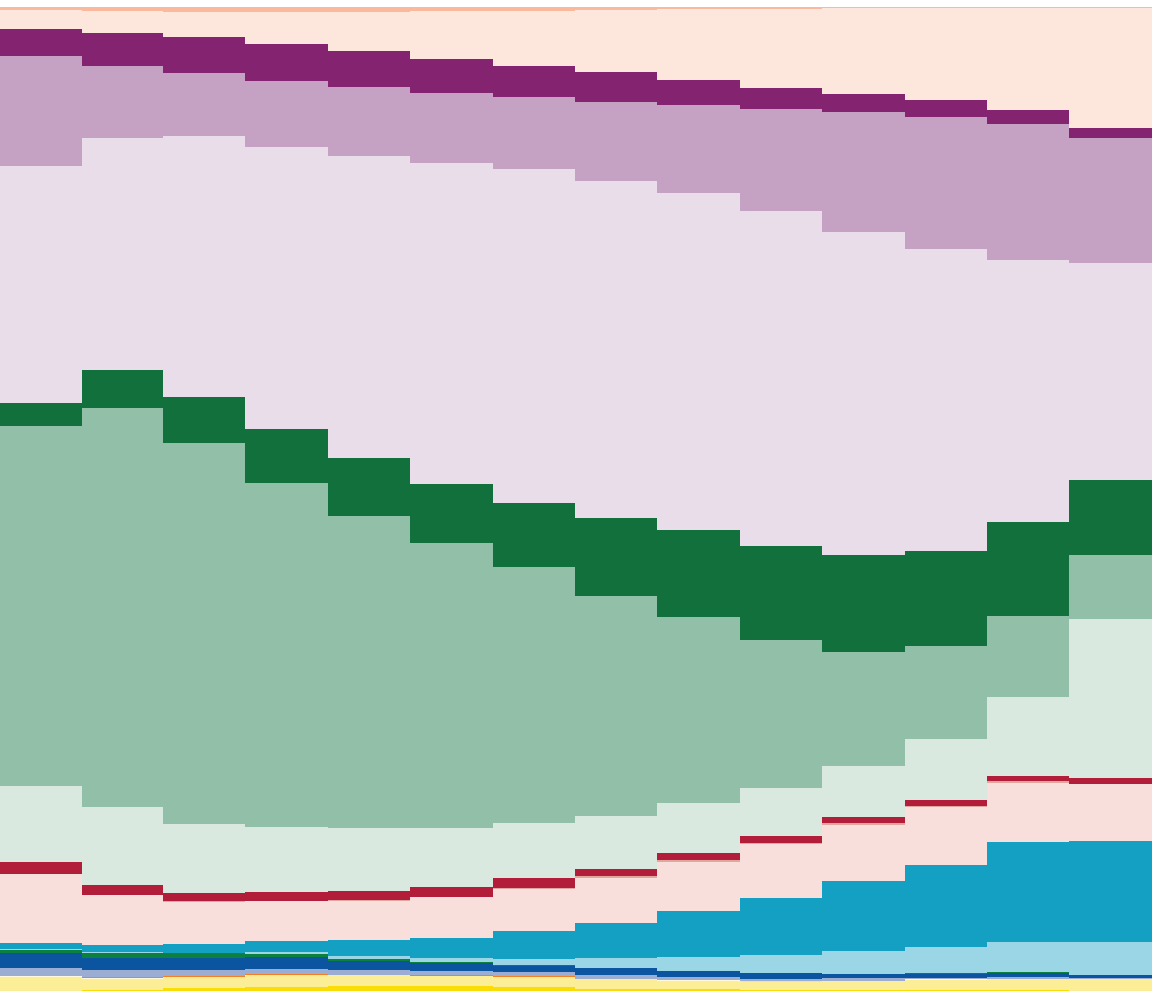
THE GLOBAL BURDEN OF DISEASE:

GENERATING EVIDENCE, GUIDING POLICY

EUROPEAN UNION AND EUROPEAN FREE TRADE ASSOCIATION REGIONAL EDITION

INSTITUTE FOR HEALTH METRICS AND EVALUATION
UNIVERSITY OF WASHINGTON



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This report was prepared by the Institute for Health Metrics and Evaluation (IHME) 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.

