NW
Washington, DC 20433
USA
www.worldbank.org

Contact:
Anne-Maryse Pierre-Louis
Public Health Cluster Leader
apierrelouis@worldbank.org

Printed in the United States of America

ISBN 978-0-9894752-0-4

THE WORLD BANK

IHME GBD

THE GLOBAL BURDEN OF DISEASE: GENERATING EVIDENCE, GUIDING POLICY

EUROPE AND CENTRAL ASIA REGIONAL EDITION

ABOUT IHME

The Institute for Health Metrics and Evaluation (IHME) is an independent global health research center at the University of Washington that provides rigorous and comparable measurement of the world's most important health problems and evaluates the strategies used to address them. IHME makes this information freely available so that policymakers have the evidence they need to make informed decisions about how to allocate resources to best improve population health.

To express interest in collaborating, participating in GBD training workshops, or receiving updates of GBD or copies of this publication, please contact IHME at:

Institute for Health Metrics and Evaluation
2301 Fifth Ave., Suite 600
Seattle, WA 98121
USA

Telephone: +1-206-897-2800
Fax: +1-206-897-2899
E-mail: comms@healthmetricsandevaluation.org
www.healthmetricsandevaluation.org

ABOUT THE HUMAN DEVELOPMENT NETWORK AT THE WORLD BANK GROUP

The World Bank Group is one of the world's largest sources of funding and knowledge for developing countries. It comprises five closely associated institutions: the International Bank for Reconstruction and Development and the International Development Association (IDA), which together form the World Bank; the International Finance Corporation (IFC); the Multilateral Investment Guarantee Agency (MIGA); and the International Centre for Settlement of Investment Disputes (ICSID). Each institution plays a distinct role in the mission to end extreme poverty and build shared prosperity in the developing world.

The World Bank's Human Development Network (HDN) invests in creating equal opportunities for people to live healthy and productive lives, secure meaningful jobs, and protect themselves from crises. HDN takes a lifecycle and systems approach to help developing countries deliver equitable and effective education; health, nutrition, and population; and social protection and labor services. HDN works across all development sectors and with ministries of finance to demonstrate how these investments in people promote inclusive development; long, healthy, and productive lives; economic growth; and country competitiveness. HDN focuses on results through building strong, integrated systems and country capacity; promoting evidence-based policy and program decision-making; and leveraging partnerships with donors and development agencies, civil society, the private sector, and communities to deliver country-tailored solutions. HDN's work helps support the most effective

policies, tools, and instruments to make a real difference toward the broader goal of ending extreme poverty and building shared prosperity.

For more information, go to www.worldbank.org/health.

ACKNOWLEDGMENTS

The Global Burden of Disease Study 2010 (GBD 2010) was implemented as a collaboration between seven institutions: the Institute for Health Metrics and Evaluation (IHME) as the coordinating center, the University of Queensland School of Population Health, Harvard School of Public Health, the Johns Hopkins Bloomberg School of Public Health, the University of Tokyo, Imperial College London, and the World Health Organization. This summary draws on seven GBD 2010 papers published in *The Lancet* (2012 Dec 13; 380). GBD 2010 had 488 co-authors from 303 institutions in 50 countries.

IHME and the World Bank oversaw the production of this publication. In particular, we thank IHME's Board for their continued leadership. We are grateful to the report's writer, Brian Childress; to Christopher Murray, Michael MacIntyre, Theo Vos, Rafael Lozano, Ali Mokdad, Rhonda Stewart, and William Heisel at IHME, and Anne-Maryse Pierre-Louis of the Human Development Network at the World Bank, and Daniel Dulitzky and team at the World Bank for content guidance; to Ryan Barber and Daniel Dicker for data analysis; to Brittany Wurtz and Summer Ohno for program coordination; to Patricia Kiyono for editing and production oversight; to Katherine Leach-Kemon for writing support and production management; to Rica Asuncion-Reed for editorial support; and to Miriam Alvarado, Ian Bolliger, Roy Burstein, Emily Carnahan, Greg Freedman, Nicole Johns, Katherine Lofgren, and Richard Luning for fact checking. This report would not have been possible without the ongoing contributions of Global Burden of Disease collaborators around the world.

Finally, we would like to extend our gratitude to the Human Development Network at the World Bank for co-financing this report, and to the Bill & Melinda Gates Foundation for generously funding IHME and for its consistent support of the Global Burden of Disease research.

GLOSSARY

Years of life lost (YLLs): Years of life lost due to premature mortality.

Years lived with disability (YLDs): Years of life lived with any short-term or long-term health loss, adjusted for severity.

Disability-adjusted life years (DALYs): The sum of years lost due to premature death (YLLs) and years lived with disability (YLDs). DALYs are also defined as years of healthy life lost.

Healthy life expectancy, or health-adjusted life expectancy (HALE): The number of years that a person at a given age can expect to live in good health, taking into account mortality and disability.

Sequelae: Consequences of diseases and injuries.

Health states: Groupings of sequelae that reflect key differences in symptoms and functioning.

Disability weights: Number on a scale from 0 to 1 that represents the severity of health loss associated with a health state.

Risk factors: Potentially modifiable causes of disease and injury.

Uncertainty intervals: A range of values that is likely to include the correct estimate of health loss for a given cause. Narrow uncertainty intervals indicate that evidence is strong, while wide uncertainty intervals show that evidence is weaker.

INTRODUCTION

The Global Burden of Disease (GBD) approach 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 latest iteration of that effort, the Global Burden of Diseases, Injuries, and Risk Factors Study 2010 (GBD 2010), was published in *The Lancet* in December 2012. The intent is to create a global public good that will be useful for informing the design of health systems and the creation of public health policy. It estimates 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 2010 was a collaborative effort among 488 researchers from 50 countries and 303 institutions. The Institute for Health Metrics and Evaluation (IHME) acted as the coordinating center for the study. The collaboration strengthened both the data-gathering effort and the quantitative analysis by bringing together some of the foremost minds from a wide range of disciplines. Our intention is to build on this collaboration by enlarging the network in the years to come. Similarly, IHME and its collaborators hope to expand the list of diseases, injuries, and risk factors included in GBD and routinely update the GBD estimates. Continual updates will ensure that the international community can 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.

Over the last two decades, the global health landscape has undergone rapid transformation. People around the world are living longer than ever before, and the population is getting older. The number of people in the world is growing. Many countries have made remarkable progress in preventing child deaths. As a result, disease burden is increasingly defined by disability instead of premature mortality. The leading causes of death and disability have changed from communicable diseases in children to non-communicable diseases in adults. Eating too much has overtaken hunger as a leading risk factor for illness. While there are clear trends at the global level, there is substantial variation across regions and countries. Nowhere is this contrast more striking than in sub-Saharan Africa, where communicable, maternal, nutritional, and newborn diseases continue to dominate.

In Europe and Central Asia, many of the leading causes of health loss were non-communicable diseases. Similar to global trends, communicable, maternal, nutritional, and newborn causes are becoming less important in the region as non-communicable diseases kill more people prematurely and cause increasing disability. Risk factors such as dietary risks, high blood pressure, alcohol use, smoking, high

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*. This original study 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.

The GBD 1990 study 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, GBD 2010 updated its methods for determining disability weights and used data gathered from thousands of respondents from different countries around the world.

GBD 2010 shares many of the founding principles of the original GBD 1990 study, such as using all available data on diseases, injuries, and risk factors; using comparable metrics to estimate the impact of death and disability on society; and ensuring that the science of disease burden estimation is not influenced by advocacy.

Despite these similarities, GBD 2010 is broader in scope and involved a larger number of collaborators than any previous GBD study. 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.

body mass index (BMI), and physical inactivity contributed to the rise of non-communicable diseases in these regions, while risks related to illness in children such as suboptimal breastfeeding and childhood underweight remained more prominent in lower-income countries such as Tajikistan.

This publication summarizes the global GBD 2010 findings as well as the regional findings for Europe and Central Asia. It also explores intraregional differences in diseases, injuries, and risk factors. The overall findings for the region are summarized are summarized in the next section.

MAIN FINDINGS FOR EUROPE AND CENTRAL ASIA

- Europe and Central Asia have made significant progress in reducing mortality and prolonging life since 1970. However, after the collapse of the Soviet Union in the mid-1990s, there were increases in adult mortality in the region among men ages 45 to 59 years.
- Over the last 20 years, the region has succeeded in decreasing premature death and disability from most communicable, newborn, nutritional, and maternal causes with the exception of HIV/AIDS. Despite these improvements, substantial burdens of communicable, newborn, nutritional, and maternal causes persist in poorer countries in Europe and Central Asia, such as Kyrgyzstan and Tajikistan.
- Between 1990 and 2010, disease burden from many non-communicable causes increased, especially ischemic heart disease, cirrhosis, diabetes, and musculoskeletal disorders including low back pain and neck pain. Today, drug and alcohol use disorders are causing more early death and disability in Europe and Central Asia compared to two decades ago.
- The region has seen a sharp increase in injuries associated with interpersonal violence and self-harm, but there was a decline in injuries resulting from fire, drowning, and poisonings.
- In Europe and Central Asia, the leading causes of disability in the region largely mirrored global trends. Mental disorders such as depression and anxiety as well as low back pain, neck pain, and other musculoskeletal disorders were dominant causes of disability. In comparison to global trends, falls ranked higher and asthma ranked lower as causes of disability in the region.
- Dietary risks, high blood pressure, alcohol use, smoking, high body mass index, and physical inactivity were leading risk factors for premature death and disability in Europe and Central Asia. Risk factors that primarily cause illness in children, such as household air pollution, iron deficiency, and suboptimal breastfeeding, were important in lower-income countries such as Kyrgyzstan and Tajikistan.

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.

THE GBD APPROACH TO TRACKING HEALTH PROGRESS AND CHALLENGES

For decision-makers striving to create evidence-based policy, the GBD approach provides numerous advantages over other epidemiological studies. These key features are further explored in this report.

A CRITICAL RESOURCE FOR INFORMED POLICYMAKING

To ensure a health system is adequately aligned to a population's true health challenges, policymakers must be able to compare the effects of different diseases that kill people prematurely and cause ill health. The original GBD study's creators developed a single measurement, disability-adjusted life years (DALYs), to quantify the number of years of life lost as a result of both premature death and disability. One DALY equals one lost year of healthy life. DALYs will be referred to by their acronym, as "years of healthy life lost," and "years lost due to premature death and disability" throughout this publication. Decision-makers can use DALYs to quickly assess the impact caused by conditions such as cancer versus depression using a comparable metric. Considering the number of DALYs instead of causes of death alone provides a more accurate picture of the main drivers of poor health. Thanks to the use of this public health monitoring tool, GBD 2010 researchers found that in most countries, as mortality declines, disability becomes increasingly important. Information about changing disease patterns is a crucial input for decision-making, as it illustrates the challenges that individuals and health care providers are facing in different countries.

In addition to comparable information about the impact of fatal and non-fatal conditions, decision-makers need comprehensive data on the causes of ill health that are most relevant to their country. The hierarchical GBD cause list (available on IHME's website at http://www.ihmeuw.org/gbdcauselist) has been designed to include the diseases, injuries, and sequelae that are most relevant for public health policymaking. To create this list, researchers reviewed epidemiological and cause of death data to identify which diseases and injuries resulted in the most ill health. Inpatient and outpatient records were also reviewed to understand the conditions for which patients sought medical care. For example, researchers added chronic kidney disease to the GBD cause list after learning that this condition accounted for a large number of hospital visits and deaths.

GBD provides high-quality estimates of diseases and injuries that are more rigorous than those published by disease-specific advocates. GBD was created in part due to researchers' observation that deaths estimated by different disease-specific studies added up to more than 100% of total deaths when summed. The GBD approach ensures that deaths are counted only once. First, GBD counts the total number of deaths in a year. Next, researchers work to assign a single cause to each death using a variety of innovative methods (see Annex). Estimates of cause-specific mortality

are then compared to estimates of deaths from all causes to ensure that the cause-specific numbers do not exceed the total number of deaths in a given year. Other components of the GBD estimation process are interconnected with similar built-in safeguards, such as those for the estimation of impairments that are caused by more than one disease.

Beyond providing a comparable and comprehensive picture of causes of premature death and disability, GBD also estimates the disease burden attributable to different risk factors. The GBD approach goes beyond risk-factor prevalence, such as the number of smokers or heavy drinkers in a population. With comparative risk assessment, GBD incorporates both the prevalence of a given risk factor as well as the relative harm caused by that risk factor. It counts premature death and disability attributable to high blood pressure, tobacco and alcohol use, lack of exercise, air pollution, poor diet, and other risk factors that lead to ill health.

The flexible design of the GBD machinery allows for regular updates as new data are made available and epidemiological studies are published. Similar to the way in which a policymaker uses gross domestic product data to monitor a country's economic activity, GBD can be used at the global, national, and local levels to understand health trends over time.

Policymakers in Brazil, Colombia, Mexico, Norway, Saudi Arabia, and the United Kingdom are exploring collaborations with IHME to adopt different aspects of the GBD approach. Box 3 contains decision-makers' and policy-influencers' reflections about the value of using GBD tools and results to inform policy discussions. GBD data visualization tools (see Box 4) on the IHME website allow users to interact with the results in a manner not seen in past versions of the study. Users report that the visualization tools provide a unique, hands-on opportunity to learn about the health problems that different countries and regions face, allowing them to explore

Box 3: Views on the value of GBD for policymaking

"While the GBD 2010 offers significant epidemiologic findings that will shape policy debates worldwide, it also limns the gaps in existing disease epidemiology knowledge and offers new ways to improve public health data collection and assessment." **Dr. Paul Farmer**, *Chair, Department of Global Health and Social Medicine, Harvard Medical School*

"If we look at sub-Saharan Africa, you've got the double burden of communicable diseases and the rising instances of non-communicable diseases. The dilemma will be how to deal with the non-communicable diseases without compromising what you've already been doing for communicable diseases." **Dr. Christine Kaseba-Sata**, *First Lady of Zambia*

"At UNICEF we've always had a focus on metrics and outcomes as a driver of the work we do. We welcome the innovation, energy, and attention that this work is bringing to the importance of holding ourselves accountable to meaningful outcomes and results." **Dr. Mickey Chopra**, *UNICEF Chief of Health/Associate Director of Programmes*

seemingly endless combinations of data. The following list illustrates the range of estimates that can be explored using the GBD data visualization tools:

- Changes between 1990 and 2010 in leading causes of death, premature death, disability, and DALYs as well as changes in the amount of health loss attributable to different risk factors across age groups, sexes, and locations.
- Rankings for 1990 and 2010 of the leading causes of death, premature death, disability, and DALYs attributable to risk factors across different countries and regions, age groups, and sexes.
- Changes in trends for 21 cause groups in 1990 and 2010 in different regions, sexes, and metrics of health loss.
- The percentage of deaths, premature deaths, disability, or DALYs in a country or region caused by myriad diseases and injuries for particular age groups, sexes, and time periods.
- The percentage of health loss by country or region attributable to specific risk factors by age group, sex, and time period.

In addition to promoting understanding about the major findings of GBD, these visualization tools can help government officials build support for health policy changes, allow researchers to visualize data prior to analysis, and empower teachers to illustrate key lessons of global health in their classrooms.

To use the GBD data visualization tools, visit www.ihmeuw.org/GBDcountryviz.

THE EGALITARIAN VALUES INHERENT IN GBD

When exploring the possibility of incorporating GBD measurement tools into their health information systems, policymakers should consider the egalitarian values on which this approach is founded.

The core principle at the heart of the GBD approach is that everyone should live a long life in full health. As a result, GBD researchers seek to measure the gap between this ideal and reality. Calculation of this gap requires estimation of two different components: years of life lost due to premature death (YLLs) and years lived with disability (YLDs).

Box 4: GBD data visualization tools

For the first time in the history of GBD research, IHME has developed many free data visualization tools that allow individuals to explore health trends for different countries and regions. The visualization tools allow people to view GBD estimates through hundreds of different dimensions. Only a few examples are explored in the figures throughout this document. We encourage you to visit the IHME website to use the GBD data visualization tools and share them with others.

To measure years lost to premature death, GBD researchers had to answer the question: "How long is a 'long' life?" For every death, researchers determined that the most egalitarian answer to this question was to use the highest life expectancy observed in the age group of the person who died. The Annex contains more information about the estimation of YLLs.

In order to estimate years lived with disability, or YLDs, researchers were confronted with yet another difficult question: "How do you rank the severity of different types of disability?" To determine the answer, researchers created disability weights based on individuals' perceptions of the impact on people's lives from a particular disability, everything from tooth decay to schizophrenia.

GBD REGIONAL CLASSIFICATIONS

GBD 2010 created regions based on two criteria: epidemiological similarity and geographic closeness. The GBD regional groupings differ from the World Bank regional classification system. More information about GBD regional classifications can be found on the IHME website at www.ihmeuw.org/gbdfaq.

Rather than using the GBD regional classifications, this report provides findings based on the countries in World Bank's regional definition of Europe and Central Asia. Figures reflect World Bank regional classifications. GBD, however, does not produce estimates for territories or countries with fewer than 50,000 people or countries that have only recently come into existence.

RAPID HEALTH TRANSITIONS: GBD 2010 RESULTS

In most countries in Europe and Central Asia, loss of healthy life, or DALYs, from non-communicable diseases are rising, while DALYs from communicable, newborn, nutritional, and maternal causes are declining. To help decision-makers establish health service priorities within countries when faced with limited resources, we will explore changes in disease burden around the globe, in Europe and Central Asia, and in specific countries in this section. In the section entitled "Using GBD to assess countries' health progress," we will compare how well countries are performing in health relative to other countries in the region using a metric called age-standardized rates.

In terms of disease burden at the global level, GBD 2010 found that the leading causes of loss of healthy life have evolved dramatically over the past 20 years. Figure 1 shows the changes in the leading global causes of DALYs in 1990 and 2010. Communicable, newborn, maternal, and nutritional causes are shown in red, non-communicable diseases appear in blue, and injuries are shown in green. Dotted lines indicate causes that have fallen in rank during this period, while solid lines signal causes that have risen in rank.

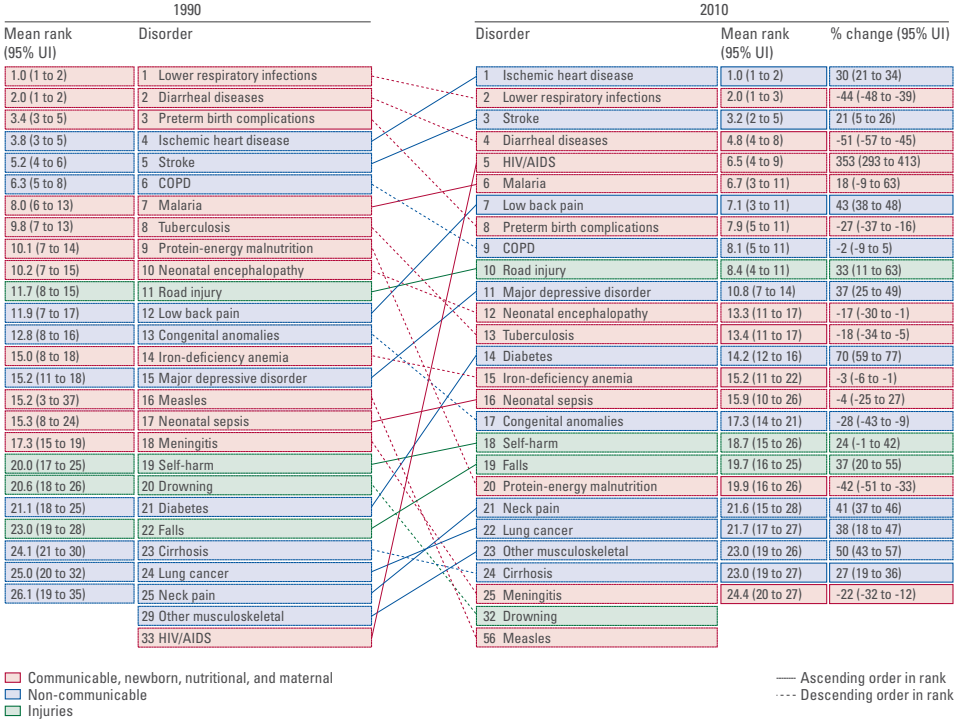
Causes associated with ill health and death in adults, such as ischemic heart disease, stroke, and low back pain, increased in rank between 1990 and 2010, while causes that primarily affect children, such as lower respiratory infections, diarrhea, preterm birth complications, and protein-energy malnutrition, decreased in rank. Unlike most of the leading communicable causes, HIV/AIDS and malaria increased by 353% and 18%, respectively. Since 2005, however, premature mortality and disability from these two causes have begun to decline. Four main trends have driven changes in the leading causes of DALYs globally: aging populations, increases in non-communicable diseases, shifts toward disabling causes and away from fatal causes, and changes in risk factors.

To provide a closer look at the epidemiological changes occurring at the regional level, Figure 2 shows how the leading causes of premature death and disability have changed over time in Europe and Central Asia. Figures showing changes in the leading causes of DALYs by country can be found in the Annex of this report. Many trends observed in this region mirror the global trends seen in Figure 1. For example, there was an increase in burden caused by non-communicable diseases and a drop in most communicable, maternal, nutritional, and newborn causes. HIV/AIDS increased dramatically in most parts of the world, but its increase of more than 7,000% was extraordinarily sharp in Europe and Central Asia and put HIV/AIDS in the top 10 causes of disease burden. The degree of the rise in HIV/AIDS

burden varied across countries, however; Kyrgyzstan and Ukraine were among the countries that experienced the greatest increases in health loss associated with HIV/AIDS, and countries such as Bosnia and Herzegovina and Macedonia experienced the smallest.

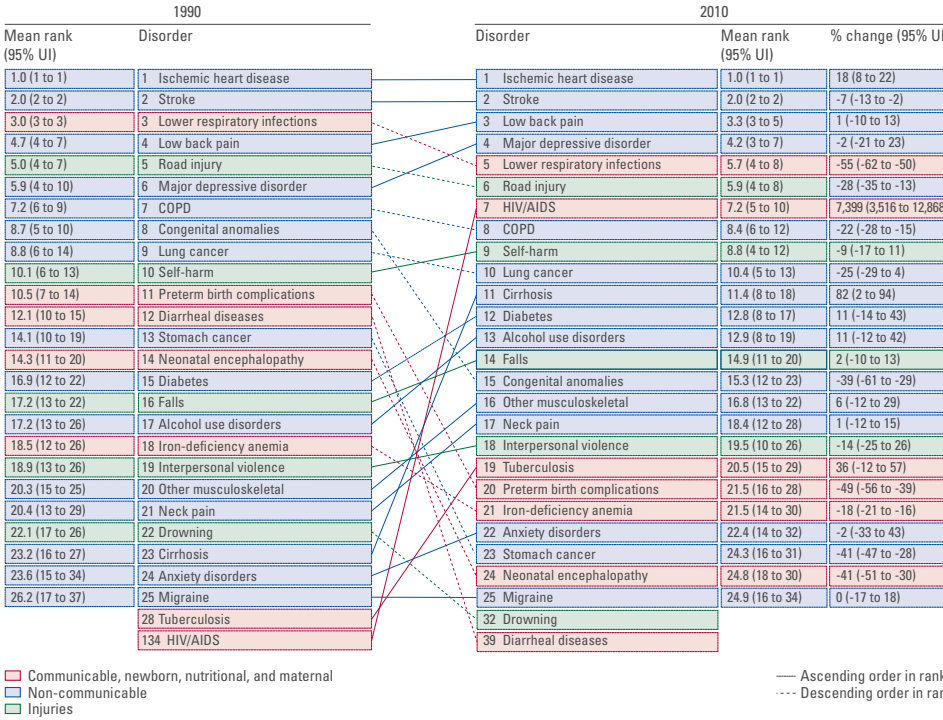
While the trends in Europe and Central Asia were largely consistent with global patterns, the region is unique in many ways. Health loss from tuberculosis decreased by 18% at the global level, but it increased by 36% in Europe and Central Asia. Also, certain non-communicable diseases were much more prominent causes of premature death and disability in the region compared to the world as a whole. Depression ranked fourth in this region, for example, but ranked 11th globally. Road injuries ranked sixth as a cause of premature death and disability in the region and ranked 10th at the global level. Another cause that ranked higher in this region compared to the world overall was cirrhosis. Cirrhosis was the 24th leading cause of DALYs globally but ranked 11th in this region.

Figure 1: Global disability-adjusted life year ranks, top 25 causes, and percentage change, 1990-2010



Note: Solid lines indicate a cause that has moved up in rank or stayed the same. Broken lines indicate a cause that has moved down in rank. The causes of DALYs are color coded, with blue for non-communicable diseases, green for injuries, and red for communicable, newborn, nutritional, and maternal causes. COPD: Chronic obstructive pulmonary disease. To view an interactive version of this figure, visit IHME's website: http://ihmeuw.org/gbdarrowdiagram.

Figure 2: Disability-adjusted life year ranks, top 25 causes, and percentage change in Europe and Central Asia, 1990-2010



Note: Solid lines indicate a cause that has moved up in rank or stayed the same. Broken lines indicate a cause that has moved down in rank. The causes of DALYs are color coded, with blue for non-communicable diseases, green for injuries, and red for communicable, newborn, nutritional, and maternal causes.

MOST OF THE WORLD'S POPULATION IS LIVING LONGER AND DYING AT LOWER RATES

In much of the world, GBD 2010 found that people are living to older ages than ever before, and the entire population is getting older. Since 1970, the average age of death has increased 20 years globally. Sub-Saharan Africa, however, has not made nearly as much progress as other developing regions, and people in this part of the world tend to die at much younger ages than in any other region. Progress in sub-Saharan Africa has in particular been held back by the HIV/AIDS epidemic, maternal deaths, and child mortality caused by infectious diseases and malnutrition, but some of these trends have begun to change in the past decade. Figure 3 illustrates the changes that occurred during this period in Europe and Central Asia.

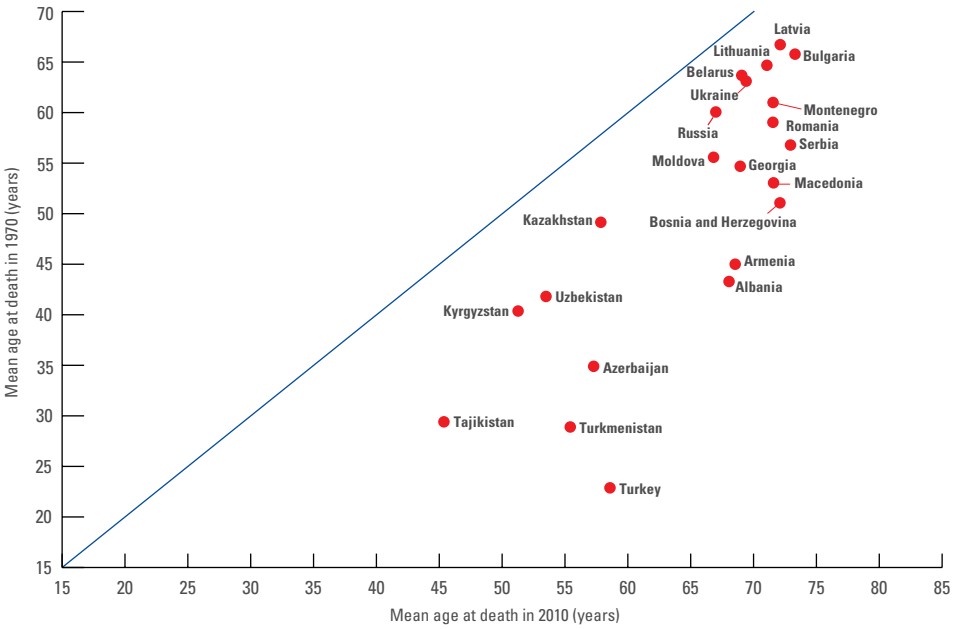
Overall, from 1970 to 2010, the countries of Europe and Central Asia made measurable progress in extending the lives of their populations, as seen in Figure 3. There were variations, however, in the size of the increases in average age at death across

the countries of the region. For example, the average age of death grew by the greatest amount in Turkey (35.7 years) during this period. Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, and Turkmenistan each extended their average age of death by more than 20 years between 1970 and 2010. Belarus and Latvia had the smallest increases in average age at death in the region (5.4 years), and Bulgaria, Kazakhstan, Lithuania, Russia, and Ukraine added less than 10 years to their average age of death.

Another way to understand changes in global demographic trends is to explore reductions in mortality rates by sex and age group. Figure 4 shows how death rates have declined in all age groups between 1970 and 2010. These changes have been most dramatic among males and females aged 0 to 9 years, whose death rates have dropped over 60% since 1970. Among age groups 15 and older, the decrease in female death rates since 1970 has been greater than the drop in male death rates. The gap in progress between men and women was largest between the ages of 15 to 54, most likely due to the persistence of higher mortality from injuries, as well as alcohol and tobacco use, among men.

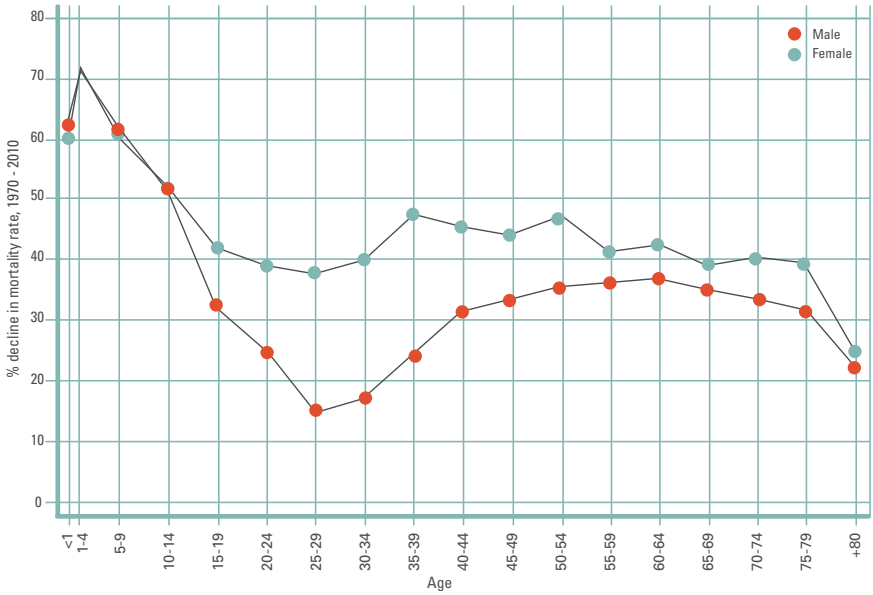
Figure 5 depicts the decline in mortality rates in Europe and Central Asia. In nearly every age group older than 10 to 14 years, declines in mortality were faster among

Figure 3: Average age of death for countries in Europe and Central Asia, 1970 compared with 2010



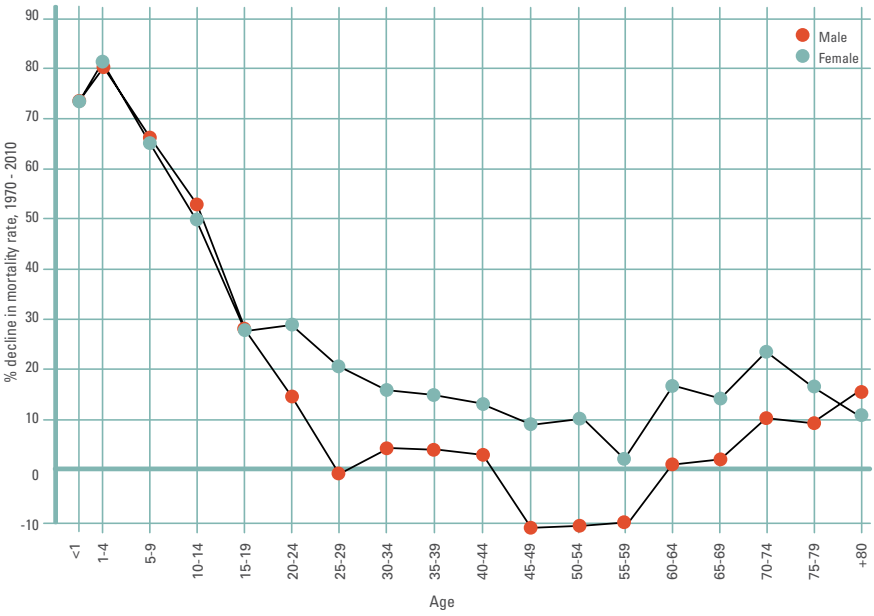
Note: Countries falling on the right side of the 45-degree angle line had a greater average age of death in 2010 compared to 1970.

Figure 4: Global decline in age-specific mortality rate, 1970-2010



Note: Higher values indicate greater declines in mortality; lower values indicate smaller declines in mortality.

Figure 5: Decline in age-specific mortality rate in Europe and Central Asia, 1970-2010



Note: Higher values indicate greater declines in mortality; lower values indicate smaller declines in mortality. Points below 0 indicate an increase in mortality rate between 1970 and 2010.

women than in men. Compared to global trends, declines in mortality rates among adult males and females were smaller in Europe and Central Asia with the exception of those groups under age 5. Mortality rates barely changed among 25- to 29-year-old men in the region over the past 40 years, and men ages 45 to 59 died at higher rates in 2010 compared to 1970, largely due to alcohol use.

LEADING CAUSES OF DEATH ARE SHIFTING TO NON-COMMUNICABLE DISEASES

In part because many people are living longer lives and the population is growing older, the leading causes of death have changed. Worldwide, the number of people dying from non-communicable diseases, such as ischemic heart disease and diabetes, has grown 30% since 1990. To a lesser extent, overall population growth also contributed to this increase in deaths from non-communicable diseases.

The rise in the total number of deaths from non-communicable diseases has increased the number of healthy years lost, or DALYs, from these conditions. Figure 6 shows global changes in the 25 leading causes of DALYs between 1990 and 2010 ordered from highest to lowest ranking cause from top to bottom. Non-communicable causes are shown in blue; communicable, nutritional, maternal, and newborn causes in red; and injuries in green.

Figure 7 shows that, among non-communicable diseases with the largest burden, health loss from cirrhosis, ischemic heart disease, diabetes, alcohol use disorders, and low back and other musculoskeletal disorders increased the most in Europe and Central Asia between 1990 and 2010. While there was a decrease in disease burden from many communicable diseases in the region, HIV/AIDS was a notable exception.

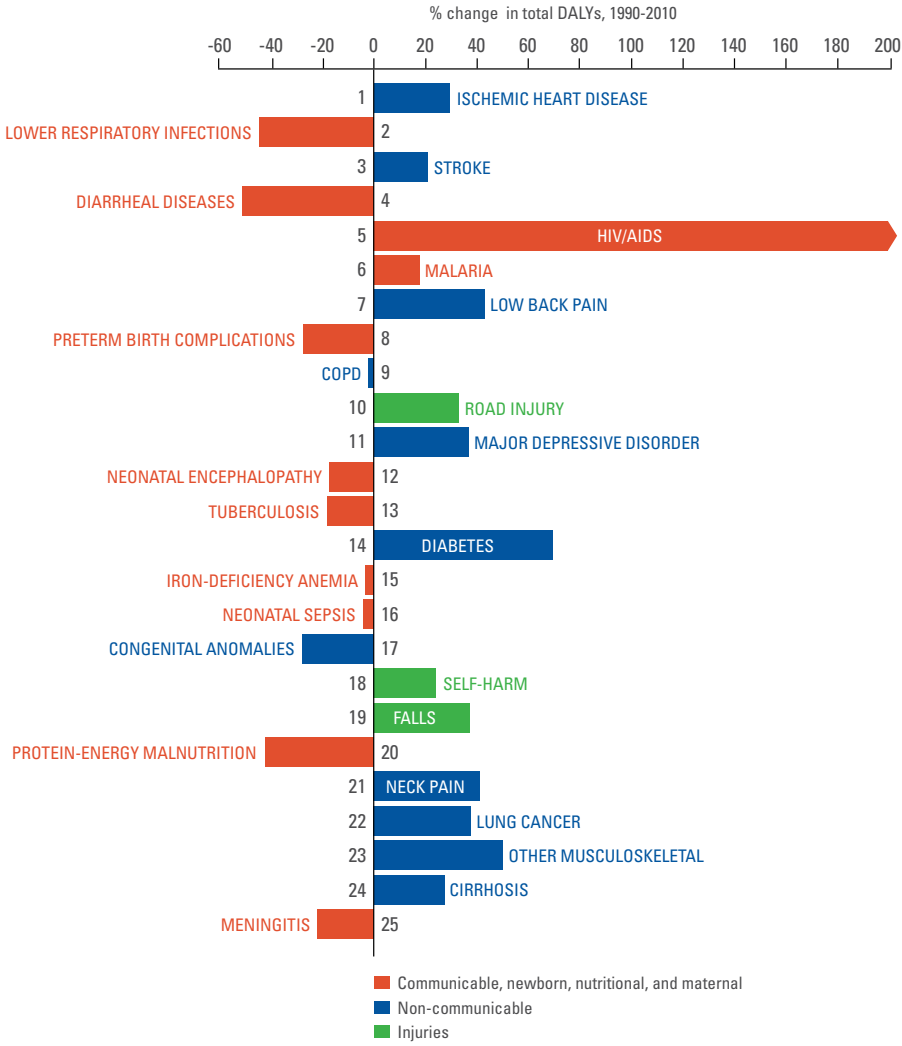
In many countries, non-communicable diseases account for the majority of DALYs. Figure 8 shows the percent of healthy years lost from this disease group by country in 2010. In most countries outside of sub-Saharan Africa, non-communicable diseases caused 50% or more of all DALYs. In Australia, Japan, and richer countries in Western Europe and North America, the percentage was greater than 80%.

Figure 8 shows the important role played by non-communicable diseases in Europe and Central Asia. Among countries in the region, Bulgaria had the highest percentage of DALYs due to non-communicable diseases (86.7%), while Tajikistan had the lowest percentage of DALYs from these conditions (51.3%).

An in-depth look at the country-level data reveals the specific diseases that are driving overall shifts from communicable to non-communicable diseases. As an example, Figure 9 displays the changes in the top 20 causes of DALYs in Turkish females between 1990 and 2010. The causes are organized by ranking from

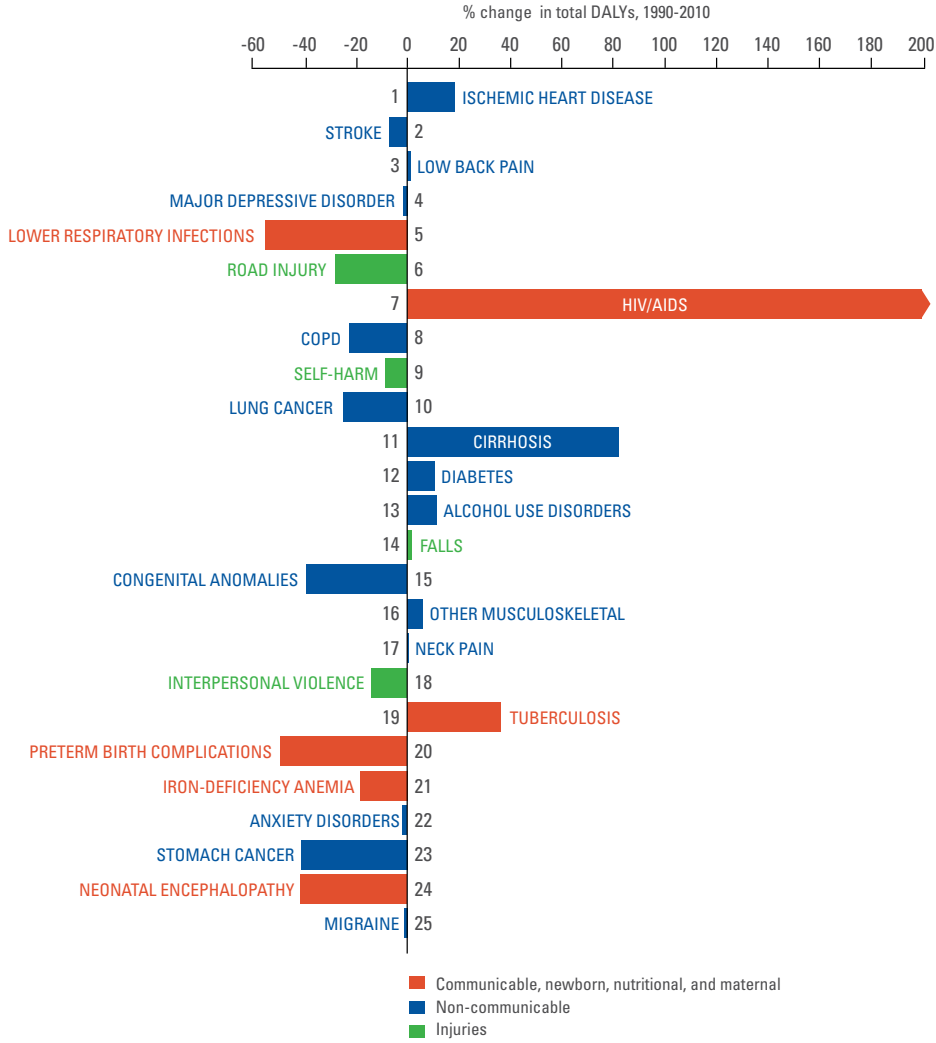
top to bottom. Most non-communicable diseases rose over time, while most communicable, newborn, nutritional, and maternal conditions fell during this period. Among the top five causes of DALYs in 2010, low back pain increased the most (63%), followed by anxiety and depression, which grew 59% and 53%, respectively. Among communicable, nutritional, newborn, and maternal conditions, lower respiratory infections and meningitis experienced the most dramatic declines, falling by 81% and 60%, respectively.

Figure 6: Global shifts in leading causes of DALYs, 1990-2010



Note: The leading 25 causes of DALYs are ranked from top to bottom in order of the number of DALYs they contributed in 2010. Bars to the right of the vertical line show the percent by which DALYs have increased since 1990. Bars on the left show the percent by which DALYs have decreased. Pointed arrows indicate causes that have increased by a greater amount than shown on the x-axis.

Figure 7: Shifts in leading causes of DALYs in Europe and Central Asia, 1990-2010



Note: The leading 25 causes of DALYs are ranked from top to bottom in order of the number of DALYs they contributed in 2010. Bars to the right of the vertical line show the percent by which DALYs have increased since 1990. Bars on the left show the percent by which DALYs have decreased. Pointed arrows indicate causes that have increased by a greater amount than shown on the x-axis.