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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:

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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) as well as papers on United Kingdom health performance published in *The Lancet* (2013 March 23; 381) and the state of United States health published in the *Journal of the American Medical Association* (2013 Aug 14; 310 (6)). GBD 2010 had 488 co-authors from 303 institutions in 50 countries.

We thank IHME's Board for their continued leadership. We are grateful to the report's writer Rhonda Stewart; Christopher Murray, Michael MacIntyre, Heidi Larson, Isabel de la Mata, Katherine Leach-Kemon, and William Heisel at IHME for content guidance; Ryan Barber for data analysis; Kyle Heuton for country profile analysis; Brittany Wurtz and Anne Bulchis for program coordination; Patricia Kiyono for production oversight; Kate Muller and Adrienne Chew for editing; Ryan Diaz for graphic design; and Brian Childress for editorial support. 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 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 effort 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. Continuous 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.

The European Union (EU) and the European Free Trade Association (EFTA) encompass 32 countries in Western and Central Europe. They are Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

This report includes analysis of countries in the EU and EFTA regions with the exception of Liechtenstein. At the time of the latest update to the GBD, IHME produced estimates only for countries with populations over 50,000.

The EU and EFTA countries provide rich opportunities for GBD analysis, as health care is a cross-border issue and tremendous health improvements have been made over 20 years. The countries have diverse economies and population structures but are united in common priorities, as seen in the European Commission's (EC) most recent health strategy. These priorities include encouraging healthy aging, addressing pandemics and other threats to health, and supporting new technologies to improve health systems. The EC health strategy also argues that health policy "must be based on the best scientific evidence derived from sound data and information, and relevant research."

For EU and EFTA countries the rise in disabling conditions, the growing impact of potentially preventable risk factors, and the challenges posed by regional funding priorities present many possibilities for research. By drawing comparisons across countries and over time and measuring trends in diseases, injuries, risk factors, and mortality, GBD data allow policymakers to identify the most pressing health challenges and develop appropriate measures to address them.

In EU and EFTA countries, 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 poorer countries in the region as non-communicable diseases kill more people prematurely and cause increasing disability. The epidemiologic profile of these countries closely resembles that of countries such as the United States and Canada, with health loss from many non-communicable diseases, including diabetes, depression, and musculoskeletal disorders, increasing steadily over 20 years. Risk factors such as high blood pressure, poor diets, and smoking contributed to the rise of non-communicable diseases in these regions.

This publication summarizes findings for the EU and EFTA region. It also explores intraregional differences in diseases, injuries, and risk factors.

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 (nonfatal 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 nonfatal 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.

MAIN FINDINGS GLOBALLY AND FOR THE EUROPEAN UNION AND EUROPEAN FREE TRADE ASSOCIATION REGION

A range of risk factors pose significant challenges to health in the region. Despite progress made in reducing health loss from ischemic heart disease and stroke, these remain among the top three causes of disease burden in the EU/EFTA region. There is enormous potential to reduce the impact of these diseases by addressing dietary risks, high blood pressure, and strengthening tobacco control efforts.

- Between 1990 and 2010, the EU and EFTA countries succeeded in decreasing premature death and disability from most communicable, newborn, nutritional, and maternal causes, especially in poorer countries such as Romania and Bulgaria. HIV/AIDS, lower respiratory infections, iron-deficiency anemia, and preterm birth complications were the only communicable, newborn, nutritional, and maternal causes found among the top 25 causes of health loss in any EU and EFTA country.