Figure 8: Percent of global DALYs due to non-communicable diseases, 2010

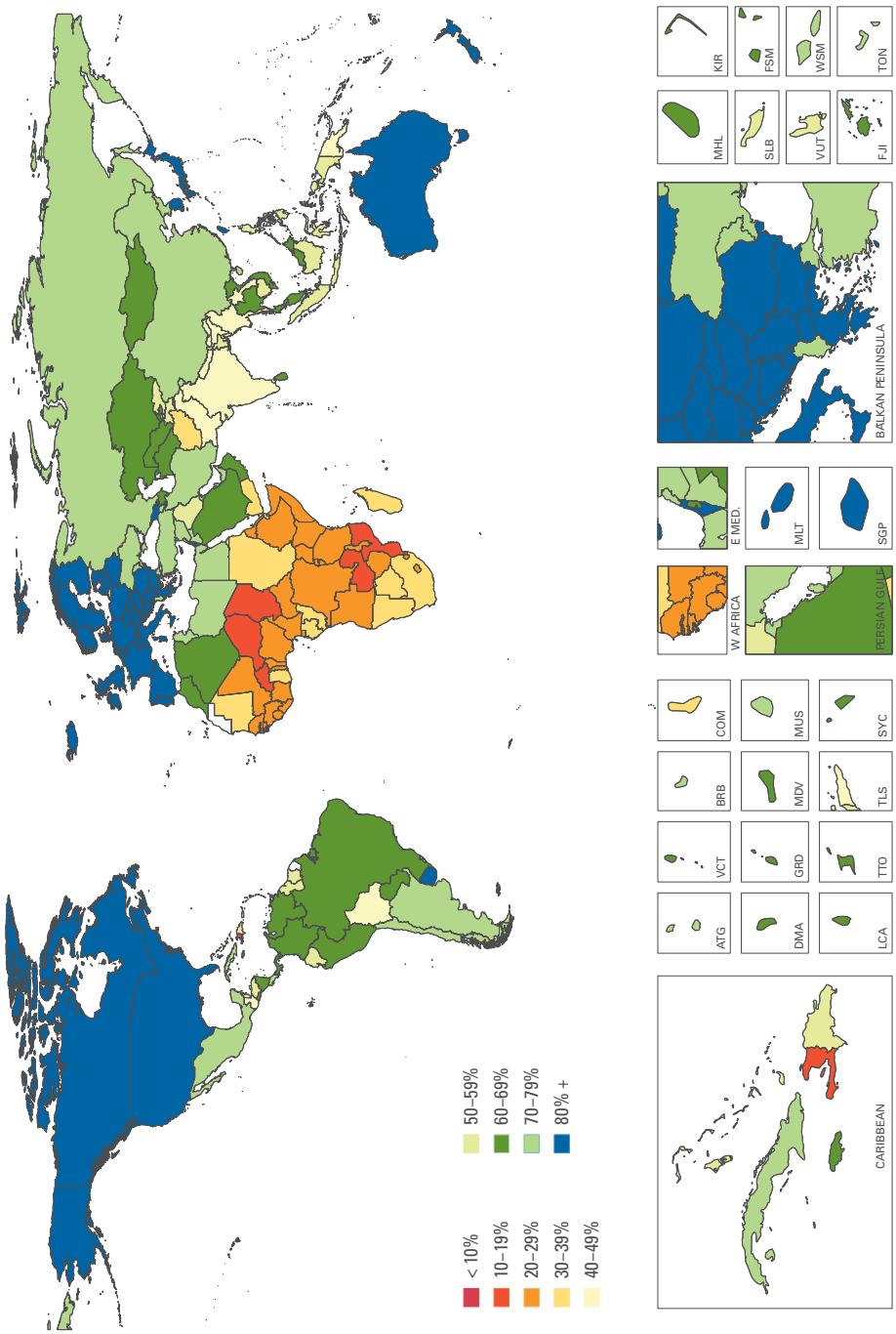
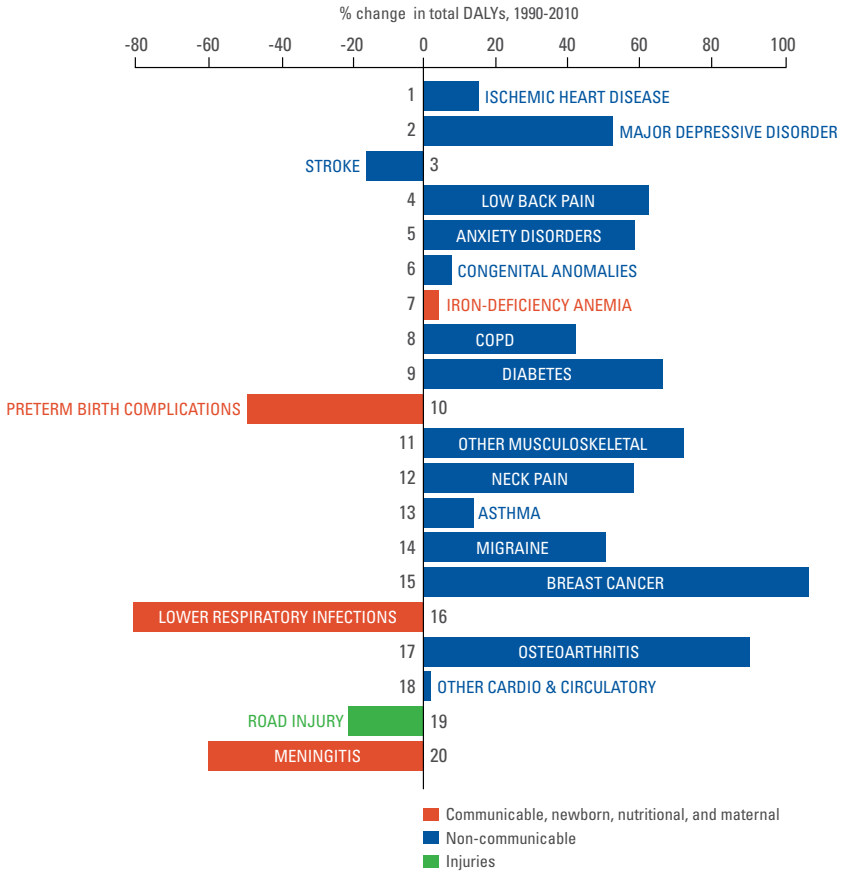


Figure 10 shows declines in DALYs among Turkish males from communicable, nutritional, and newborn conditions coupled with increases in non-communicable diseases between 1990 and 2010. Out of all the non-communicable diseases shown in this figure, drug use disorders increased the most over the period (78%). Other leading causes of DALYs, such as lung cancer, increased by 74%, depression grew by 55%, and low back pain by 56%. In addition to displaying the rising prominence of non-communicable diseases, this visualization shows that injuries are among the most dominant causes of healthy life lost in men in Turkey. DALYs caused by self-harm increased by 459% to a ranking of 15th, while falls increased by 50% to 16th.

Another visualization tool, GBD Compare, displays proportional changes in disease patterns over time using a treemap diagram, which is essentially a square pie chart. Causes of DALYs, or numbers of healthy years lost, are shown in boxes. The size of each box represents the percentage of total DALYs due to a specific cause. Figures

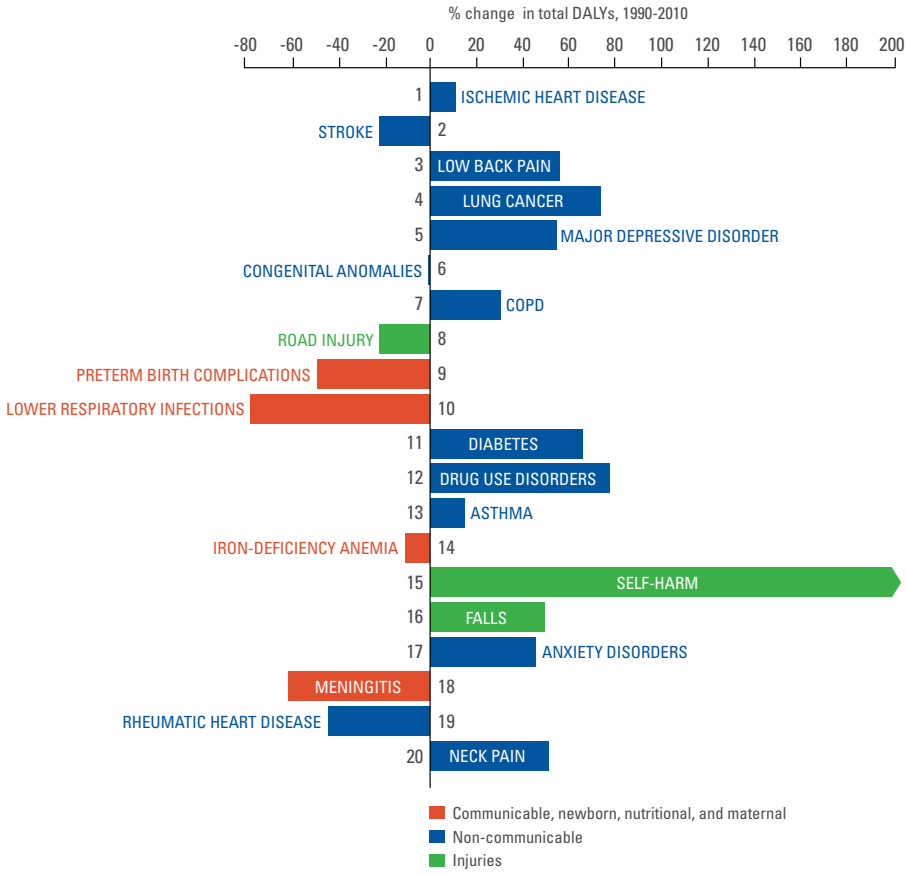
Figure 9: Shifts in leading causes of DALYs for females, Turkey, 1990-2010



Note: The leading 20 causes of DALYs are ranked from top to bottom in order of the number of DALYs they contributed in 2010. Bars to the right of the vertical line show the percent by which DALYs have increased since 1990. Bars on the left show the percent by which DALYs have decreased.

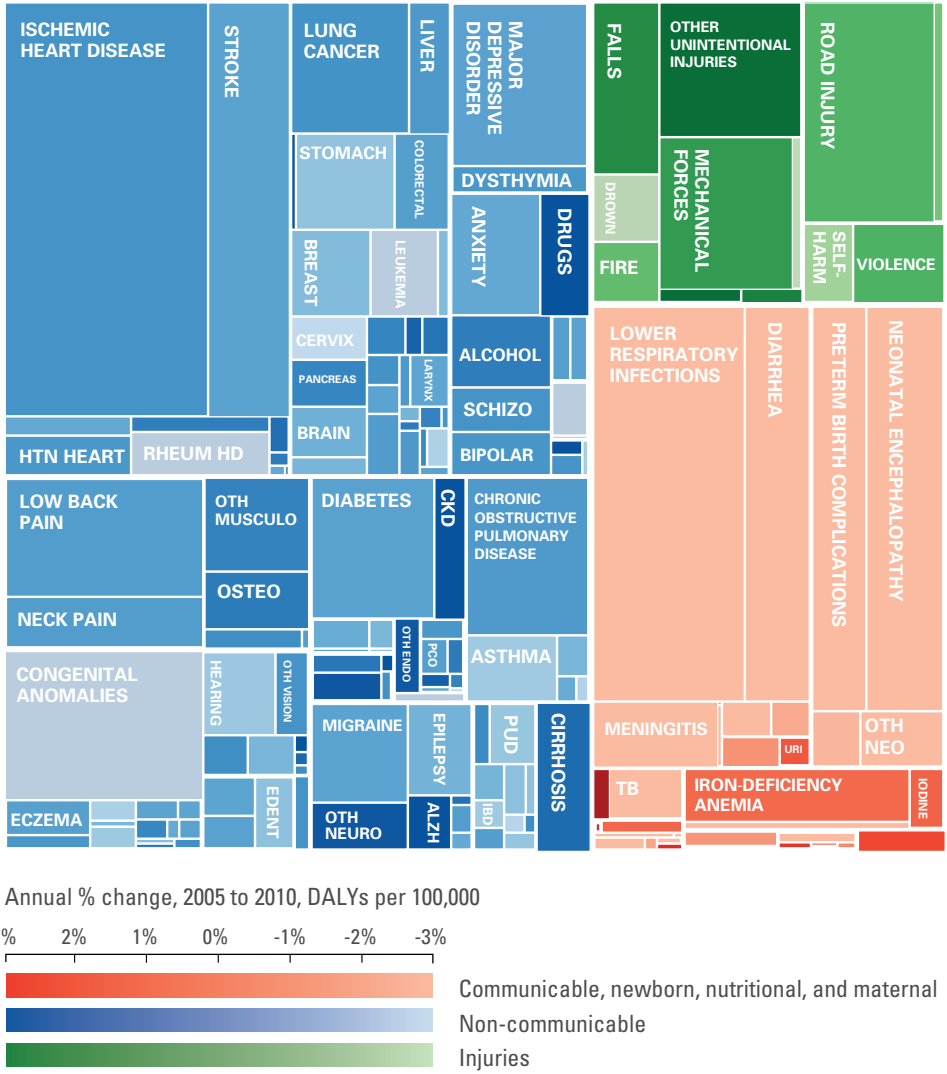
11a and 11b show how DALYs have changed in Armenia between 1990 and 2010. In 1990, non-communicable diseases accounted for 62.4% of DALYs in both sexes, while communicable, nutritional, maternal, and newborn causes accounted for 24.2%. By 2010, they represented 79.6% and 10.3% of total disease burden, respectively. Premature death and disability from most communicable, nutritional, maternal, and newborn causes decreased during this period, with the notable exception of HIV/AIDS and tuberculosis. DALYs from many non-communicable causes rose. Increases occurred in causes such as ischemic heart disease (20%), stroke (26%), cirrhosis (70%), and diabetes (69%). In 2010, ischemic heart disease caused 15.7% of total DALYs in the country, the largest percentage by any non-communicable cause. Contrary to global trends, health loss from road traffic injuries and falls decreased by 35% and 20%, respectively, while DALYs from fire-related injuries declined 68% between 1990 and 2010.

Figure 10: Shifts in leading causes of DALYs for males, Turkey, 1990-2010



Note: The leading 20 causes of DALYs are ranked from top to bottom in order of the number of DALYs they contributed in 2010. Bars to the right of the vertical line show the percent by which DALYs have increased since 1990. Bars on the left show the percent by which DALYs have decreased. Pointed arrows indicate causes that have increased by a greater amount than shown on the x-axis.

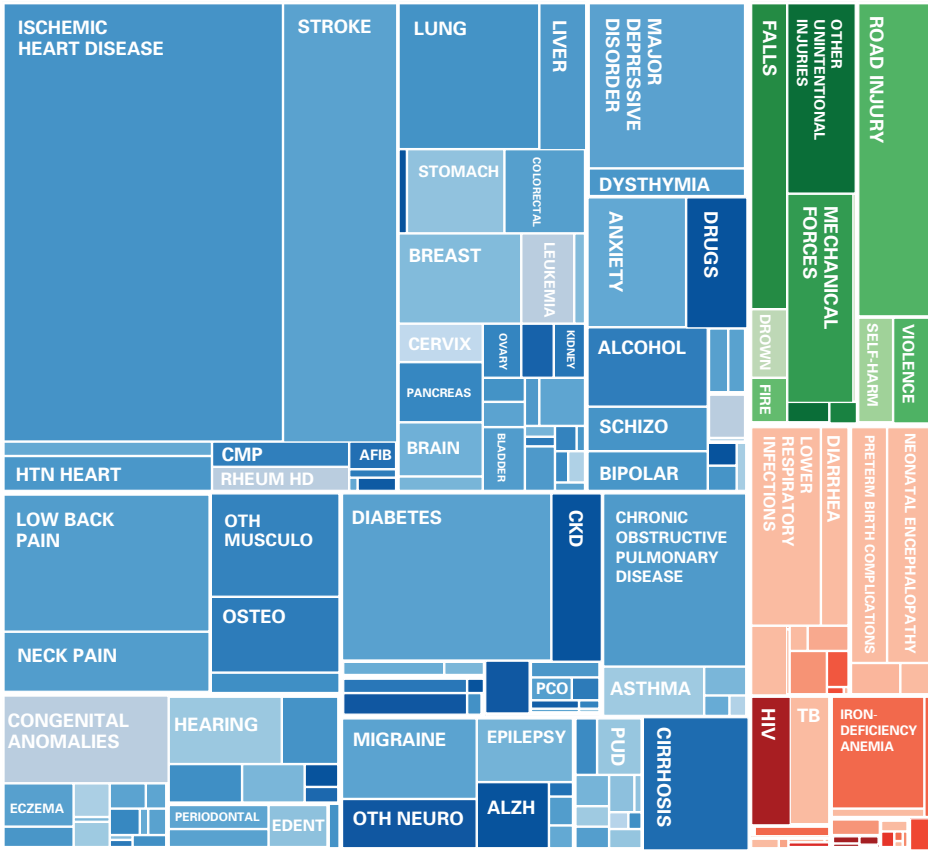
Figure 11a: Causes of DALYs, both sexes, all ages, Armenia, 1990

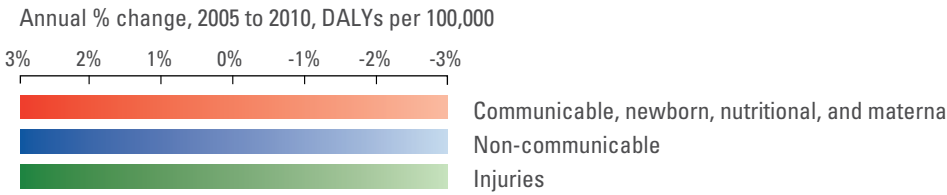


Annual % change, 2005 to 2010, DALYs per 100,000

Note: The size of each box in this square pie chart represents the percentage of total DALYs caused by a particular disease or injury. To view an interactive version of this figure, visit IHME's website: http://ihmeuw.org/gbdcompare.

Figure 11b: Causes of DALYs, both sexes, all ages, Armenia, 2010





Note: The size of each box in this square pie chart represents the percentage of total DALYs caused by a particular disease or injury. To view an interactive version of this figure, visit IHME's website: http://ihmeuw.org/gbdcompare.

DISABILITY INCREASES IN MIDDLE- AND HIGH-INCOME COUNTRIES

Most countries in the world have succeeded in reducing deaths early in life. To a growing extent, longer lives are redefining "old age" in many countries, and people in all age groups are dying at lower rates than in the past. Simply living longer does not mean that people are healthier. Little progress has been made in reducing the prevalence of disability, so people are living to an older age but experiencing more ill health. Many people suffer from different forms of disability throughout their lives, such as mental and behavioral health problems starting in their teens and musculoskeletal disorders beginning in middle age. These findings have far-reaching implications for health systems.

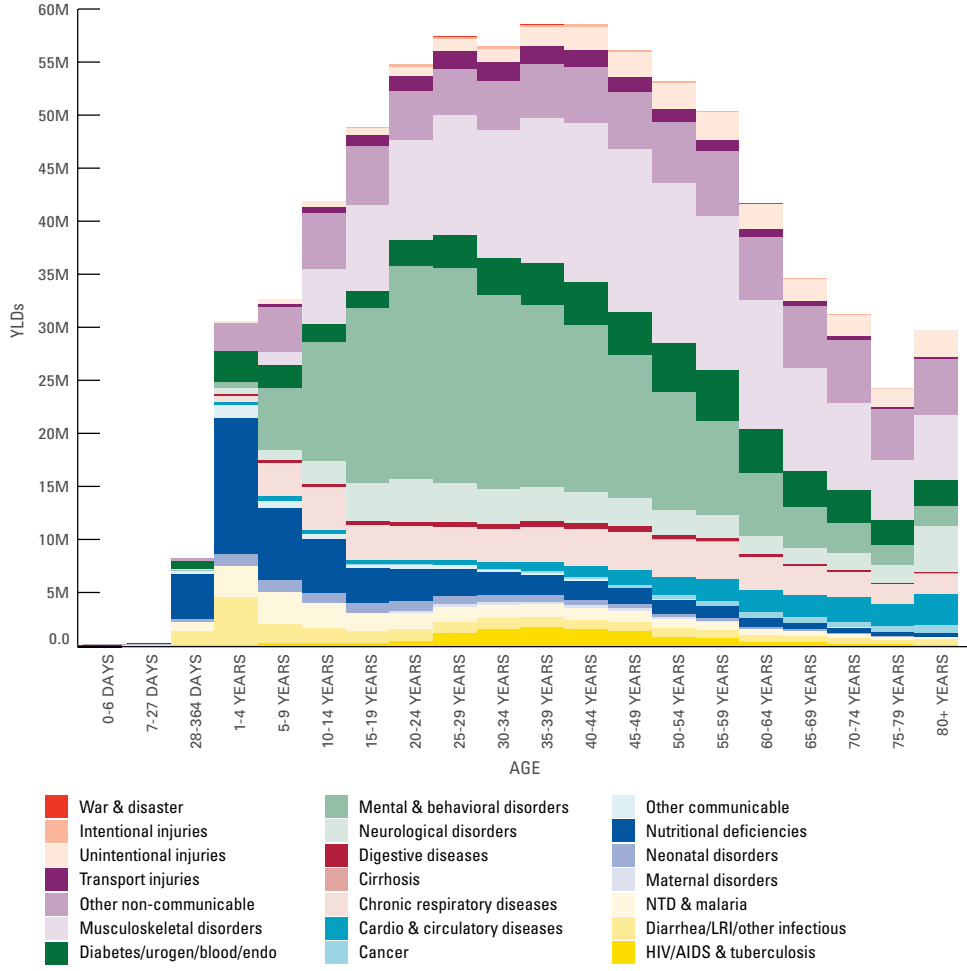
Healthy years lost (DALYs) are calculated by adding together years lived with disability (YLDs) and years of life lost (YLLs, also known as years lost to premature death). Between 1990 and 2010, years lived with disability increased as a percentage of total DALYs in all areas of the world except Eastern Europe, southern sub-Saharan Africa, and the Caribbean. This disability transition has been most dramatic in parts of Latin America, the Middle East and North Africa, and many areas in Asia. The percentage of burden from YLDs also increased in sub-Saharan Africa with the exception of the southern part of the region.

Figure 12 tells a more detailed story about the different conditions that cause disability globally. It is important to keep in mind that these estimates reflect both how many individuals suffer from a particular condition as well as the severity of that condition. Mental and behavioral disorders, such as depression, anxiety, and drug use, were the primary drivers of disability worldwide and caused over 40 million years of disability in 20- to 29-year-olds. Musculoskeletal conditions, which include low back pain and neck pain, accounted for the next largest number of years lived with disability. People aged 45 to 54 were most impacted by these conditions, as musculoskeletal disorders caused over 30 million years of disability in each of these age groups.

Figure 13 shows the causes of disability in Europe and Central Asia. Disability patterns in this region exhibit marked differences from global trends for people aged 45 to 59. At the global level, overall disability dropped in these ages, but disability increased in these age groups in Europe and Central Asia. Increases in disability in these age groups were driven by musculoskeletal disorders; diabetes; urogenital, blood, and endocrine disorders; other non-communicable disorders; and unintentional injuries.

Another way to view the world's health challenges is by comparing how different conditions rank. Figure 14 ranks the leading causes of disability globally and in each of the six World Bank regions in 2010, using color coding to indicate how high a condition ranks in a region. Low back pain caused the most disability in East Asia and the Pacific, Europe and Central Asia, and in the Middle East and North Africa. This condition can inhibit people's ability to perform different types of work both inside

Figure 12: Global disability patterns by broad cause group and age, 2010



Note: The size of the colored portion in each bar represents the number of YLDs attributable to each cause for a given age group. The height of each bar shows total YLDs for a given age group in 2010. The causes are aggregated. For example, musculoskeletal disorders include low back pain and neck pain. To view an interactive version of this figure, visit IHME's website: http://ihmeuw.org/gbdcausepattern.

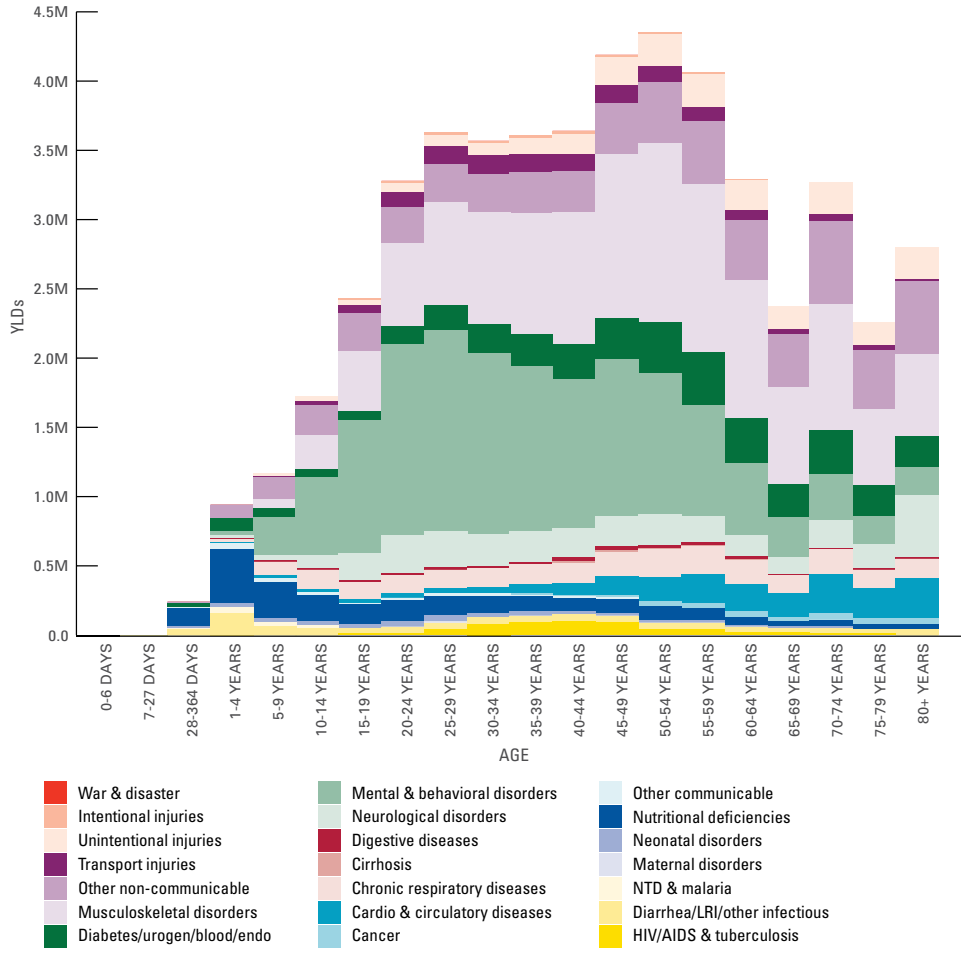
and outside the home and impair their mobility. In addition to low back pain, neck pain and other musculoskeletal disorders ranked in the top 10 causes of disability in most regions. Another musculoskeletal disorder, osteoarthritis, appeared in the top 20 causes of disability in every region.

Depression was also a major cause of disability and was one of the top three causes of disability in every region. This disorder can cause fatigue, decreased ability to work or attend school, and suicide. Anxiety, a different type of mental disorder, was one of the top 10 causes of disability in all regions, but ranked highest in Latin

America and the Caribbean and the Middle East and North Africa. Additionally, two other mental disorders, schizophrenia and bipolar disorder, appeared among the top 20 causes of disability in many regions.

While mental and musculoskeletal disorders ranked high among causes of disability across regions, Figure 14 also reveals substantial regional variation among other causes. For example, iron-deficiency anemia was the leading cause of disability in sub-Saharan Africa and South Asia, but was less important as a cause of disability in the other regions. The substantial burden in these two regions contributed to iron-deficiency anemia's ranking as the third leading cause of disability at the global level. Iron-deficiency anemia can lead to fatigue and lowered ability to fight infection and may decrease cognitive ability.

Figure 13: Disability patterns by broad cause group and age in Europe and Central Asia, 2010

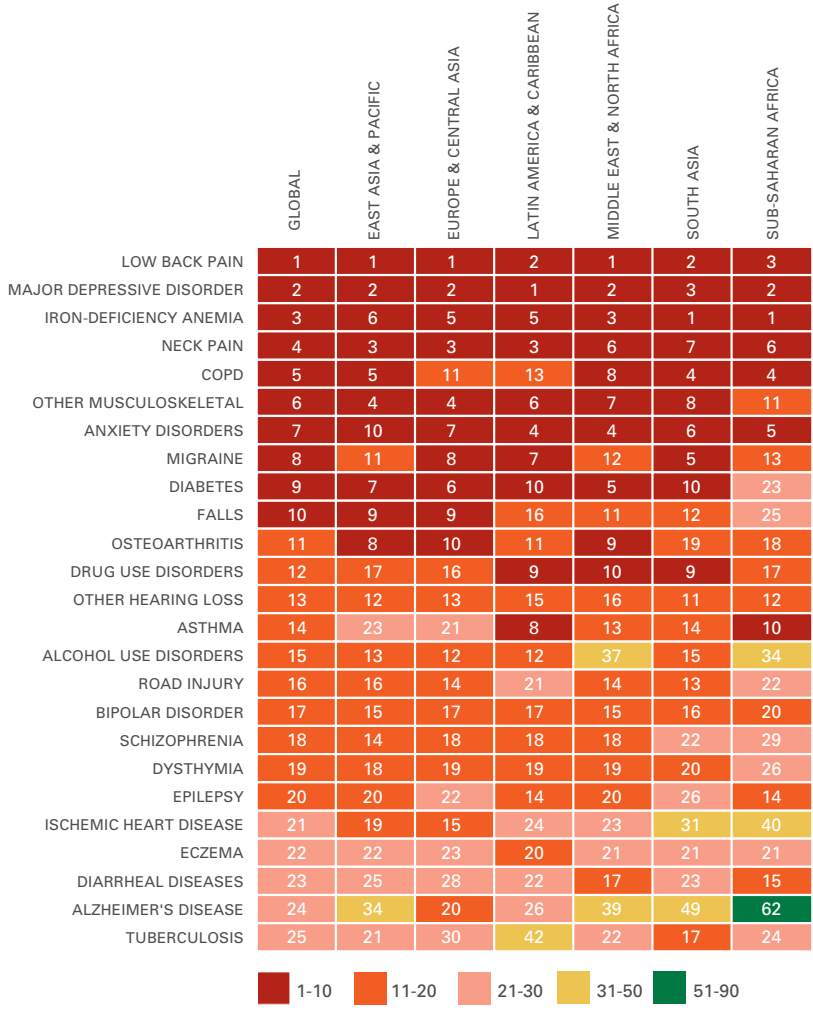


Note: The size of the colored portion in each bar represents the number of YLDs attributable to each cause for a given age group. The height of each bar shows total YLDs for a given age group in 2010. The causes are aggregated. For example, musculoskeletal disorders include low back pain and neck pain.

Chronic obstructive pulmonary disease (COPD), a term used to describe emphysema and other chronic respiratory diseases, was among the top five causes of disability in East Asia and Pacific, South Asia, and sub-Saharan Africa and was the eighth-leading cause of disability in the Middle East and North Africa. COPD ranked lower in Europe and Central Asia (11th) and Latin America and the Caribbean (13th).

In Europe and Central Asia, many of the leading causes of disability were similar to global rankings, but key differences merit further discussion. Globally, iron-deficiency anemia ranked as a higher cause of disability (third in both 1990 and 2010) than in the region, where it ranked fifth. COPD ranked 11th in Europe and Central Asia and fifth globally. In contrast to the global ranking of ninth place, diabetes was a more

Figure 14: Rankings of leading causes of disability by region, 2010



Note: In this figure, shading is used to indicate the ranking of each cause of disability in a particular region.

important cause of disability in Europe and Central Asia (sixth). Country-level disability rankings can be viewed on IHME's website: http://ihmeuw.org/gbdheatmap.

Using GBD tools to identify leading causes of disability, such as mental and behavioral disorders and musculoskeletal disorders, can help guide health system planning and medical education. Decision-makers can use GBD's findings to ensure that health care systems are designed to address the primary drivers of disability in a cost effective way.

THE GLOBAL RISK FACTOR TRANSITION

Data on potentially modifiable causes of health loss, or risk factors, can help policymakers and donors prioritize prevention strategies to achieve maximum health gains. GBD tools estimate the number of deaths, premature deaths, years lived with disability, and DALYs attributable to 67 risk factors worldwide. This study benefited from the availability of new data, such as newly available epidemiologic evidence about the health impacts of different risk factors; population, nutrition, health, and medical examination surveys; and high-resolution satellite data on air pollution.

Figure 15 shows changes in the 15 leading global risk factors for premature death and disability, or DALYs, between 1990 and 2010. Over this period, many risk factors that primarily cause communicable diseases in children declined. Examples of these risk factors are childhood underweight and suboptimal breastfeeding, which dropped by 61% and 57%, respectively, from 1990 to 2010. Childhood underweight is commonly used to measure malnutrition, and was formerly the leading risk factor for DALYs in 1990, but ranked eighth in 2010. DALYs attributable to household air pollution, which contributes to lower respiratory tract infections in children, dropped by 37% between 1990 and 2010. Unlike other risk factors that primarily cause DALYs from communicable diseases, progress in reducing premature death and disability from iron deficiency was much lower, declining by just 7% between 1990 and 2010. Slow progress in reducing iron deficiency helps explain why iron-deficiency anemia ranks as the third leading cause of disability globally.

As most risk factors for communicable diseases in children have declined, many risks associated with non-communicable diseases have grown. As the leading global risk factor for DALYs in 2010, dietary risks increased 30% between 1990 and 2010. Dietary risks include components such as high sodium intake and lack of fruit, nuts and seeds, and whole grain intake. GBD found that the diseases linked to poor diets and physical inactivity were primarily cardiovascular diseases as well as cancer and diabetes. While the focus of many public health messages about diet have stressed the importance of eating less saturated fat, GBD 2010's findings indicate that these messages should emphasize a broader range of dietary components.

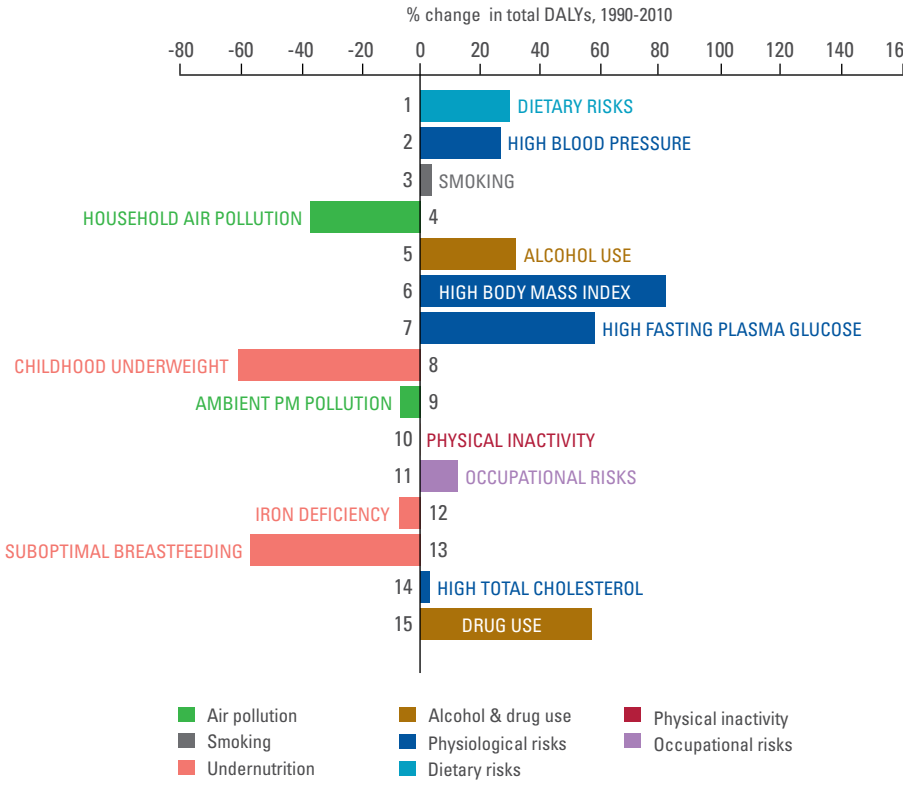
GBD 2010 used the most recent data available on the effects of different dietary risk factors. It is important to note that these data are constantly evolving as new studies on diet are conducted. Compared to data on the negative health impacts of smoking, which have been well understood for decades, the scientific evidence surrounding

dietary risk factors is much newer. Future updates of GBD will incorporate new data on risk factors as they emerge.

The second leading global risk factor, high blood pressure, increased by 27% as a cause of DALYs between 1990 and 2010. High blood pressure is a major risk factor for cardiovascular and circulatory diseases. DALYs attributable to another risk factor for non-communicable diseases, tobacco smoking, increased slightly by 3% between 1990 and 2010. Smoking increases the risk of chronic respiratory diseases, cardiovascular and circulatory diseases, and cancer. DALYs attributable to another substance, alcohol use, increased 32% during this period. Alcohol use contributes to cardiovascular and circulatory diseases, cirrhosis, and cancer. In addition to being a contributor to non-communicable diseases, alcohol increases the risk of injuries.

High BMI was another major contributor to DALYs in 2010 and was the sixth leading risk factor. High BMI is typically used as an indicator of overweight and obesity. It increased by a dramatic 82% over the period 1990 to 2010. High BMI is a leading risk factor for cardiovascular and circulatory diseases as well as diabetes. It is striking

Figure 15: Global shifts in rankings of DALYs for top 15 risk factors, 1990-2010



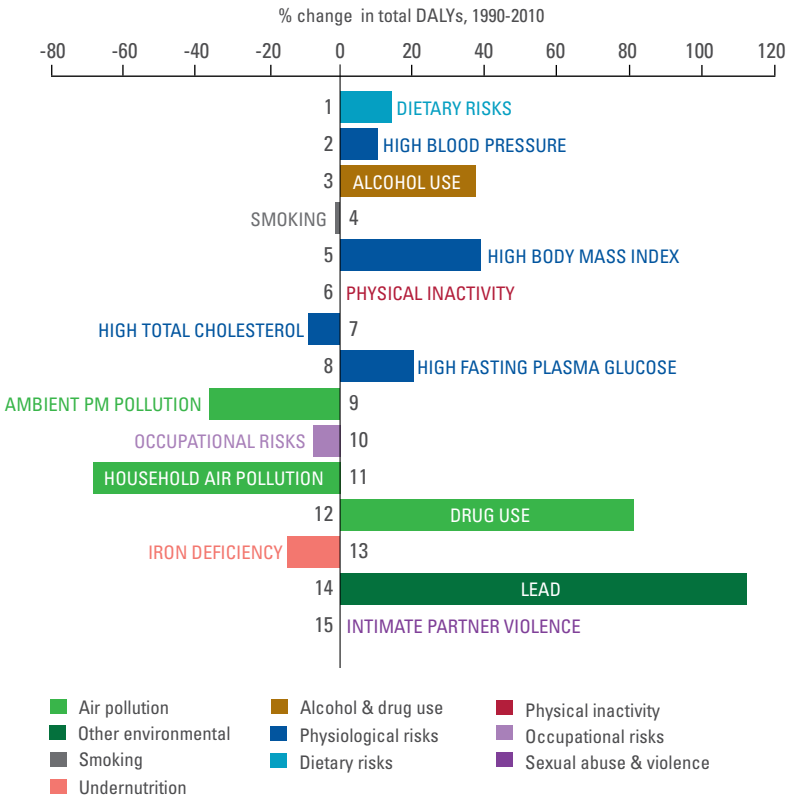
Note: The leading 15 risk factors are ranked from top to bottom in order of the number of DALYs they contributed in 2010. Bars to the right of the vertical line show the percent by which DALYs attributable to different risk factors have increased since 1990. Bars on the left show the percent by which DALYs attributable to different risk factors have decreased. Attributable DALYs were not quantified for physical inactivity for 1990.

that high BMI was a more important cause of poor health worldwide than childhood underweight in 2010, whereas childhood underweight was a much more prominent risk factor than high BMI in 1990.

Figure 16 depicts changes in the top 15 leading risk factors for DALYs in Europe and Central Asia between 1990 and 2010. While the trends in the region were largely consistent with the global trends, there are a few notable exceptions. DALYs attributable to high BMI for example, increased globally by 82% but increased by a lower rate of 39% in the region. Conversely, premature death and disability associated with drug use increased more sharply in the region compared to the world as a whole (82% in Europe and Central Asia and 57% globally).

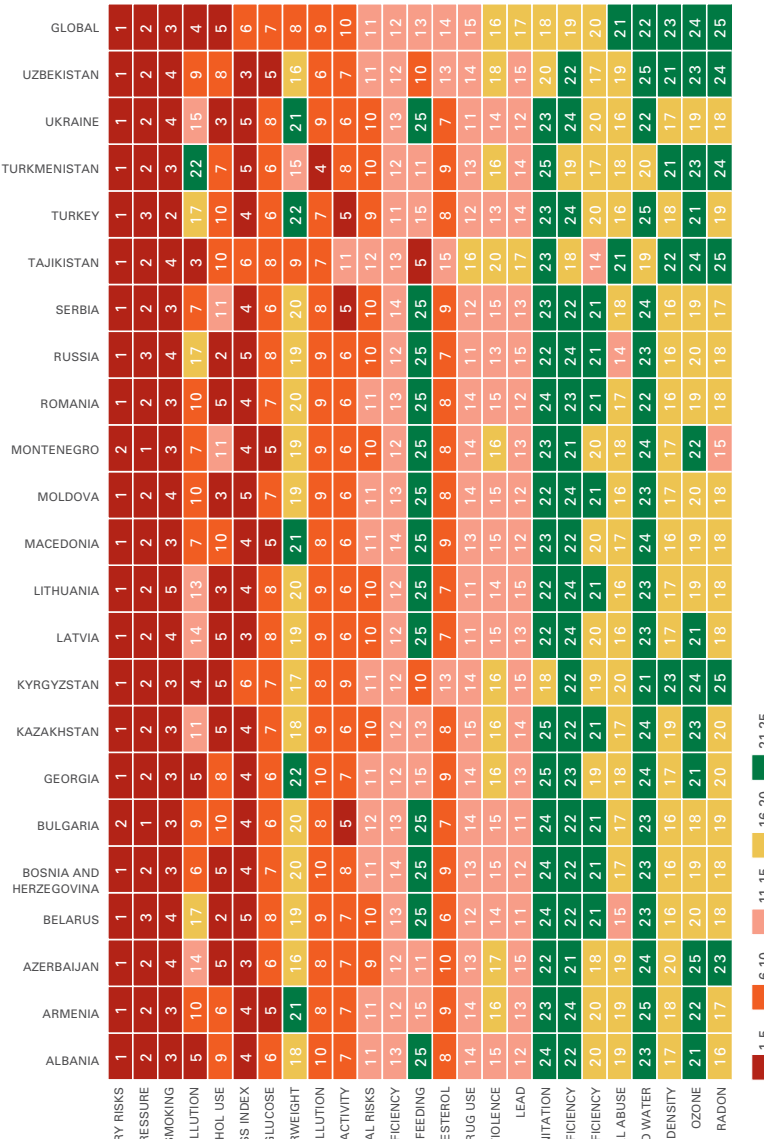
Global and regional rankings of risk factors mask important differences across countries. Figure 17 shows the leading risk factors for DALYs in select countries in Europe

Figure 16: Shifts in rankings of DALYs in Europe and Central Asia for top 15 risk factors, 1990-2010



Note: The top 15 risk factors are ranked from top to bottom in order of the number of DALYs they contributed in 2010. Bars to the right of the vertical line show the percent by which DALYs attributable to different risk factors have increased since 1990. Bars on the left show the percent by which DALYs attributable to different risk factors have decreased. Attributable DALYs were not quantified for physical inactivity and intimate partner violence for 1990.