- In this 20-year period, the global disease burden from many non-communicable causes increased, especially ischemic heart disease, cirrhosis, diabetes, and musculoskeletal disorders including low back pain and neck pain. The same was generally true in EU and EFTA countries, with the exceptions of ischemic heart disease and cirrhosis; the disease burden associated with these two causes decreased over the 20-year period. Countries with some of the greatest declines in health loss from ischemic heart disease include the UK (50%), Denmark (48%), and Ireland (40%). In another global and regional difference, drug and alcohol use disorders caused more early death and disability in EU and EFTA countries in 2010 than two decades prior, but the health loss from those disorders increased at a slower rate in the region than the global pace. One notable exception is Finland, where the percentage of disability-adjusted life years (DALYs) from alcohol use disorders jumped 110% since 1990 and the percentage of DALYs from drug use disorders was up 87% in the same period.

- In EU and EFTA countries, a greater percentage of healthy years were lost from disability in 2010 compared to 1990. Low back pain, neck pain, and other musculoskeletal disorders, as well as mental disorders such as depression and anxiety were dominant causes of disability. In Iceland, the percentage of years lived with disability from low back pain, neck pain, and other musculoskeletal disorders was up by more than a third since 1990. In Switzerland, years lost from disability for major depressive disorder increased 54%. Early death and disability from falls is a notable source of injuries in the EU/EFTA region, up by almost 25%. Aging and changing demographics will continue to fuel the rise in disability in EU and EFTA countries, making it imperative for policymakers to determine how to manage these conditions in a cost-effective way.

- EU and EFTA countries, regionally, saw a 50% decrease in premature mortality from road injury between 1990 and 2010. But given that at least one key source of road safety funding has declined from 9.1 million euros in 2007 to 1 million euros in 2011, continued efforts are needed to sustain progress that has been made. Although the percentage of DALYs from road injury in the region has dropped by half since 1990, the declines in health loss have not been as great in some countries. In Belgium, Greece, and Poland, the DALYs from road injuries dropped by 28%, 19%, and 18%, respectively.

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, 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 as "years lost due to premature death and disability" throughout this publication. Decision-makers can use DALYs to quickly compare the impact caused by conditions such as cancer and depression since the conditions are assessed 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 nonfatal 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://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 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 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 both the global and national levels to understand health trends over time.

Policymakers in Australia, Brazil, China, Colombia, Indonesia, Mexico, Norway, Saudi Arabia, Turkey, and the United Kingdom are in the process of adopting different aspects of the GBD approach. Since the release of GBD 2010 in December 2012, researchers in the US, UK, and Australia have collaborated with IHME on country-specific GBD estimates at the national level. New studies are underway in these countries to produce GBD estimates at the local level.

Box 3 contains decision-makers' and policy influencers' reflections about the value of using GBD tools and results to inform policy discussions.

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 tools, which can be found 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 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, cause, and time period.

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 use the GBD data visualization tools and share them with others.

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.

Box 3: Views on the value of GBD for policymaking

"I want us to be up there with the best in Europe when it comes to tackling the leading causes of early death, starting with the five big killer diseases – cancer, stroke, heart, respiratory, and liver diseases. But the striking picture of our health outcomes across these major causes of early death published in *The Lancet* recently shows that we have a long way to go before we are confident that we can achieve this aspiration."

Jeremy Hunt
Secretary of State for Health, United Kingdom

"The data from this report goes all the way down to the county level, which means that you'll be able to see which issues are affecting your communities the most… And once you have all this information, you'll be able to make more effective decisions to really focus your resources and programming to find solutions that fit the needs of your community."

Michelle Obama
First Lady of the United States

"We think we know where the burdens are in our society, but I bet you when we have another look at it from this frame we'll find things we didn't know. And then we'll tackle them."

Jane Halton
Secretary, Australian Department of Health and Ageing

"The Global Burden of Disease Study 2010 (GBD 2010) in *The Lancet* represents an unprecedented effort to improve global and regional estimates of levels and trends in the burden of disease. Accurate assessment of the global, regional, and country health situations and trends is critical for evidence-based decision-making for public health."