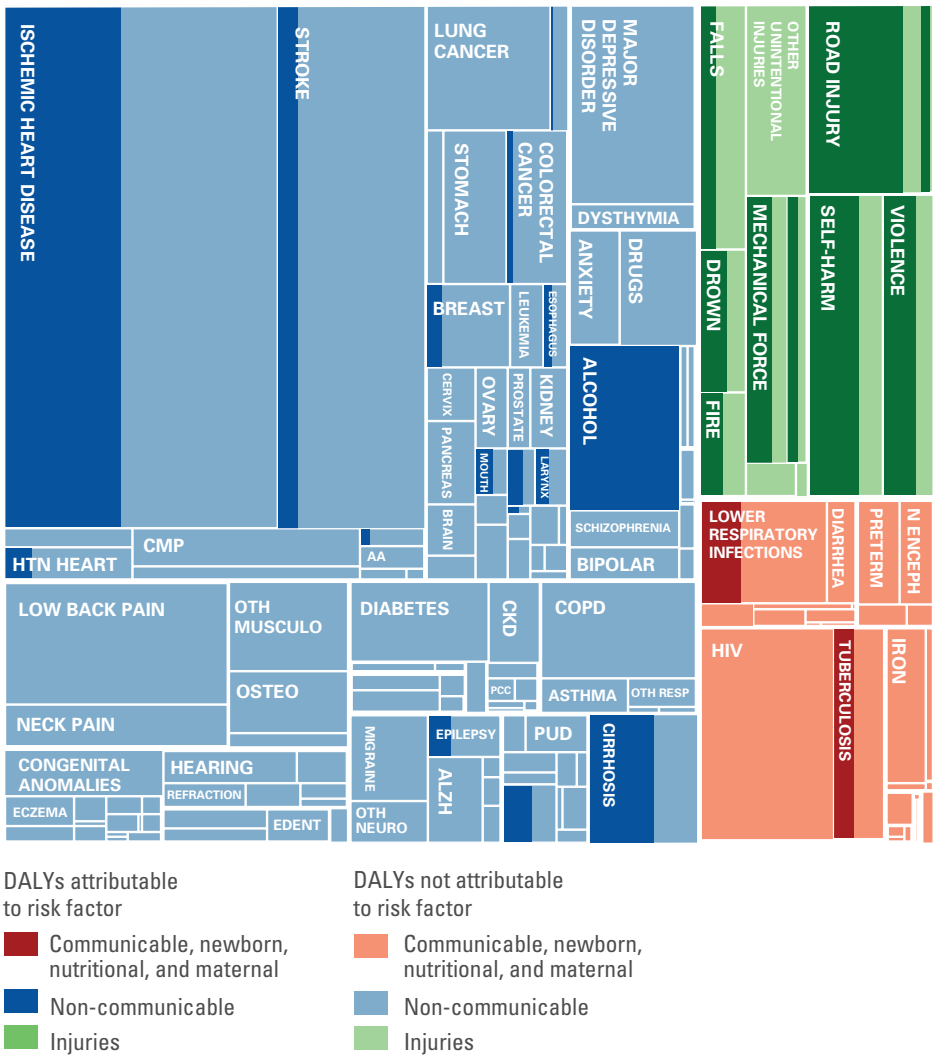
Figure 17: Rankings of DALYs attributable to leading risk factors across select countries in Europe and Central Asia, 2010



Note: In this figure, shading is used to indicate the ranking of each risk factor in a particular country or region. To view an interactive version of this figure, visit IHME's website: http://ihmeuw.org/gbdheatmap.

and Central Asia in 2010. There is some variation in risk factors across individual countries. Childhood underweight, for example, did not rank in the top 15 for most countries in the region, but it ranked ninth in Tajikistan. Globally, childhood underweight ranked eighth. In Georgia, Kyrgyzstan, and Tajikistan, household air pollution ranked in the top five risk factors, which is consistent with the global ranking, but the other countries in the region performed better than the world as a whole. Alcohol use ranked as the second-leading risk factor in Belarus and Russia, while

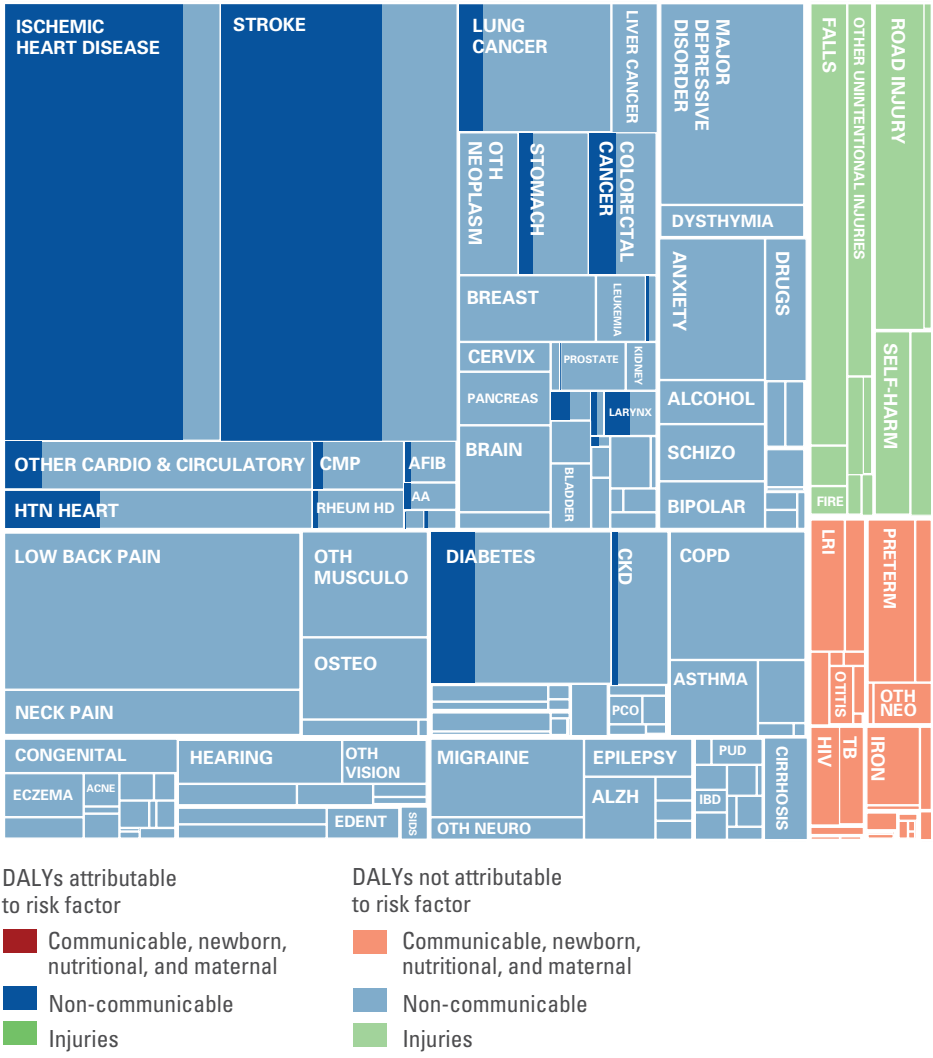
Figure 18: DALYs attributable to alcohol use, both sexes, all ages, Russia, 2010



Note: The size of each box represents the percentage of total DALYs caused by a particular disease or injury, and the proportion of each cause attributable to the risk factor is shaded. To view an interactive version of this figure, visit IHME's website: http://ihmeuw.org/gbdcompare.

it ranked below the global ranking of fifth in the other countries in the region. The importance of alcohol use was particularly low in Montenegro and Serbia, where it ranked 11th. High total cholesterol had a more prominent role in health loss in the region compared to the rest of the world; it ranked in the top 10 in every country except Kyrgyzstan, Tajikistan, and Uzbekistan, where the effect of high cholesterol on DALYs was similar to its effect globally, where it ranked 14th.

Figure 19: DALYs attributable to dietary risks, both sexes, all ages, Macedonia, 2010



Note: The size of each box represents the percentage of total DALYs caused by a particular disease or injury, and the proportion of each cause attributable to the risk factor is shaded. To view an interactive version of this figure, visit IHME's website: http://ihmeuw.org/gbdcompare.

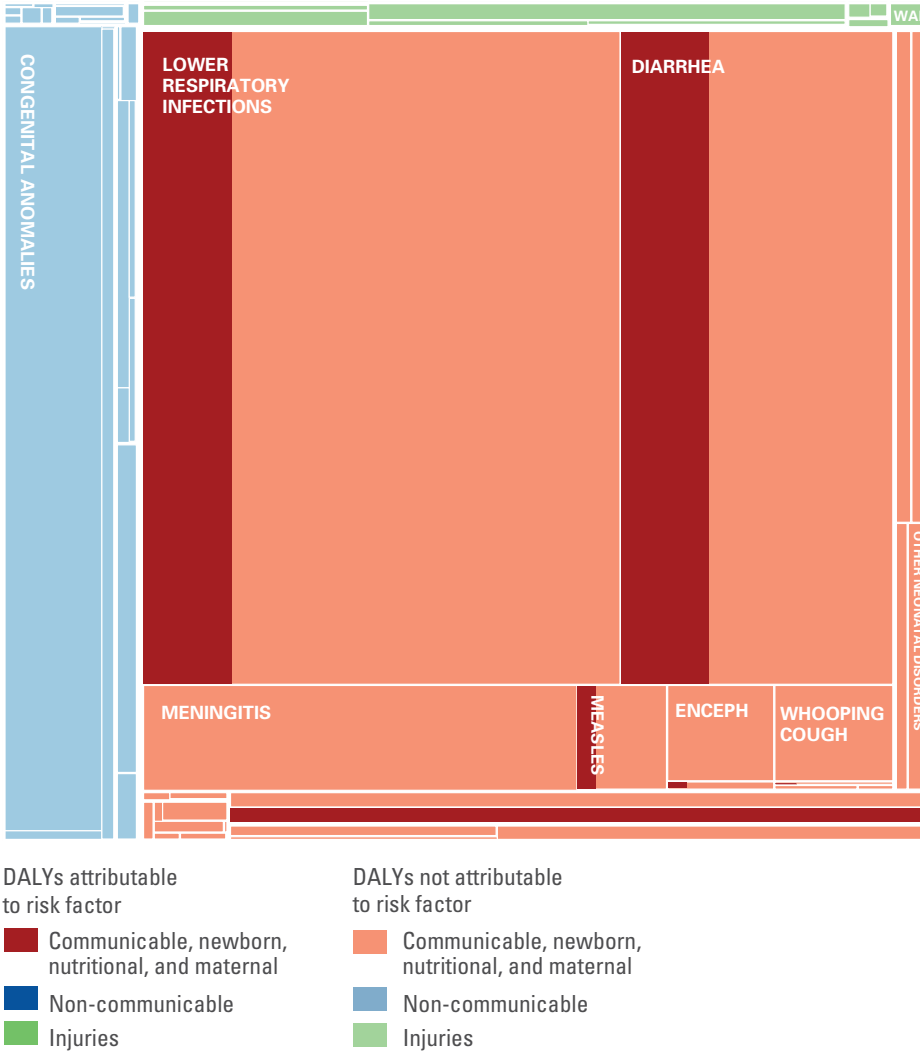
In addition to allowing users to explore how different risk factors rank across countries, decision-makers can use GBD visualization tools to understand how many DALYs could potentially be averted by addressing different risk factors. Figure 18 shows the number of DALYs attributable to alcohol use that contribute to different diseases and injuries in Russia. The percentage of DALYs that could be averted by reducing this risk factor is shown in dark shading.

The figure indicates how reductions in alcohol use could prevent substantial amounts of premature death and disability from ischemic heart disease, stroke, cirrhosis, and several cancers, as indicated by the portion of these causes that are shaded in dark blue. Reductions in alcohol use could also reduce DALYs from a variety of injuries, such as road injuries, self-harm, and interpersonal violence, as seen by the portion of these causes shaded in dark green.

Dietary risks include elements such as low consumption of fruits, nuts and seeds, and whole grains, as well as high salt intake. Figure 19 shows how many DALYs in Macedonia could be averted by improving people's diets. Substantial health loss from ischemic heart disease and stroke could be prevented, as indicated by the portion of these causes shaded in dark blue. Reduction of dietary risks could also reduce DALYs from diabetes and some cancers.

Figure 20 shows the number of DALYs attributable to childhood underweight in children aged 1 to 11 months in Tajikistan. More than 32% of the DALYs attributable to diarrhea could potentially be prevented by reducing undernutrition in this age group, as indicated by the dark shading in the boxes representing this cause. Adequate nutrition would also greatly reduce illness from lower respiratory infections and measles among these children.

Figure 20: DALYs attributable to childhood underweight, both sexes, ages 1-11 months, Tajikistan, 2010



Note: The size of each box represents the percentage of total DALYs caused by a particular disease or injury, and the proportion of each cause attributable to the risk factor is shaded. To view an interactive version of this figure, visit IHME's website: http://ihmeuw.org/gbdcompare.

USING GBD TO ASSESS COUNTRIES' HEALTH PROGRESS

GBD found that factors such as population growth, increasing average age, and decreasing mortality are driving up DALYs, or healthy years lost, from non-communicable diseases in many countries. Although non-communicable diseases are increasing relative to other health problems as a result of these demographic changes, GBD found that many countries are actually showing improvements in health as measured by age-standardized DALY rates.

Differences in population growth and ages across countries can make a country with a younger population appear better in terms of health performance than a country with an older population. Similarly, countries with low population growth will add less disease burden over time than countries with a fast-growing population. Researchers can remove the impact of these factors to isolate what is important for comparisons of health performance using age-standardized rates of DALYs and YLLs, or years of life lost due to premature death. For example, when comparing the age-standardized rates in 1990 and 2010, there was a clear decline in cardiovascular and circulatory diseases and newborn disorders in Europe and Central Asia over that two-decade period.

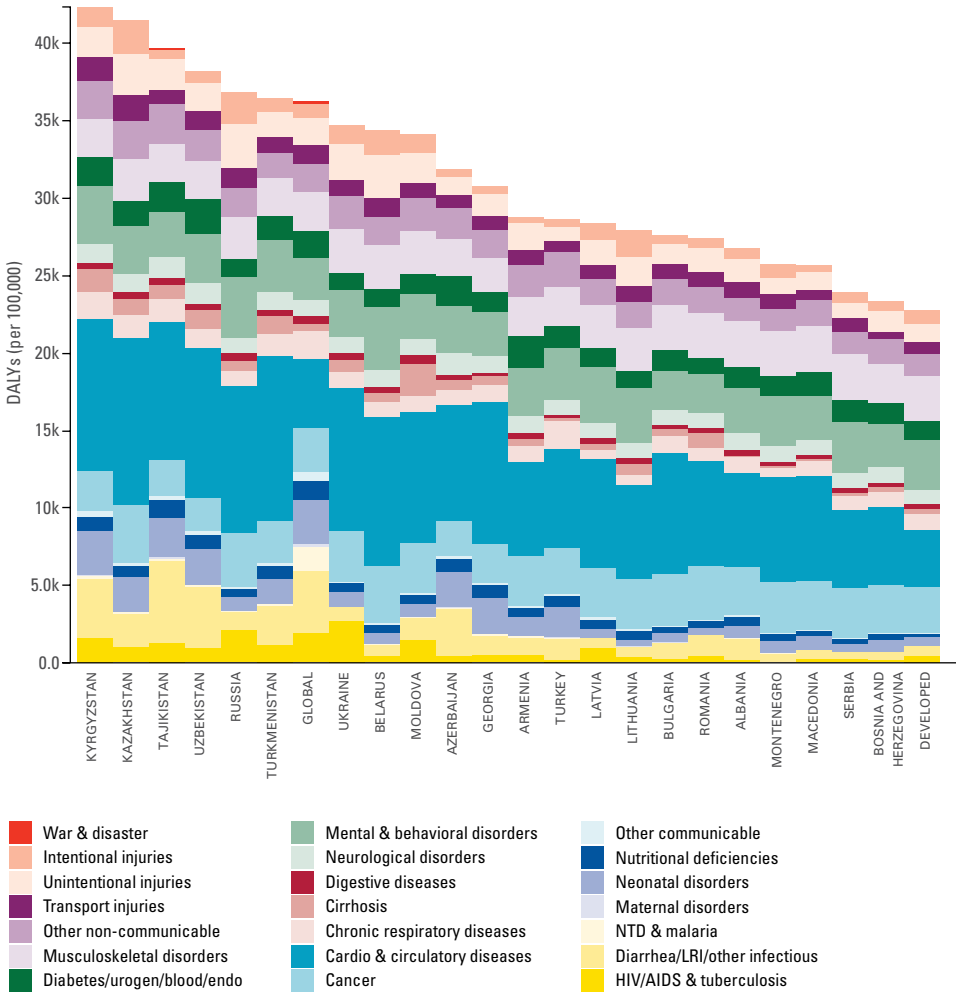
GBD can also be used to compare and contrast disease patterns across countries. Figure 21 shows age-standardized DALYs per 100,000 people in Europe and Central Asia. The leading causes of premature death and disability are aggregated. For example, causes such as low back pain and neck pain are grouped into the category of musculoskeletal disorders. In the low-income countries of Kyrgyzstan and Tajikistan, rates of communicable, newborn, nutritional, and maternal conditions exceeded 10,000 DALYs for every 100,000 people, while other lower- and upper-middle-income countries in Figure 21 had lower rates. For example, Bosnia and Herzegovina, Macedonia, and Montenegro had age-standardized DALY rates of communicable, newborn, nutritional, and maternal disorders of about 2,000 per 100,000 people or lower. Serbia had the lowest rates of DALYs due to communicable, newborn, nutritional, and maternal disorders at approximately 1,500 per 100,000 people. Russia and Ukraine had the highest rates of DALYs due to HIV/AIDS and tuberculosis in comparison to other countries, but not by a large margin. All countries had sizeable rates of DALYs from non-communicable diseases, underscoring the double burden of disease from both communicable and non-communicable diseases that many middle-income countries face. For example, Belarus, Bulgaria, Russia, and Ukraine had high age-standardized DALY rates of cardiovascular and circulatory diseases.

The GBD approach affords countries a unique opportunity to explore their success in improving health outcomes over time. GBD can also be used to better understand how fast a country's health is improving relative to similar countries. This type of progress assessment is called benchmarking. Benchmarking is a tool that can help countries put their health achievements in context and identify areas for improve-

ment. IHME invites countries interested in collaborating on benchmarking exercises to contact us.

As an example of a benchmarking exercise, Figure 22 ranks levels of years of life lost in Europe and Central Asia in 2010. The columns are arranged by the top 30 causes of YLLs in the region. The countries are ordered according to levels of premature mortality. For each cause, rankings are coded to reflect each country's level of age-standardized years of life lost relative to the others. The best performers for

Figure 21: Age-standardized DALY rates across select countries in Europe and Central Asia, 2010



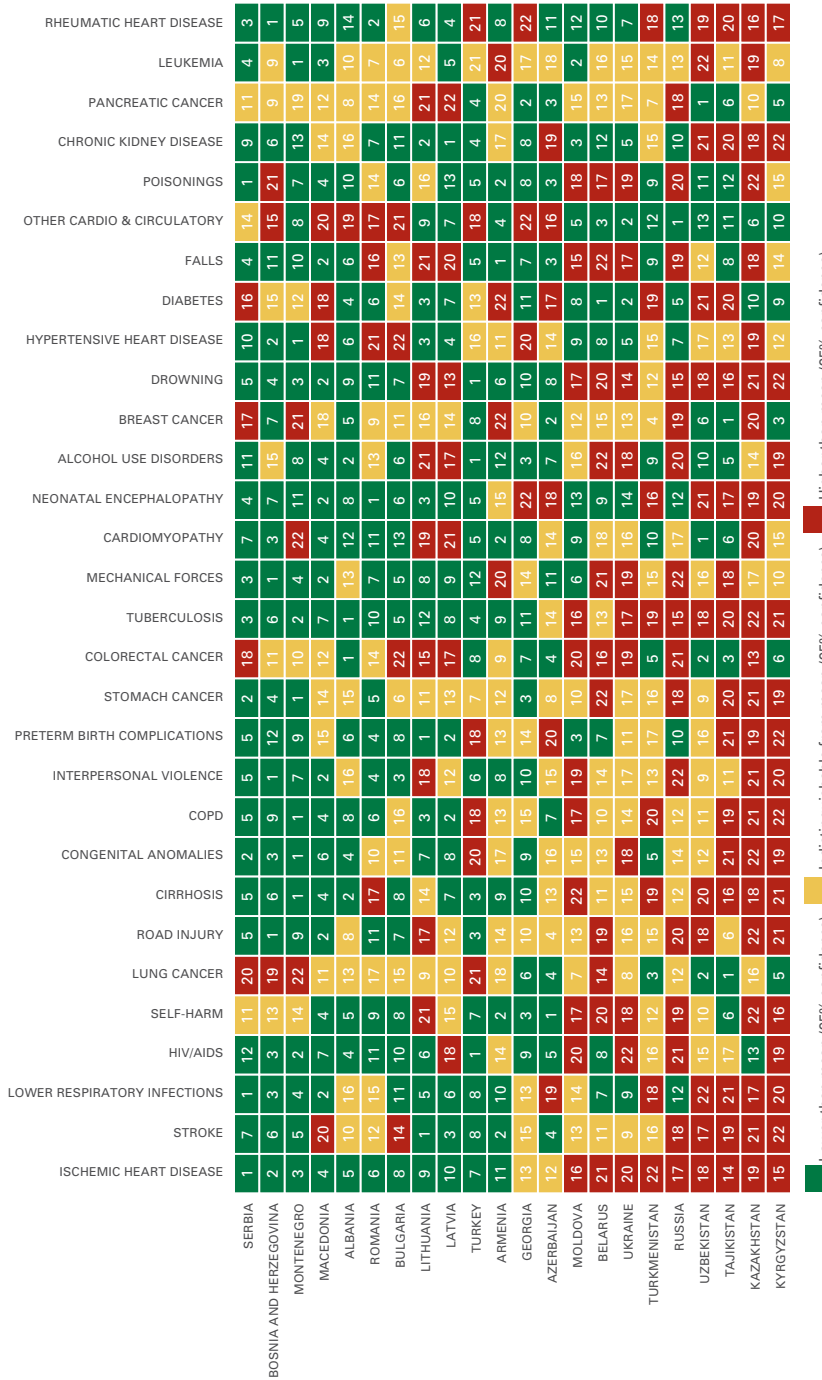
Note: The size of the colored portion in each bar represents the number of age-standardized DALYs per 100,000 people attributable to each cause. The height of each bar shows which age groups had the most age-standardized DALYs per 100,000 people in 2010. The causes are aggregated. For example, musculoskeletal disorders include low back pain and neck pain. To view an interactive version of this figure, visit IHME's website: http://ihmeuw.org/gbdcausepattern.

each cause are in green while the worst performers for each cause appear in red. Yellow shading indicates that the ranking for a particular country is not statistically significant from the regional average. For example, in comparison to the 20 other countries, Latvia performed better than average for stroke (third-best in the region), preterm birth complications (second), COPD (second), and chronic kidney disease (first). Relative to the other countries shown in Figure 22, Belarus was among the worst performers for conditions including ischemic heart disease (21st in the region), self-harm (20th), stomach cancer (22nd), and alcohol use disorders (22nd).

To further illustrate how benchmarking can be implemented at the country level, IHME is currently working with public health experts in the United Kingdom to explore changes in population health over time and to compare its health performance to other countries with similar and higher levels of health spending. Through close collaboration with decision-makers at the National Health Service and Public Health England, the IHME-UK benchmarking project is examining the context in which health progress has occurred, such as the UK's provision of universal health coverage and its implementation of numerous public health interventions.

For the UK, GBD estimates of life expectancy and healthy life expectancy, years lost due to premature death (YLLs), years lived with disability (YLDs), and healthy years lost (DALYs) will provide a detailed and comprehensive picture of changes in health outcomes over time. Comparing GBD estimates across countries will elucidate areas of health where the UK performs both better and worse than its peers. In addition, analysis of potentially modifiable risk factors can shed light on ways that public health policy could address major causes of ill health and premature death. The IHME-UK benchmarking study aims to identify key opportunities to speed up the pace of health improvements in the nation.

Figure 22: Causes of leading years of life lost, Europe and Central Asia countries relative to regional average, 2010



Note: The columns are ordered by the absolute number of YLLs for that particular year. The numbers indicate the rank across countries for each cause in terms of age-standardized YLL rates, with 1 as the best performance and 22 as the worst.

CONCLUSION

The Global Burden of Disease provides detailed data on diseases, injuries, and risk factors that are essential inputs for evidence-based policymaking. This collaborative project shows that the world's health is undergoing rapid change.

The Global Burden of Diseases, Injuries, and Risk Factors Study 2010 (GBD 2010) identified major trends in global health that can be summarized by the three Ds: demographics, disease, and disability. As most countries have made great strides in reducing child mortality, people are living longer and the population is growing older. These demographic changes are driving up premature deaths and disability, or DALYs, from non-communicable diseases. Health problems are increasingly defined not by what kills us, but what ails us. In 1990, childhood underweight was the leading risk factor for ill health, but high body mass index surpassed it in 2010 as a more important cause of premature death and disability. This finding illustrates global shifts away from risk factors for communicable disease in children toward risk factors for non-communicable diseases.

GBD 2010 found that non-communicable diseases and disability caused a greater share of health loss in 2010 compared to 1990 in most regions of the world. At the same time, the study revealed that the leading causes of DALYs in sub-Saharan Africa have changed little over the past 20 years. Still, GBD 2010 provides evidence of encouraging progress in this region, such as reductions in mortality from malaria, HIV/AIDS, and maternal conditions.

In Europe and Central Asia, GBD 2010 documented important regional trends that reveal increasing health loss due to injuries and non-communicable diseases. Over the past two decades, there have been sharp decreases in burden associated with communicable diseases such as lower respiratory infections and diarrheal diseases. The region has also seen a notable decline in many causes associated with illnesses in children, such as preterm birth complications, meningitis, protein-energy malnutrition, and neonatal encephalopathy. Ischemic heart disease, stroke, low back pain, road injury, and depression were the dominant causes of premature death and disability in Europe and Central Asia. Non-communicable diseases such as diabetes and drug use disorders increased in the region between 1990 and 2010.

Risk factors such as dietary risks, high blood pressure, alcohol use, smoking, high body mass index, and physical inactivity have become important threats to public health in many countries in Europe and Central Asia. At the same time, risk factors related to illness in children persist in certain low-income countries such as Kyrgyzstan and Tajikistan.

While GBD 2010 provides key information about health trends at global and regional levels, its tools also allow users to view data specific to 187 countries. Similar to the ways in which governments use financial data to monitor economic trends and make necessary adjustments to ensure continued growth, decision-makers can use GBD data to inform health policy. Continual updates of GBD will incorporate the most recent data on disease patterns as well as the latest science about the effects of different risk factors on health.

Future updates of GBD will be enriched by widening the network of collaborators. Expanded collaboration between researchers, staff of ministries of health, and IHME on national and subnational burden of disease studies will ensure that GBD tools are used to understand causes of premature death and disability at the community level. Despite similarities of epidemiological trends in most regions, GBD illustrates the unique patterns of diseases, injuries, and risk factors that exist in different countries. Local epidemiological assessment is crucial for informing local priorities. The GBD approach to health measurement can help guide the design of public health interventions to ensure they are tailored to countries' specific needs.

IHME is seeking partners interested in conducting in-depth studies of the burden of disease in countries. Through such partnerships, IHME is helping governments and donors gain insights into localized health trends to inform planning and policymaking. IHME is committed to building capacity for GBD analysis in countries around the world, and will be conducting a variety of training workshops. Information on these trainings can be found at http://www.healthmetricsandevaluation.org/gbd/training.

GBD data visualization tools can display regional and national data from burden of disease studies. These user-friendly tools are helpful for planning, presentations, and educational purposes. Also, IHME has designed a variety of data visualization tools to compare trends between various raw data sources at the national level. By visualizing all available data, ministry of health officials and researchers can quickly identify unexpected trends in the data that they may wish to flag for further investigation.

Currently, IHME is working to expand GBD to track expenditure for particular diseases and injuries. Also, IHME is estimating utilization of outpatient and inpatient facilities and other health services for specific diseases and injuries. Side-to-side comparisons of these estimates to the number of DALYs from myriad causes will allow decision-makers to evaluate health system priorities. Data on disease-specific expenditure and disease burden are essential for policymakers facing difficult decisions about how to allocate limited resources.

ANNEX

METHODS

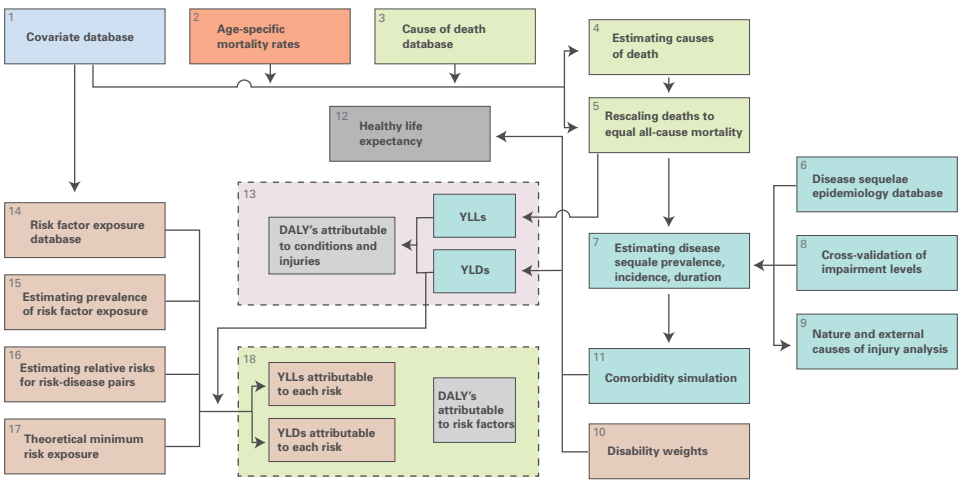
The analytical strategy of GBD

The GBD approach contains 18 distinct components, as outlined in Figure A1. The components of GBD are interconnected. For example, when new data is incorporated into the age-specific mortality rates analysis (component 2), other dependent components must also be updated, such as rescaling deaths for each cause (component 5); healthy life expectancy, or HALE (component 12); YLLS, or years of life lost (component 13); and estimation of YLLs attributable to each risk factor (component 18). The inner workings of key components are briefly described in this publication, and more detailed descriptions of each component are included in the published articles.

Estimating age- and sex-specific mortality

Researchers identified sources of under-5 and adult mortality data from vital and sample registration systems as well as from surveys that ask mothers about live births and deaths of their children and ask people about siblings and their survival. Researchers processed that data to address biases and estimated the probability of death between ages 0 and 5 and ages 15 and 60 using statistical models. Finally, researchers used these probability estimates as well as a model life table system to estimate age-specific mortality rates by sex between 1970 and 2010.

Figure A1: The 18 components of GBD and their interrelations



Estimating years lost due to premature death

Researchers compiled all available data on causes of death from 187 countries. Information about causes of death was derived from vital registration systems, mortality surveillance systems, censuses, surveys, hospital records, police records, mortuaries, and verbal autopsies. Verbal autopsies are surveys that collect information from individuals familiar with the deceased about the signs and symptoms the person had prior to death. GBD 2010 researchers closely examined the completeness of the data. For those countries where cause of death data were incomplete, researchers used statistical techniques to compensate for the inherent biases. They also standardized causes of death across different data sources by mapping different versions of the International Classification of Diseases coding system to the GBD cause list.

Next, researchers examined the accuracy of the data, scouring rows and rows of data for "garbage codes." Garbage codes are misclassifications of death in the data, and researchers identified thousands of them. Some garbage codes are instances where we know the cause listed cannot possibly lead to death. Examples found in records include "abdominal rigidity," "senility," and "yellow nail syndrome." To correct these, researchers drew on evidence from medical literature, expert judgment, and statistical techniques to reassign each of these to more probable causes of death.

After addressing data-quality issues, researchers used a variety of statistical models to determine the number of deaths from each cause. This approach, named CODEm (for Cause of Death Ensemble modeling), was designed based on statistical techniques called "ensemble modeling." Ensemble modeling was made famous by the recipients of the Netflix Prize in 2009, BellKor's Pragmatic Chaos, who engineered the best algorithm to predict how much a person would like a film, taking into account their movie preferences.

To ensure that the number of deaths from each cause did not exceed the total number of deaths estimated in a separate GBD demographic analysis, researchers applied a correction technique named CoDCorrect. This technique makes certain that estimates of the number of deaths from each cause do not add up to more than 100% of deaths in a given year.

After producing estimates of the number of deaths from each of the 235 fatal outcomes included in the GBD cause list, researchers then calculated years of life lost to premature death, or YLLs. For every death from a particular cause, researchers estimated the number of years lost based on the highest life expectancy in the deceased's age group. For example, if a 20-year-old male died in a car accident in Ukraine in 2010, he has 66 years of life lost, that is, the highest remaining life expectancy in 20-year-olds, as experienced by 20-year-old females in Japan.

When comparing rankings of the leading causes of death versus YLLs, YLLs place more weight on the causes of death that occur in younger age groups, as shown in Figure A2. For example, lower respiratory infections represent a greater percentage of total YLLs than total deaths since they are a leading killer of children under age 5. Ischemic heart disease, by contrast, accounts for a smaller percentage of total YLLs than total deaths as it primarily kills older people.

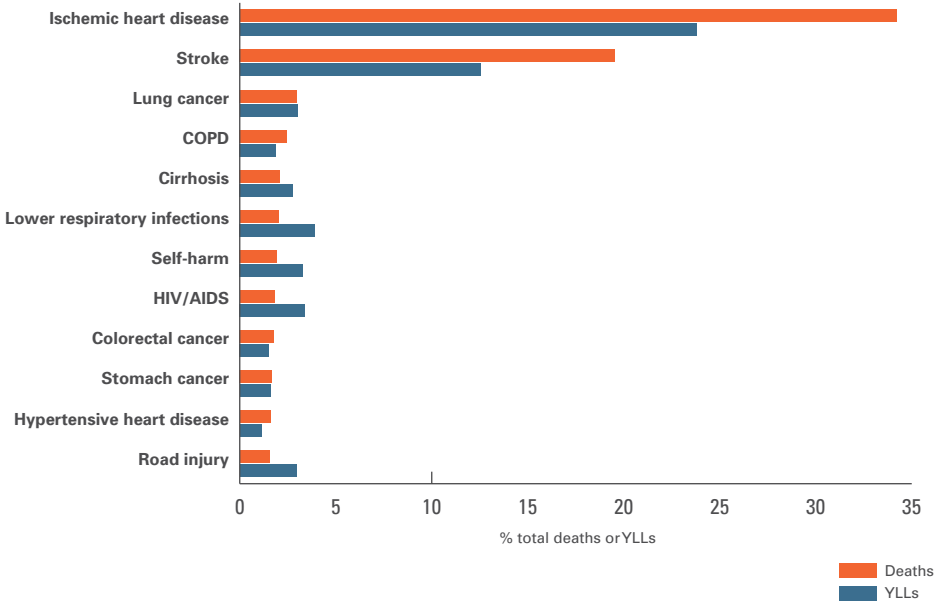
Estimating years lived with disability

Researchers estimated the prevalence of each sequela using different sources of data, including government reports of cases of infectious diseases, data from population-based disease registries for conditions such as cancers and chronic kidney diseases, antenatal clinic data, hospital discharge data, data from outpatient facilities, interview questions, and direct measurements of hearing, vision, and lung function testing from surveys and other sources.

Confronted with the challenge of data gaps in many regions and for numerous types of sequelae, they developed a statistical modeling tool named DisMod-MR (for Disease Modeling – Metaregression) to estimate prevalence using available data on incidence, prevalence, remission, duration, and extra risk of mortality due to the disease.

Researchers estimated disability weights using data collected from almost 14,000 respondents via household surveys in Bangladesh, Indonesia, Peru, Tanzania, and

Figure A2: Leading causes of death and premature death in Europe and Central Asia, 2010



the United States. Disability weights measure the severity of different sequelae that result from disease and injury. Data were also used from an Internet survey of more than 16,000 people. GBD researchers presented different lay definitions of sequelae grouped into 220 unique health states to survey respondents, and respondents were then asked to rate the severity of the different health states. The results were similar across all surveys despite cultural and socioeconomic differences. Respondents consistently placed health states such as mild hearing loss and long-term treated fractures at the low end of the severity scale, while they ranked acute schizophrenia and severe multiple sclerosis as very severe.

Finally, years lived with disability, or YLDs, are calculated as prevalence of a sequela multiplied by the disability weight for that sequela. The number of years lived with disability for a specific disease or injury are calculated as the sum of the YLDs from each sequela arising from that cause.

Estimating disability-adjusted life years

Disability-adjusted life years, or DALYs, are calculated by adding together YLLs and YLDs. Figure A3 compares the 10 leading diseases and injuries calculated as percentages of both deaths and DALYs in Europe and Central Asia. This figure also shows the top 10 risk factors attributable to deaths and DALYs in the region. It illustrates how a decision-maker looking only at the top 10 causes of death would fail to see the importance of low back pain, for example, which was a leading cause of DALYs in 2010. Because they measure disease burden from non-fatal as well as fatal conditions, DALYs are a powerful tool for priority setting.

Estimating DALYs attributable to risk factors

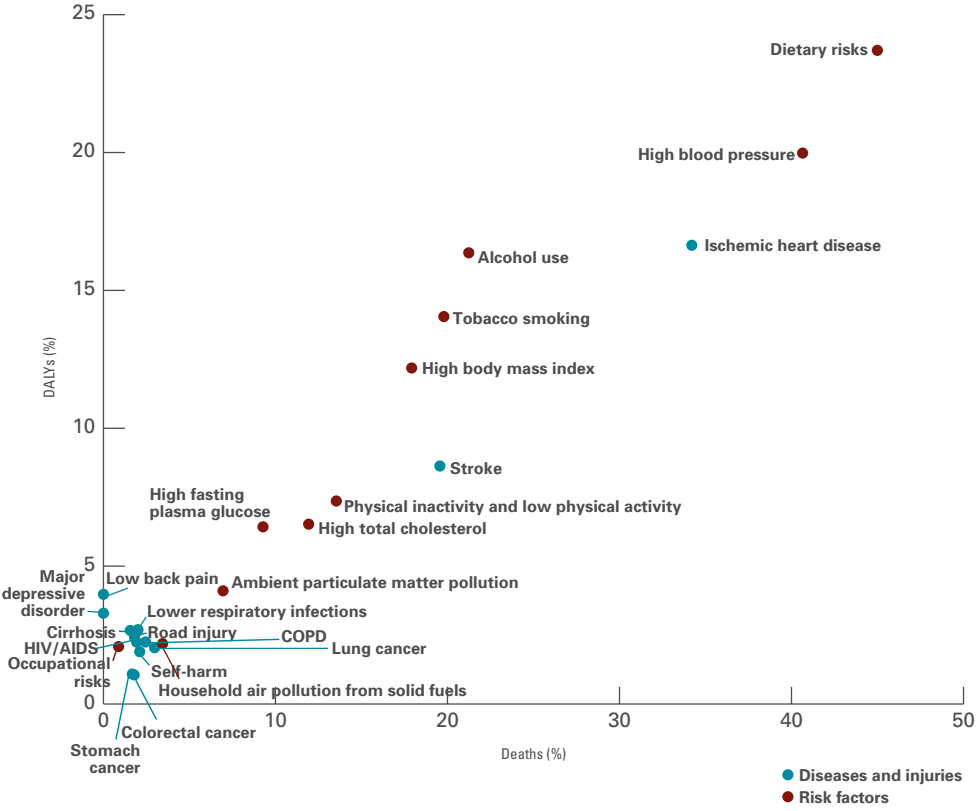
To estimate the number of healthy years lost, or DALYs, attributable to potentially modifiable risk factors, researchers collected detailed data on exposure to different risk factors. The study used data from sources such as satellite data on air pollution, breastfeeding data from population surveys, and blood and bone lead levels from medical examination surveys and epidemiological surveys. Researchers then collected data on the effects of risk factors on disease outcomes through systematic reviews of epidemiological studies.

All risk factors analyzed met common criteria in four areas:

1. The likely importance of a risk factor for policymaking or disease burden.
2. Availability of sufficient data to estimate exposure to a particular risk factor.
3. Rigorous scientific evidence that specific risk factors cause certain diseases and injuries.
4. Scientific findings about the effects of different risk factors that are relevant for the general population.

To calculate the number of DALYs attributable to different risk factors, researchers compared the disease burden in a group exposed to a risk factor to the disease burden in a group that had zero exposure to that risk factor. When subjects with zero exposure were impossible to find, as in the case of high blood pressure, for example, researchers established a level of minimum exposure that leads to the best health outcomes.

Figure A3: The 10 leading diseases and injuries and 10 leading risk factors based on percentage of deaths and DALYs in Europe and Central Asia, 2010



Note: This figure compares the percent of DALYs and deaths attributable to different diseases and injuries (shown in blue) as well as risk factors (shown in red). Certain causes, such as low-back pain, cause substantial numbers of DALYs, but cause few deaths. DALYs are an important tool for decision-makers because they capture years of healthy life lost from both fatal and non-fatal causes.

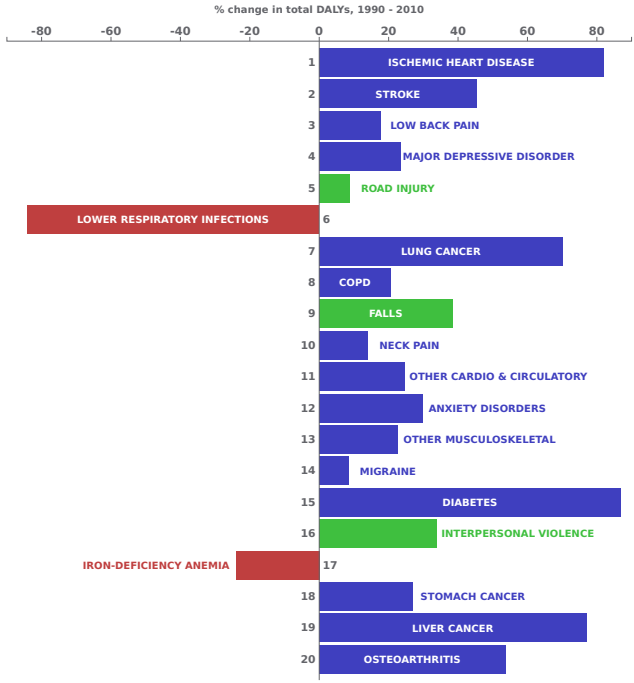
Table A1: Age-standardized death rates, years of life lost, and years lived with disability, and life expectancy at birth and healthy life expectancy at birth for 1990 and 2010 for both sexes combined

Country	**Age-standardized death rate** (per 100,000)				**Age-standardized YLL rate** (per 100,000)			
	1990		2010		1990		2010	
	Rate	*Rank*	*Rate*	*Rank*	*Rate*	*Rank*	*Rate*	*Rank*
Albania	666 (649-682)	1 (1-3)	653 (606-705)	5 (3-9)	19,166 (18,407-19,819)	4 (3-4)	15,110 (14,041-16,344)	5 (5-6)
Armenia	809 (788-834)	4 (4-5)	674 (641-705)	6 (5-9)	24,125 (23,100-25,017)	12 (10-13)	17,197 (16,282-18,229)	11 (7-11)
Azerbaijan	961 (932-988)	16 (14-17)	695 (671-721)	9 (6-11)	31,387 (30,062-32,891)	18 (17-19)	20,272 (19,308-21,403)	13 (12-13)
Belarus	877 (867-887)	10 (9-10)	914 (893-930)	17 (14-19)	22,551 (21,957-23,024)	8 (8-9)	22,829 (22,304-23,345)	15 (14-16)
Bosnia and Herzegovina	834 (828-840)	7 (5-7)	584 (577-591)	2 (2-3)	19,064 (18,779-19,341)	3 (3-4)	12,248 (12,006-12,489)	2 (1-2)
Bulgaria	864 (857-869)	8 (8-8)	747 (742-752)	13 (13-13)	20,104 (19,759-20,338)	5 (5-5)	16,486 (16,313-16,708)	7 (6-10)
Georgia	825 (789-848)	5 (4-7)	716 (690-742)	12 (9-12)	24,291 (22,818-25,345)	13 (9-13)	19,529 (18,550-20,627)	12 (12-13)
Kazakhstan	1,043 (1,016-1,087)	19 (19-21)	1,043 (981-1,091)	22 (21-22)	31,524 (30,535-33,026)	19 (17-19)	29,881 (27,950-31,426)	21 (21-22)
Kyrgyzstan	1,047 (1,017-1,076)	20 (19-21)	999 (961-1,031)	21 (20-21)	33,446 (32,117-34,713)	20 (20-20)	30,037 (28,433-31,588)	22 (21-22)
Latvia	914 (905-920)	13 (12-14)	703 (696-714)	10 (9-11)	23,599 (23,201-23,878)	11 (10-12)	16,613 (16,347-16,992)	8 (7-11)
Lithuania	833 (826-838)	6 (5-7)	678 (672-686)	7 (5-9)	21,127 (20,779-21,378)	6 (6-7)	16,608 (16,384-16,937)	9 (7-10)
Macedonia	873 (863-883)	9 (9-10)	682 (674-688)	8 (6-9)	21,414 (20,877-21,947)	7 (6-7)	13,939 (13,714-14,163)	4 (4-4)
Moldova	1,000 (991-1,009)	18 (18-18)	912 (904-921)	14 (14-19)	26,698 (26,099-27,281)	15 (15-15)	22,769 (22,375-23,332)	14 (14-16)
Montenegro	674 (642-707)	2 (1-3)	637 (616-653)	4 (3-5)	16,059 (15,091-17,039)	1 (1-1)	13,549 (13,071-13,903)	3 (3-3)
Romania	895 (889-900)	11 (11-11)	712 (708-716)	11 (10-12)	23,494 (23,067-23,902)	10 (10-13)	16,325 (16,157-16,580)	6 (6-8)
Russia	953 (947-959)	15 (14-17)	952 (947-959)	20 (18-20)	25,715 (25,268-26,205)	14 (14-14)	25,387 (25,067-25,797)	18 (17-19)
Serbia	698 (662-733)	3 (2-3)	572 (563-582)	1 (1-1)	16,985 (15,849-18,058)	2 (2-2)	12,077 (11,914-12,296)	1 (1-2)
Tajikistan	1,067 (1,035-1,099)	21 (19-21)	911 (862-962)	15 (14-19)	38,138 (36,124-39,849)	21 (21-22)	27,409 (25,788-29,155)	20 (19-20)
Turkey	942 (895-980)	14 (12-17)	628 (584-660)	3 (2-5)	30,025 (28,350-31,541)	17 (16-18)	16,760 (15,331-18,071)	10 (6-11)
Turkmenistan	1,144 (1,111-1,174)	22 (22-22)	919 (836-1,029)	18 (14-21)	39,780 (37,878-41,823)	22 (21-22)	24,522 (22,204-27,768)	17 (14-19)
Ukraine	913 (903-926)	12 (12-14)	917 (899-937)	19 (14-19)	22,976 (22,623-23,345)	9 (8-10)	23,559 (22,896-24,257)	16 (16-17)
Uzbekistan	972 (949-998)	17 (15-17)	911 (846-987)	16 (14-20)	29,477 (28,478-30,538)	16 (16-17)	26,063 (24,088-28,140)	19 (17-20)