Margaret Chan
Director-General, World Health Organization

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).

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, 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.

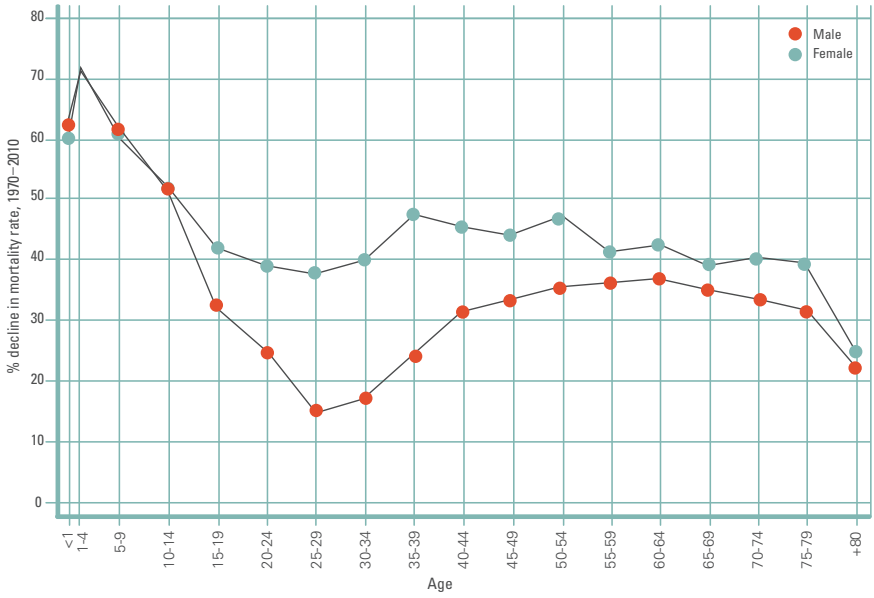
GBD REGIONAL CLASSIFICATIONS

GBD 2010 created regions based on two criteria: epidemiological similarity and geographic closeness. More information about GBD regional classifications can be found on the IHME website at www.ihmeuw.org/gbdfaq. For the purposes of this report, we focused on the countries in the EU and EFTA, with the exception of Liechtenstein.

Disease burden is evaluated by calculating DALYs, which are the sum of YLLs and YLDs. DALYs can also be defined as years of healthy life lost. While the trends in the EU and EFTA countries were largely consistent with global patterns, the region is unique in several ways.

In terms of disease burden at the global level, GBD 2010 found that in many parts of the world mortality rates are declining, healthy life expectancy is increasing, and the leading causes of premature death, or YLLs, have evolved dramatically over the past 20 years.