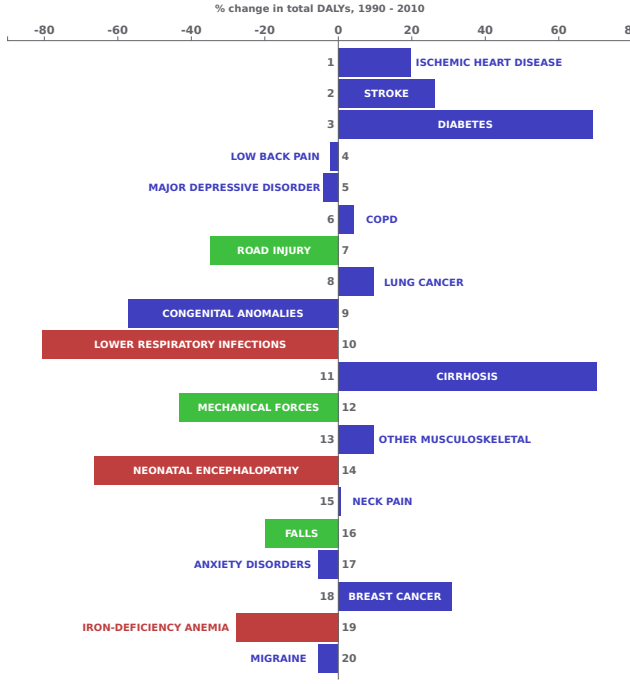
	Age-standardized YLD rate (per 100,000)				Life expectancy at birth				Health-adjusted life expectancy at birth			
	1990		2010		1990		2010		1990		2010	
	Rate	*Rank*	*Rate*	*Rank*	*LE*	*Rank*	*LE*	*Rank*	*HALE*	*Rank*	*HALE*	*Rank*
	11,609 (9,383-14,158)	7 (1-21)	11,628 (9,369-14,279)	12 (1-22)	73.1 (72.9-73.5)	3 (2-3)	74.9 (73.0-76.7)	5 (2-12)	62.9 (60.6-64.9)	2 (1-6)	64.6 (61.7-67.0)	5 (2-12)
	11,778 (9,562-14,296)	10 (2-21)	11,588 (9,511-13,999)	10 (1-21)	70.3 (69.6-71.0)	9 (7-13)	73.9 (72.8-74.8)	9 (5-12)	60.6 (58.4-62.4)	12 (7-14)	63.7 (61.4-65.7)	10 (4-13)
	12,212 (10,041-14,774)	17 (5-22)	11,620 (9,524-13,968)	13 (2-21)	66.7 (66.1-67.4)	18 (16-19)	72.5 (71.5-73.5)	13 (11-13)	57.4 (55.3-59.1)	18 (16-20)	62.6 (60.3-64.5)	13 (10-14)
	11,589 (9,552-13,953)	6 (1-21)	11,578 (9,343-14,046)	9 (1-22)	70.4 (70.0-70.9)	8 (7-11)	70.0 (69.5-70.5)	15 (14-18)	61.1 (59.1-62.8)	8 (5-13)	60.9 (58.9-62.8)	16 (14-18)
	12,186 (9,924-14,738)	16 (5-22)	11,057 (9,149-13,244)	1 (1-15)	71.9 (71.8-72.1)	4 (4-4)	76.5 (76.3-76.7)	2 (1-3)	61.9 (59.8-63.7)	5 (3-9)	66.4 (64.3-68.1)	1 (1-2)
	10,860 (8,713-13,181)	1 (1-14)	11,095 (9,001-13,389)	4 (1-20)	71.4 (71.3-71.5)	5 (5-6)	73.5 (73.4-73.7)	11 (9-12)	62.5 (60.6-64.3)	4 (2-7)	64.0 (62.0-65.7)	9 (4-12)
	11,437 (9,480-13,763)	4 (1-16)	11,256 (9,223-13,394)	5 (1-17)	70.1 (69.4-70.7)	10 (8-13)	72.6 (71.5-73.5)	12 (11-13)	60.8 (58.8-62.4)	11 (6-13)	63.0 (60.9-64.9)	12 (8-13)
	11,955 (9,783-14,290)	14 (4-20)	11,587 (9,524-13,956)	11 (3-20)	66.2 (65.4-66.9)	19 (18-20)	66.7 (65.2-68.2)	22 (20-22)	57.3 (55.5-59.0)	19 (16-20)	58.2 (56.0-60.1)	21 (19-22)
	12,606 (10,369-15,120)	22 (9-22)	12,336 (10,146-14,796)	22 (9-22)	65.5 (64.9-66.1)	20 (19-20)	66.9 (65.5-68.2)	21 (19-22)	56.2 (54.3-58.0)	20 (19-20)	57.6 (55.4-59.7)	22 (19-22)
	11,911 (9,843-14,376)	11 (2-22)	11,751 (9,650-14,072)	15 (2-22)	69.8 (69.6-69.9)	13 (11-13)	73.9 (73.7-74.1)	8 (7-10)	60.4 (58.5-62.0)	13 (8-14)	63.8 (61.8-65.6)	11 (4-13)
	11,684 (9,628-14,156)	9 (1-21)	11,302 (9,187-13,774)	6 (1-20)	71.3 (71.1-71.4)	6 (5-6)	74.1 (74.0-74.3)	7 (5-8)	61.7 (59.6-63.4)	6 (3-11)	64.3 (62.1-66.1)	6 (3-11)
	11,940 (9,622-14,617)	13 (2-22)	11,694 (9,628-14,488)	14 (1-22)	70.9 (70.7-71.1)	7 (7-8)	75.0 (74.8-75.2)	4 (4-6)	61.2 (59.0-63.1)	7 (4-13)	64.7 (62.3-66.5)	3 (2-11)
	11,653 (9,521-13,985)	8 (1-21)	11,362 (9,180-13,911)	7 (1-21)	68.1 (67.8-68.4)	15 (15-16)	70.0 (69.6-70.3)	14 (14-17)	59.2 (57.4-60.9)	15 (13-16)	61.0 (59.0-62.7)	14 (14-18)
	12,222 (9,983-15,037)	15 (3-22)	12,180 (9,848-14,751)	19 (4-22)	74.4 (73.1-75.6)	1 (1-3)	75.6 (75.1-76.2)	3 (3-5)	63.5 (61.0-65.9)	1 (1-5)	64.6 (62.3-66.7)	4 (2-11)
	11,261 (9,260-13,672)	3 (1-18)	11,043 (8,958-13,493)	2 (1-18)	69.9 (69.8-69.9)	12 (10-13)	73.8 (73.7-73.9)	10 (7-10)	60.9 (59.0-62.5)	10 (6-14)	64.2 (62.1-66.0)	7 (3-11)
	11,536 (9,582-13,845)	5 (2-16)	11,444 (9,494-13,509)	8 (2-19)	68.7 (68.4-69.0)	14 (14-14)	68.9 (68.6-69.1)	19 (17-20)	59.8 (58.1-61.3)	14 (12-15)	60.0 (58.4-61.6)	18 (16-19)
	12,440 (10,145-15,017)	20 (5-22)	11,833 (9,717-14,310)	16 (3-22)	73.7 (72.4-74.8)	2 (1-3)	76.7 (76.5-76.9)	1 (1-2)	63.0 (60.6-65.1)	3 (1-6)	65.9 (63.6-67.8)	2 (1-5)
	12,331 (10,183-15,008)	18 (6-22)	12,296 (10,034-14,793)	21 (8-22)	63.8 (63.0-64.5)	21 (21-22)	68.3 (66.5-70.0)	20 (16-22)	54.8 (52.9-56.5)	21 (21-22)	58.7 (56.4-61.0)	20 (17-22)
	12,442 (10,380-14,783)	21 (12-22)	11,885 (9,895-14,020)	18 (8-20)	67.1 (66.1-68.1)	17 (16-19)	74.4 (72.8-75.7)	6 (3-12)	57.7 (55.8-59.4)	17 (16-19)	64.0 (61.7-66.2)	8 (3-12)
	11,911 (9,754-14,511)	12 (2-21)	11,933 (9,831-14,321)	17 (4-22)	62.8 (61.8-63.7)	22 (21-22)	69.4 (65.8-72.3)	17 (13-22)	54.4 (52.3-56.3)	22 (21-22)	60.0 (56.7-63.0)	17 (13-22)
	11,316 (9,322-13,559)	2 (1-13)	11,159 (9,264-13,401)	3 (1-14)	70.0 (69.7-70.3)	11 (9-13)	69.7 (69.1-70.3)	16 (14-18)	61.0 (59.2-62.6)	9 (6-12)	60.9 (59.2-62.5)	15 (14-17)
	12,381 (10,177-14,842)	19 (6-22)	12,150 (9,930-14,652)	20 (7-22)	67.3 (66.7-67.9)	16 (16-18)	68.9 (66.3-71.4)	18 (14-22)	57.8 (55.9-59.7)	16 (16-19)	59.3 (56.6-62.0)	19 (14-22)

CHANGES IN LEADING CAUSES OF DALYS BETWEEN 1990 AND 2010 FOR COUNTRIES IN EUROPE AND CENTRAL ASIA

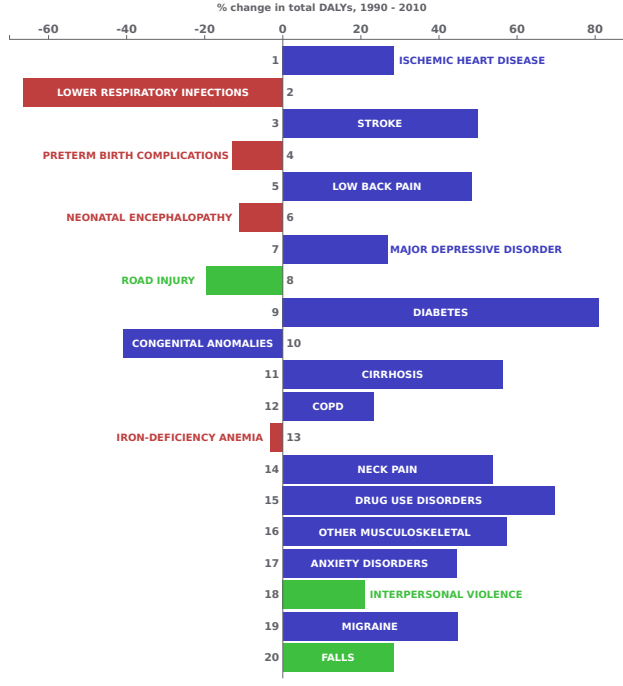
Shifts in leading causes of DALYs in Albania, 1990-2010



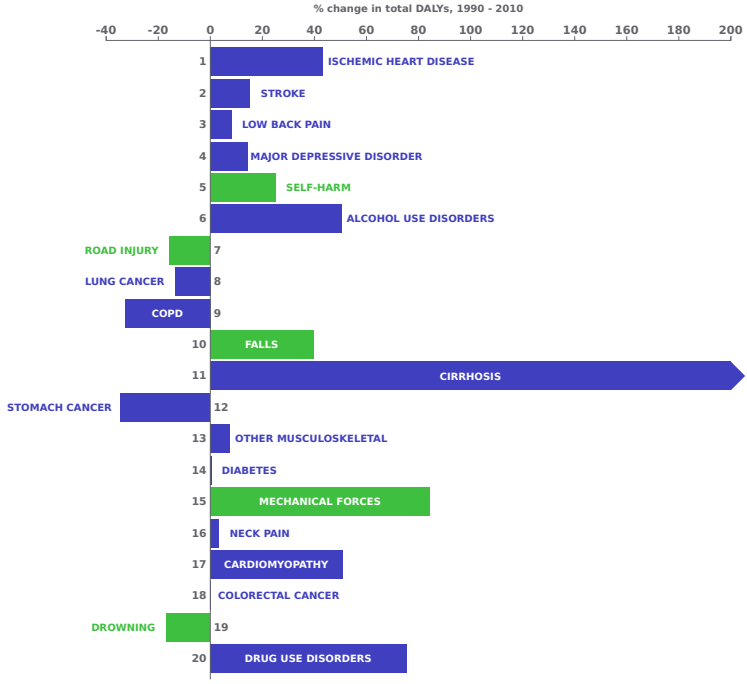
Shifts in leading causes of DALYs in Armenia, 1990-2010



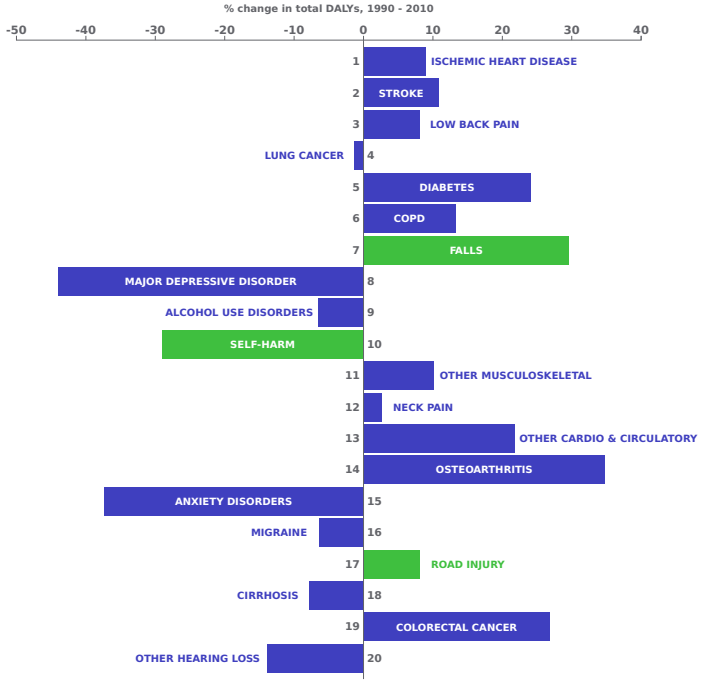
Shifts in leading causes of DALYs in Azerbaijan, 1990-2010



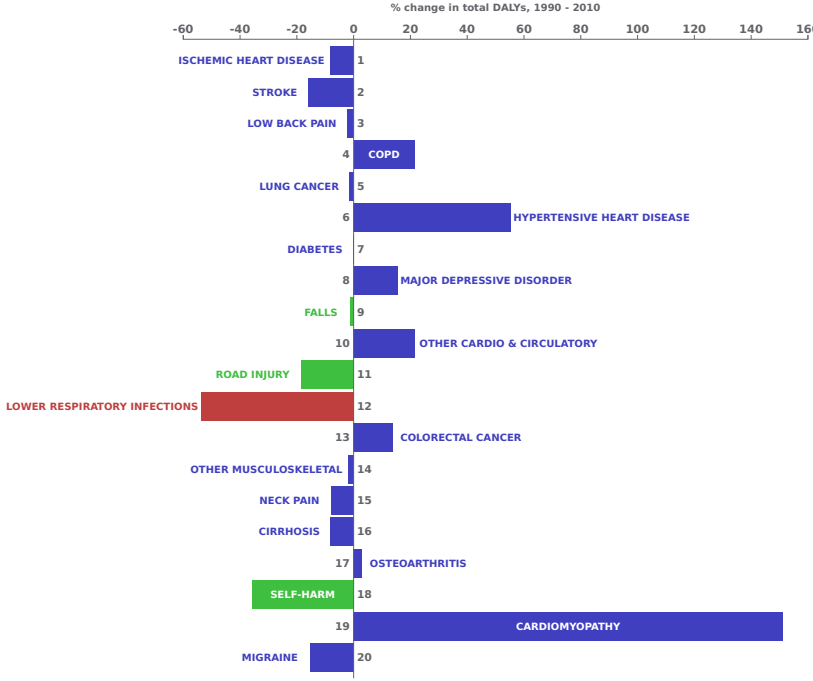
Shifts in leading causes of DALYs in Belarus, 1990-2010



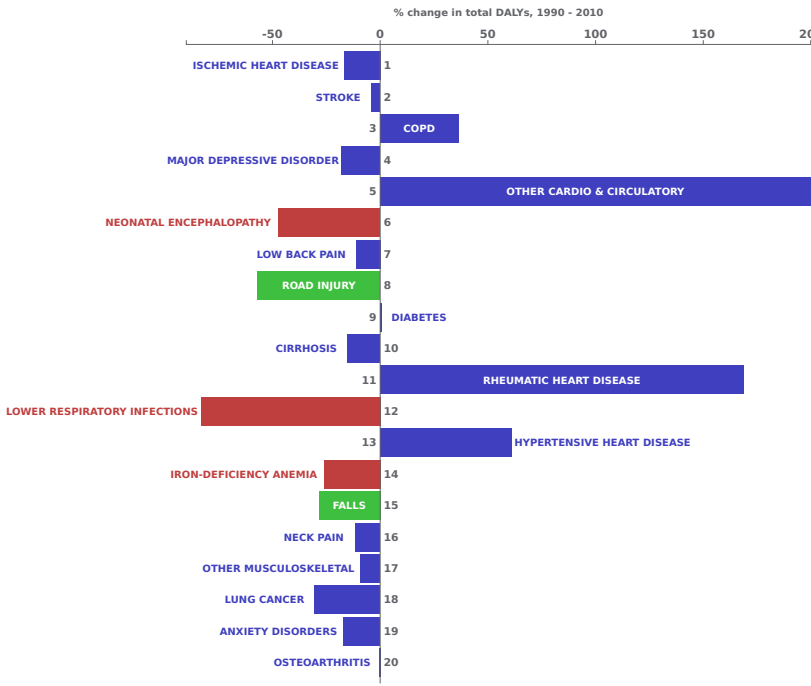
Shifts in leading causes of DALYs in Bosnia and Herzegovina, 1990-2010



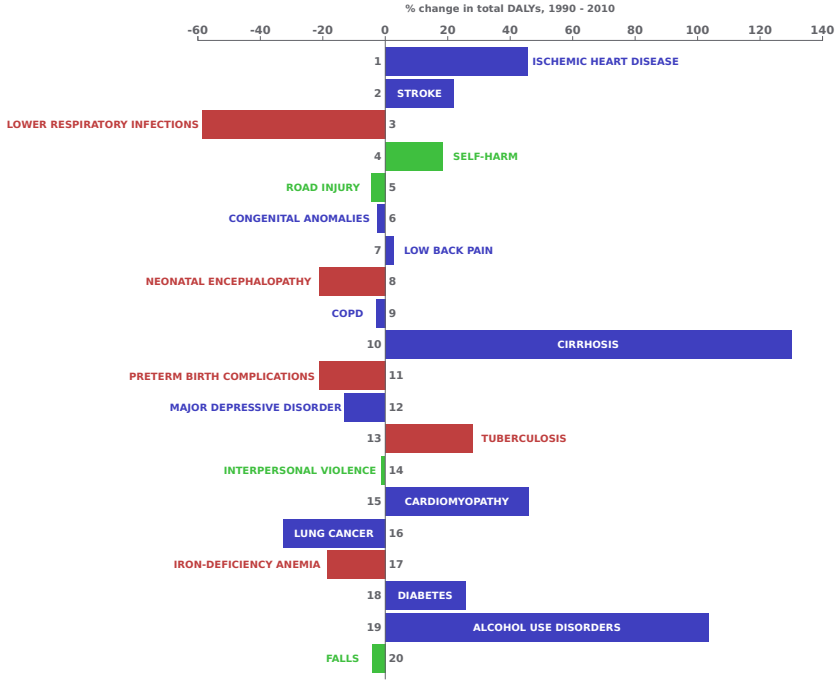
Shifts in leading causes of DALYs in Bulgaria, 1990-2010



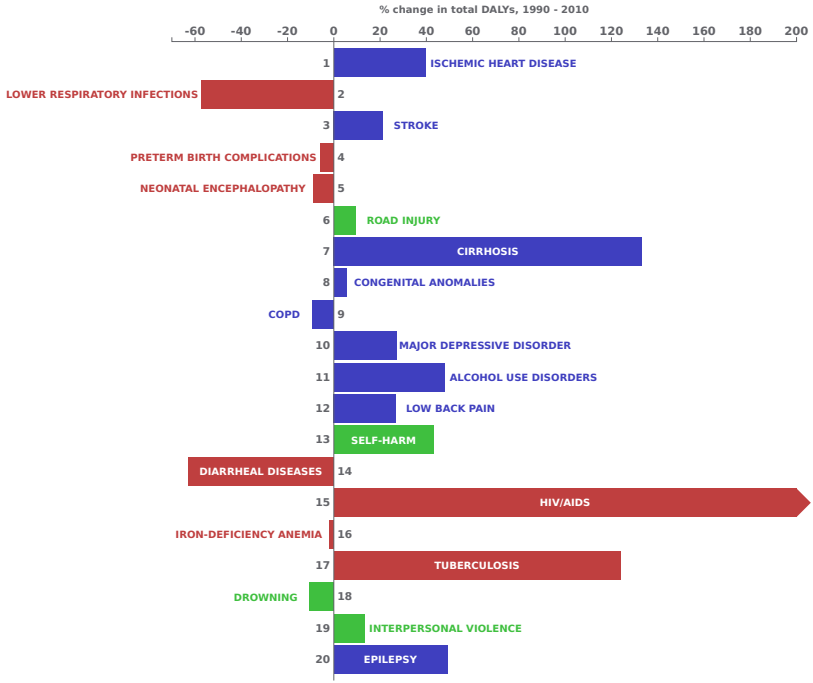
Shifts in leading causes of DALYs in Georgia, 1990-2010