Figure 1: Global decline in age-specific mortality rate, 1970–2010

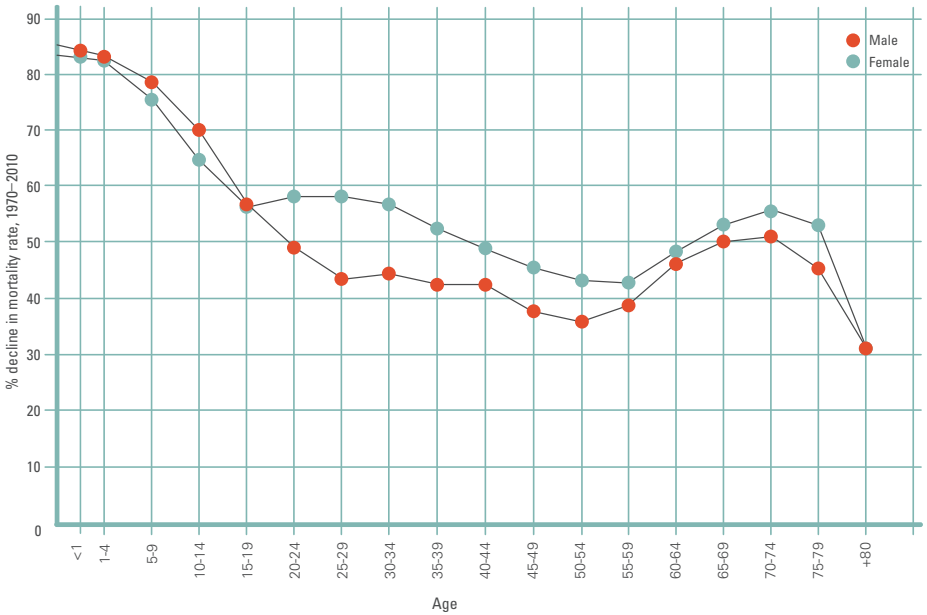


Note: Higher values indicate greater declines in mortality; lower values indicate smaller declines in mortality.

Figures 1 and 2 show declines in age-specific mortality rates between 1970 and 2010, where higher values indicate greater declines in mortality and lower values indicate smaller declines in mortality.

Figure 1 shows that global death rates in all age groups have declined, with the largest decrease among males and females aged 0 to 9. Mortality declines for females 15 and older were higher than for males in that same age group, and the largest gap between males and females occurs in the 15 to 54 age range.

Figure 2: Decline in age-specific mortality rate, EU and EFTA, 1970–2010

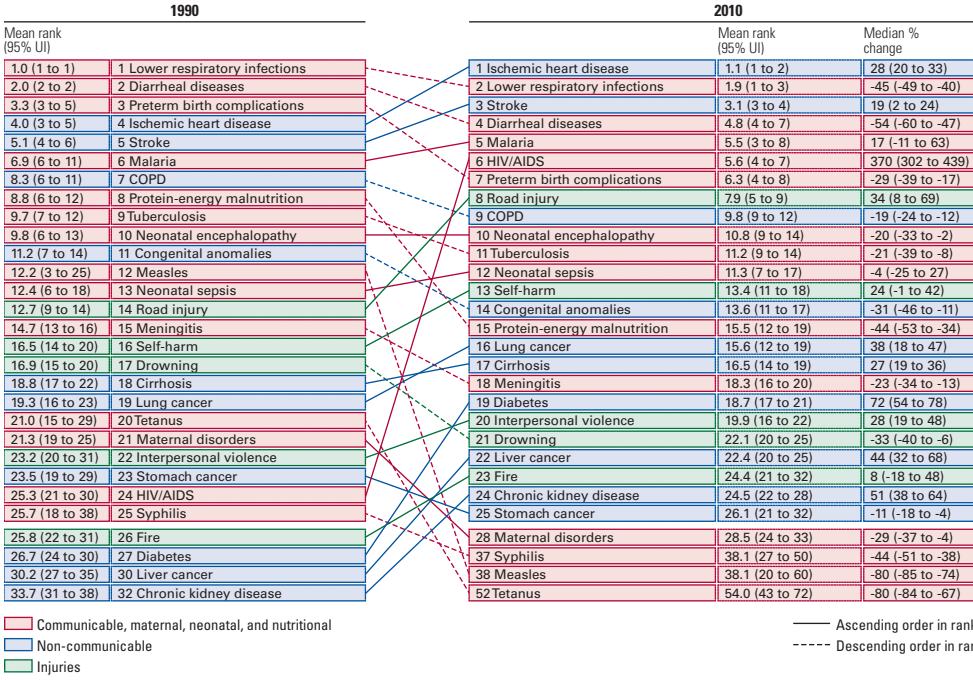


Note: Higher values indicate greater declines in mortality; lower values indicate smaller declines in mortality.

Figure 2 shows the trends in death rates in the EU/EFTA region. For males in most age groups up to 79, mortality declined by 40% or higher between 1970 and 2010. The reverse is true for males globally, where the declines in age-specific mortality rates for males are below 40% for almost all age groups. For 15- to 79-year-old females in the region, age-specific mortality declines range from just over 40% to almost as high as 60%. For 15- to 79-year-old females globally, the greatest declines are almost 50%.

Life expectancy incorporates mortality; health-adjusted life expectancy, or HALE, further incorporates years lived in less than ideal health. HALE grew by approximately three years in France, Germany, and Spain over the past 20 years. In 2010, Spaniards could expect to live 70.9 years in good health, the French 69.5 years, and Germans 69 years.

Figure 3: Shifts in top 25 causes of global YLLs, 1990–2010

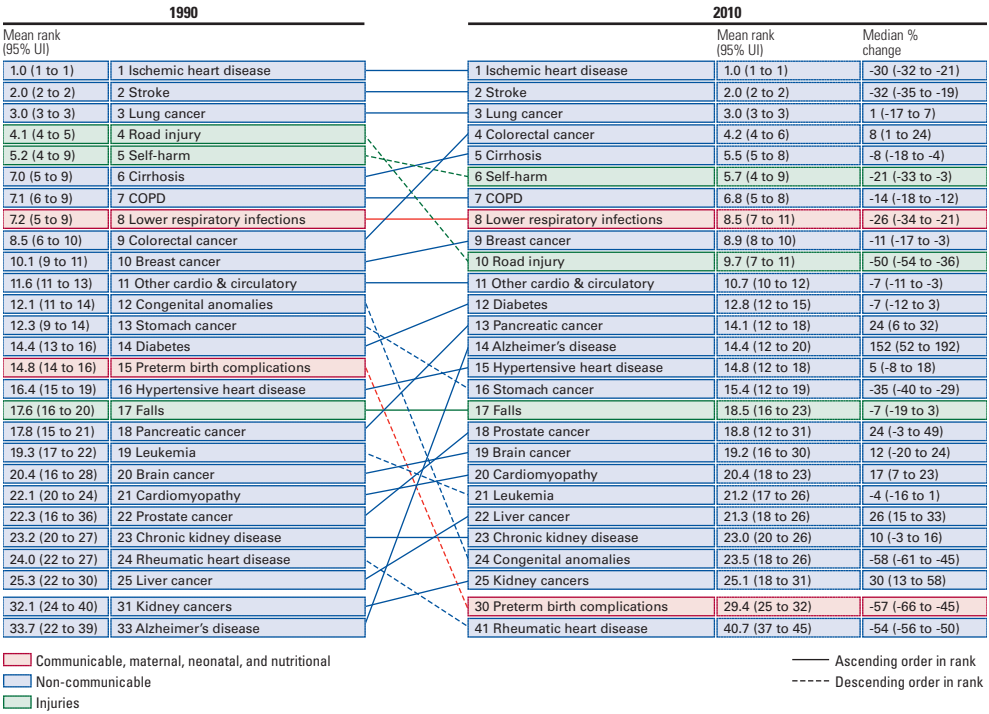


Note: Solid lines indicate a cause that has moved up in rank or stayed the same. Broken lines indicate a cause that has moved down in rank. The causes of YLLs are color coded, with blue for non-communicable diseases, green for injuries, and red for communicable, maternal, neonatal, and nutritional causes.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

Figure 3 shows the changes in the leading global causes of YLLs in 1990 and 2010. Causes associated with ill health and death in adults, such as ischemic heart disease, stroke, and various cancers, 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 370% and 17%, respectively. Four main trends have driven changes in the leading causes of YLLs 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 4 shows how the leading causes of premature death and YLLs have changed over time in EU and EFTA countries.

Figure 4: Shifts in top 25 causes of YLLs, EU and EFTA, 1990–2010



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Globally, from 1990 to 2010 there was a shift in premature death (YLLs) from predominantly communicable, maternal, neonatal, and nutritional causes to an increasing number of non-communicable causes and injuries.