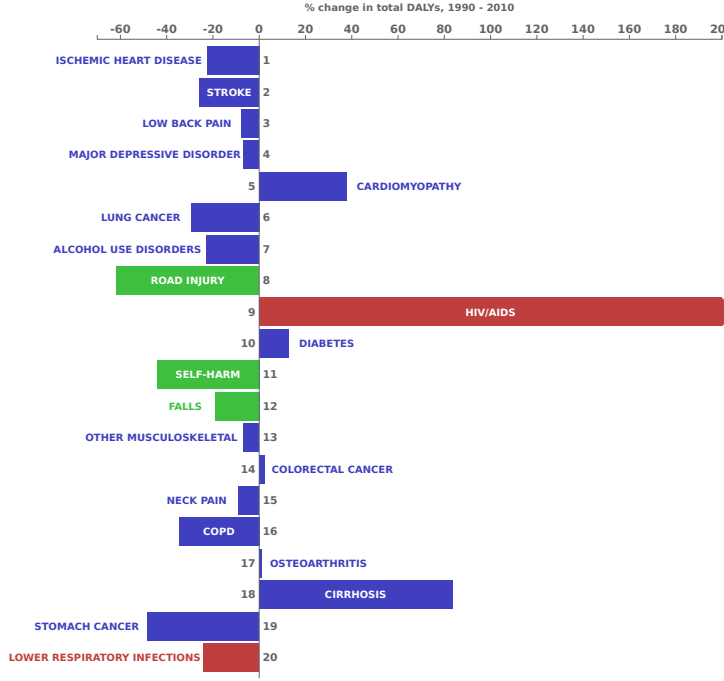
Shifts in leading causes of DALYs in Kazakhstan, 1990-2010



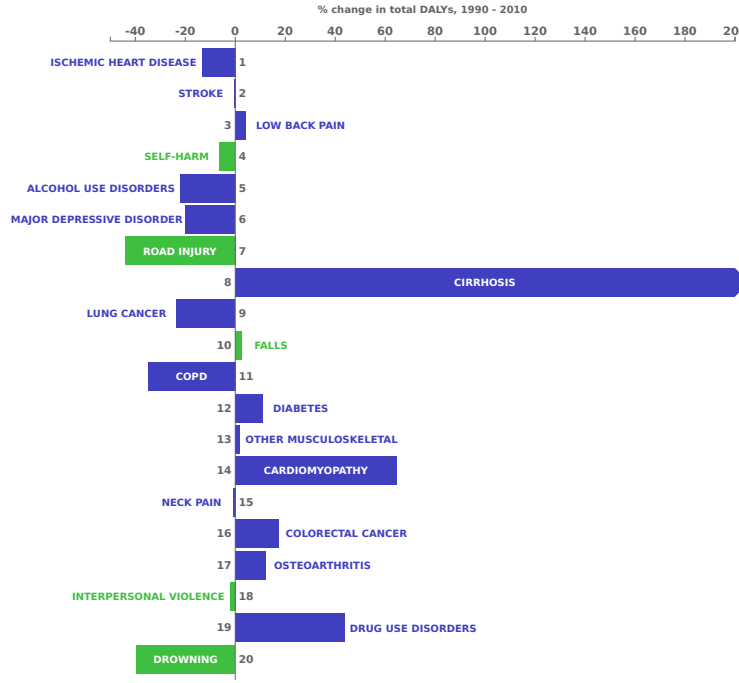
Shifts in leading causes of DALYs in Kyrgyzstan, 1990-2010



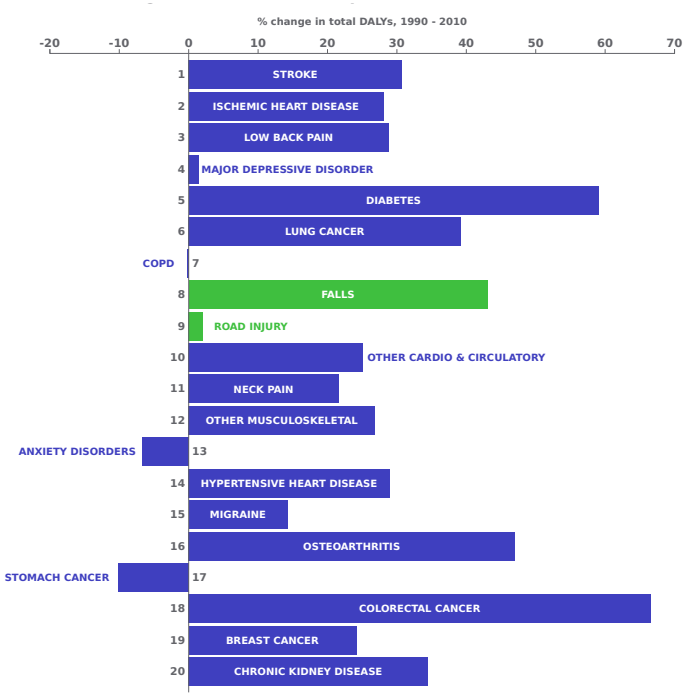
Shifts in leading causes of DALYs in Latvia, 1990-2010



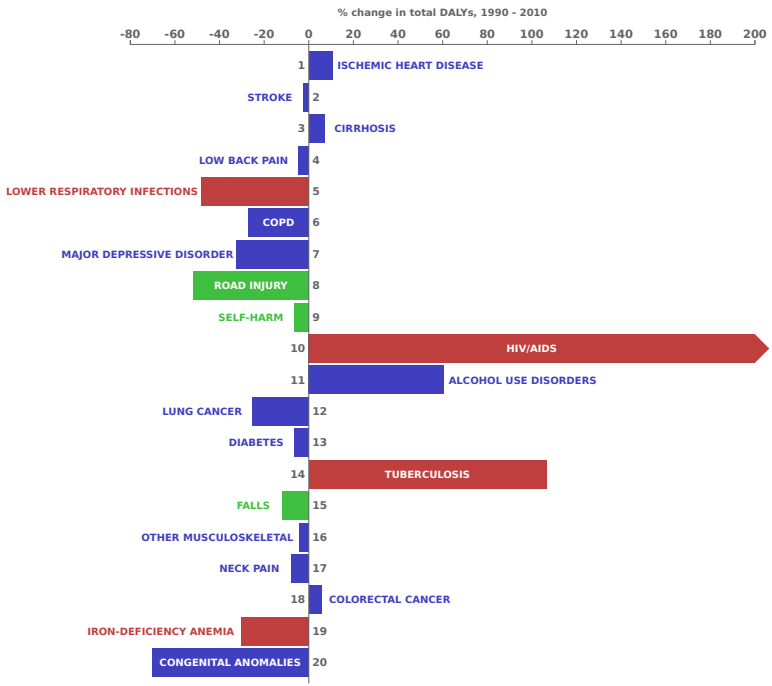
Shifts in leading causes of DALYs in Lithuania, 1990-2010



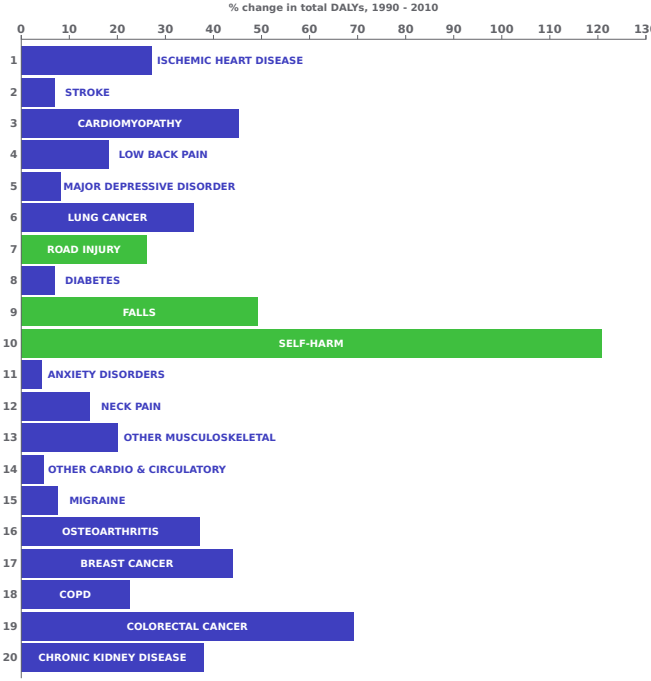
Shifts in leading causes of DALYs in Macedonia, 1990-2010



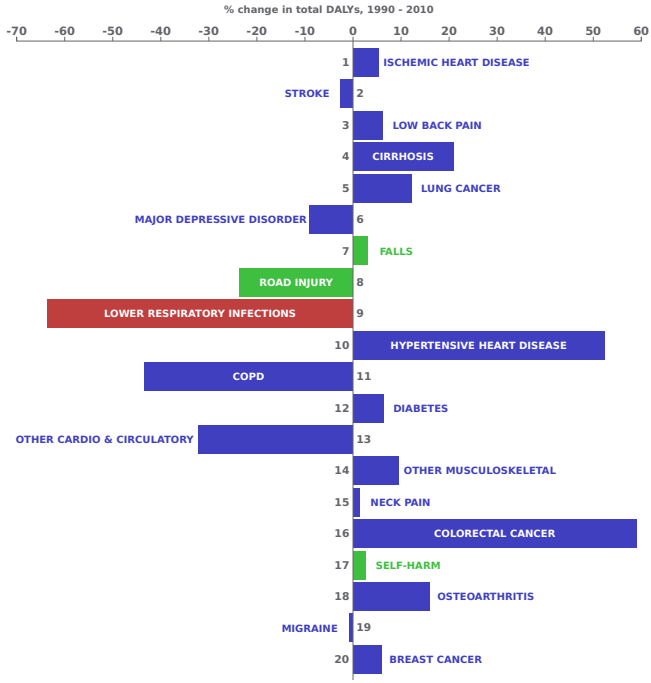
Shifts in leading causes of DALYs in Moldova, 1990-2010



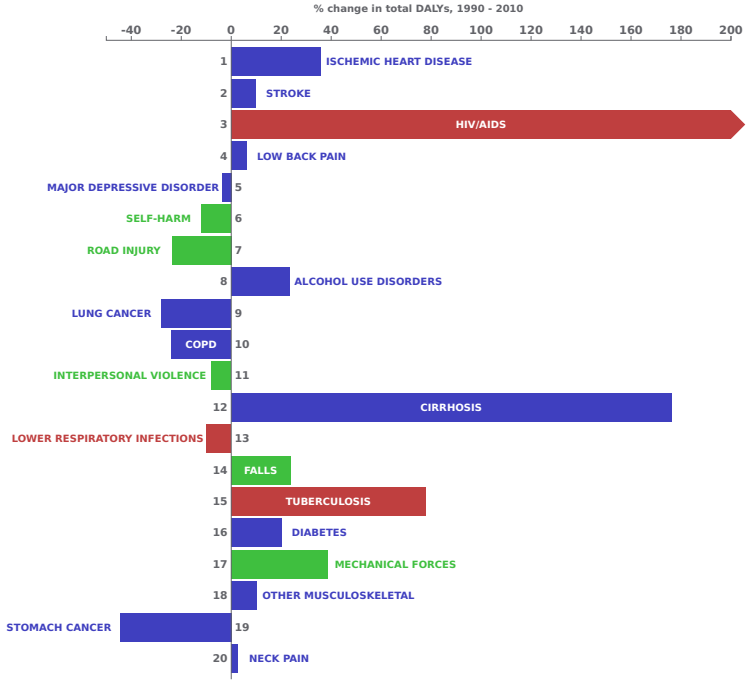
Shifts in leading causes of DALYs in Montenegro, 1990-2010



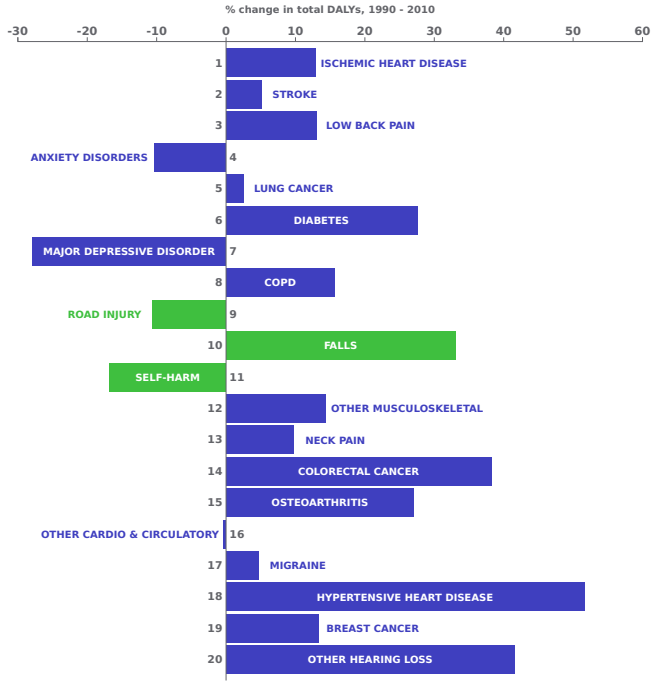
Shifts in leading causes of DALYs in Romania, 1990-2010



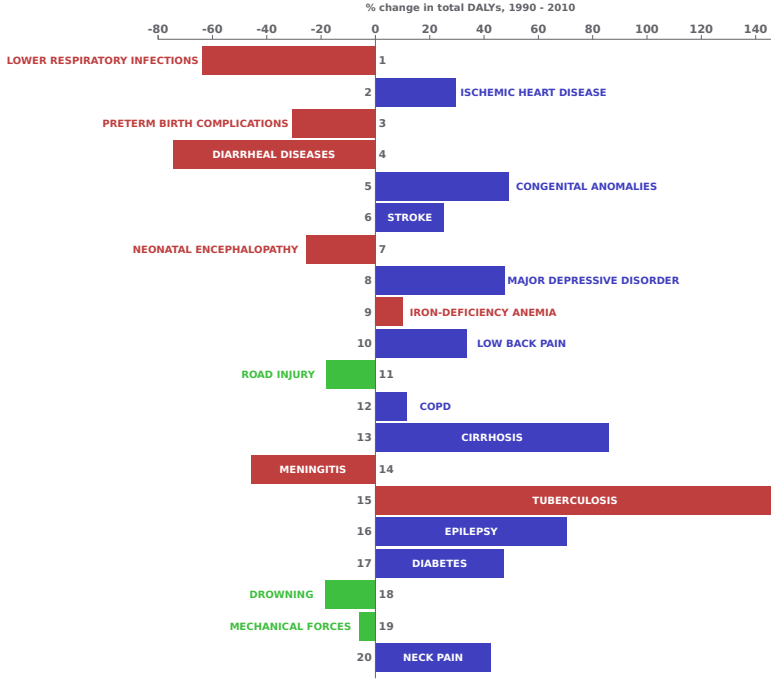
Shifts in leading causes of DALYs in Russia, 1990-2010



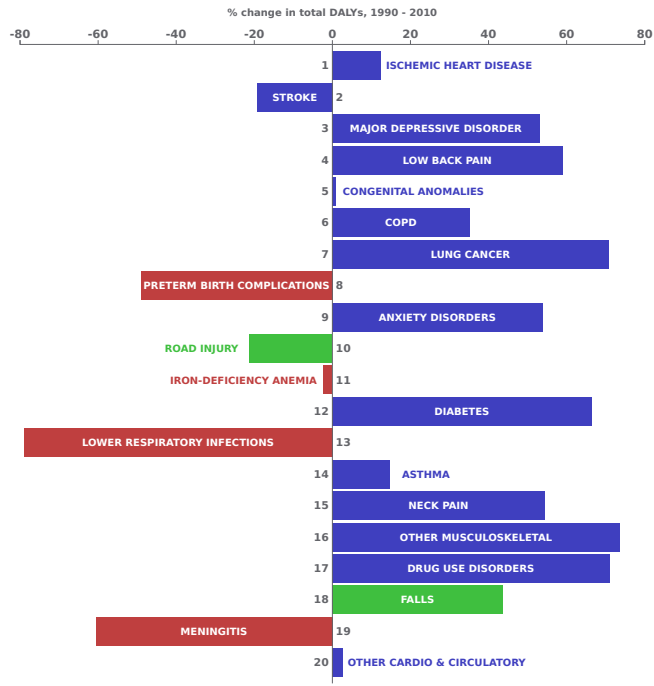
Shifts in leading causes of DALYs in Serbia, 1990-2010



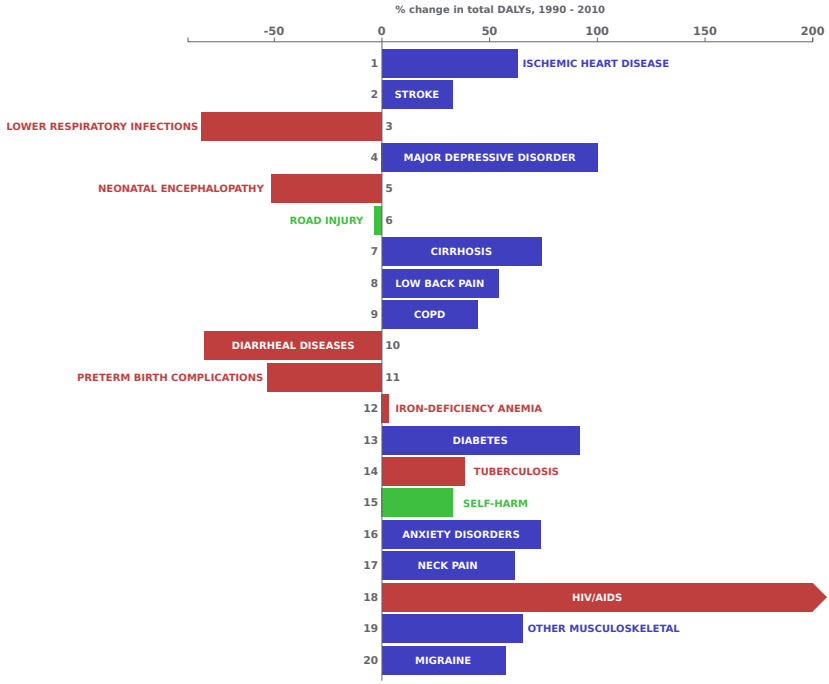
Shifts in leading causes of DALYs in Tajikistan, 1990-2010



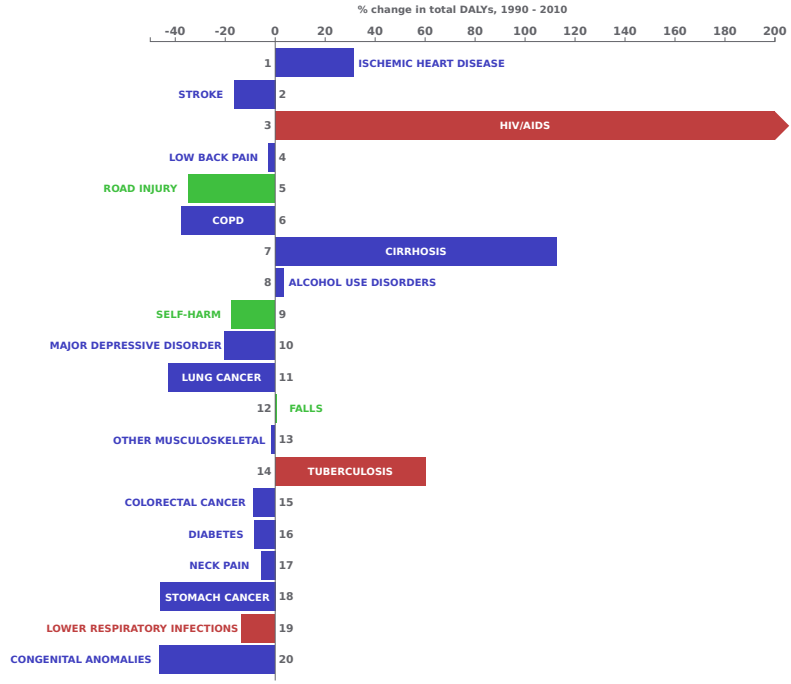
Shifts in leading causes of DALYs in Turkey, 1990-2010



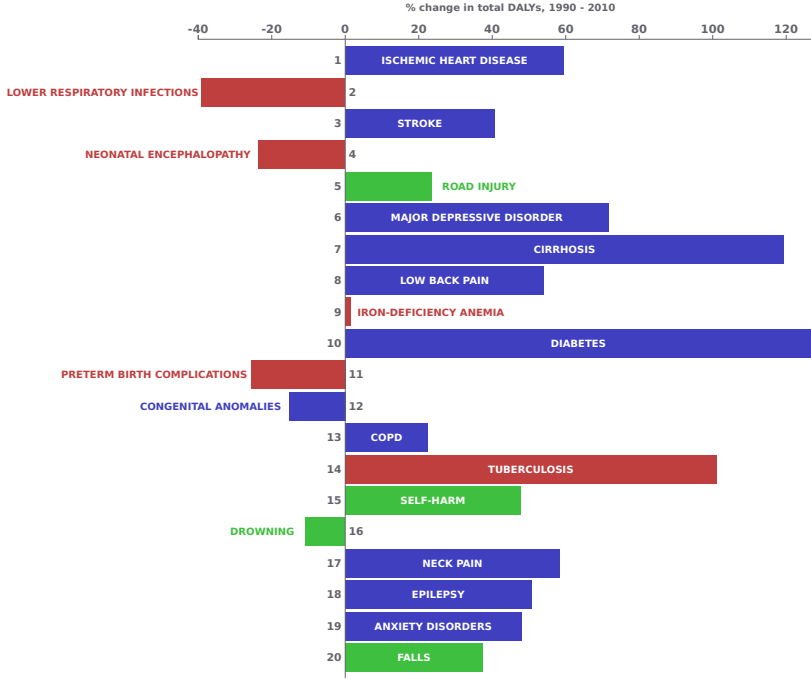
Shifts in leading causes of DALYs in Turkmenistan, 1990-2010



Shifts in leading causes of DALYs in Ukraine, 1990-2010



Shifts in leading causes of DALYs in Uzbekistan, 1990-2010



THE WORLD BANK

GBD