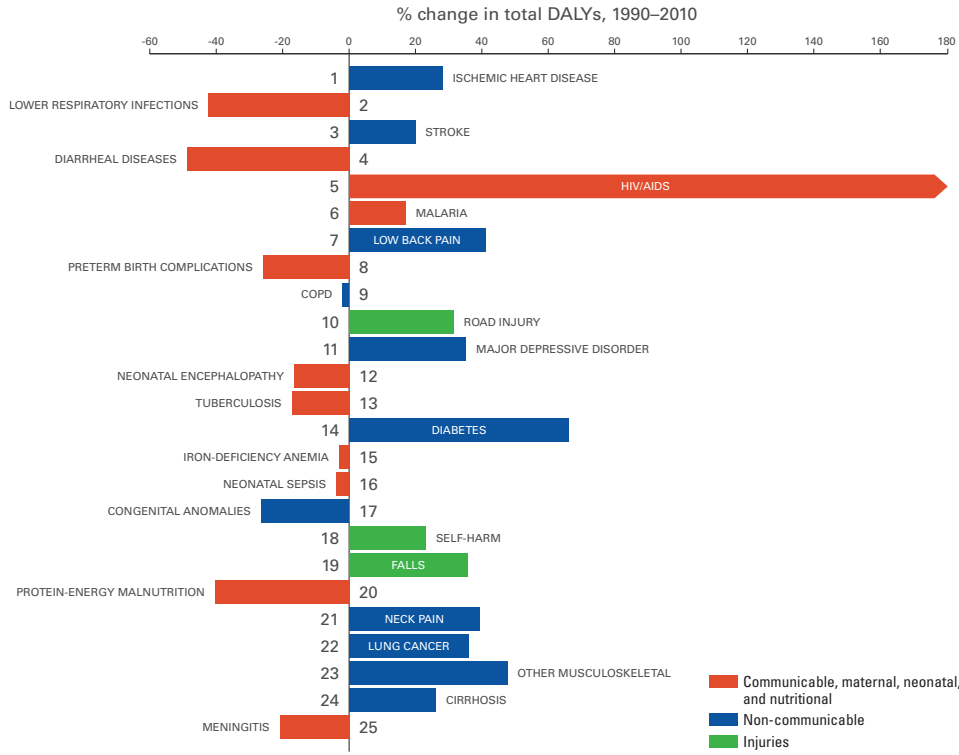
For example, in Figure 3, ischemic heart disease ranked fourth as a cause of premature mortality in 1990 and first in 2010, and stroke ranked fifth in 1990 and third in 2010. Still, over half of the top 10 global causes of YLLs are due to communicable, maternal, neonatal, and nutritional causes. In contrast, at the EU and EFTA regional level, in 1990 and 2010, YLLs were dominated by non-communicable causes. Ischemic heart disease, stroke, and lung cancer remained in the first, second, and third ranks from 1990 to 2010 as the top causes of YLLs at these two time points. Additionally, in contrast to global trends, EU and EFTA countries, regionally, saw a decrease in premature death from road injuries, with a 50% decrease in EU and EFTA countries and a 34% increase globally.

LEADING CAUSES OF DISEASE BURDEN ARE NON-COMMUNICABLE DISEASES

In part because many people are living longer lives, the leading causes of death have changed. Worldwide, the number of people dying from non-communicable diseases, such as ischemic heart disease, 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. In 2010, almost half of the top 25 causes of DALYs were non-communicable diseases, as seen in Figure 5. The figure shows global changes in the leading causes of DALYs between 1990 and 2010, ordered from highest- to lowest-ranking cause from top to bottom.

Figure 5: Global shifts in leading causes of DALYs, 1990–2010

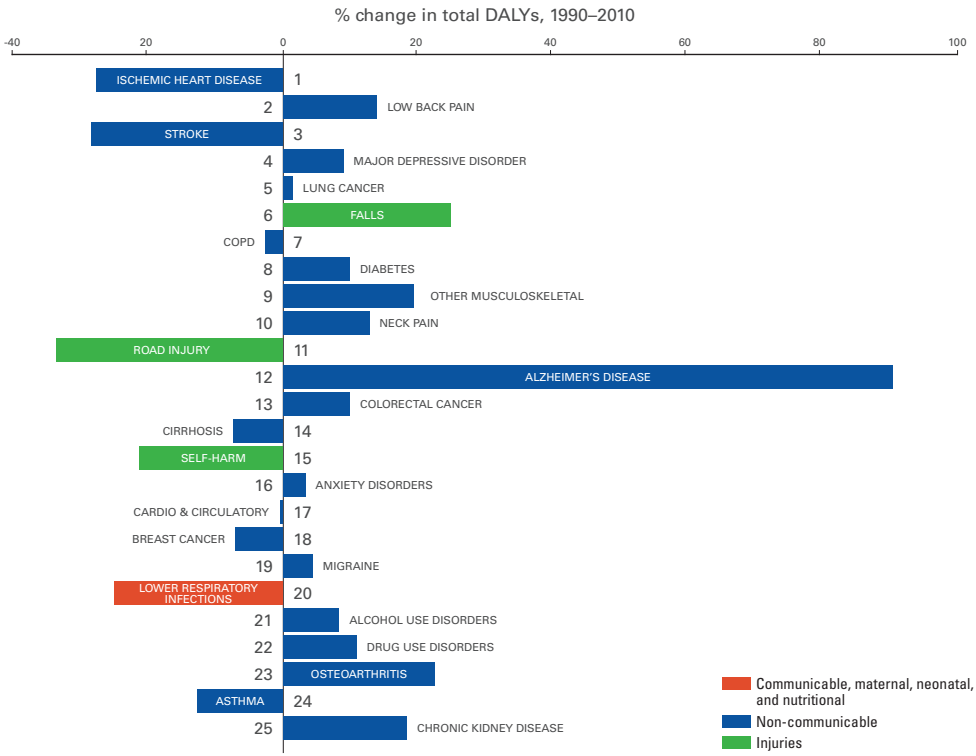


Note: Non-communicable causes are shown in blue; communicable, maternal, neonatal, and nutritional causes in red; and injuries in green. Bars to the right of the vertical line show the percent by which DALYs have increased since 1990. Bars to the left show the percent by which DALYs have decreased. Pointed arrows indicate causes that have increased by a greater amount than shown on the x-axis.

In many countries, non-communicable diseases accounted for the majority of DALYs. 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 6 shows the percent change in the leading causes of total DALYs in the EU and EFTA region for the same period. In most EU and EFTA countries, loss of healthy life, or DALYs, from non-communicable diseases are rising, while DALYs from communicable, newborn, nutritional, and maternal causes are declining.

Figure 6: Shifts in leading causes of DALYs, EU and EFTA, 1990–2010



Note: Non-communicable causes are shown in blue; communicable, maternal, neonatal, and nutritional causes in red; and injuries in green. Bars to the right of the vertical line show the percent by which DALYs have increased since 1990. Bars to 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.

The same figure further shows that, among non-communicable diseases, osteoarthritis and chronic kidney disease caused some of the most significant increases in health loss in EU and EFTA countries between 1990 and 2010. Although health loss from ischemic heart disease and stroke ranked in the top three leading causes of health loss globally as well as in EU and EFTA countries, they are declining in these European regions while they are on the rise in other parts of the world.

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 as measured by DALYs. Lung cancer ranked fifth as a cause of premature death and disability in the region and ranked 22nd at the global level. Low back pain, ranked second, and falls, ranked sixth, took a greater toll in EU and EFTA countries than globally, where the corresponding rankings were seventh and 19th.

Despite the 10% increase in DALYs due to diabetes in the EU and EFTA region, the picture was vastly different in several countries. In 2010, the rise in the percentage of DALYs caused by diabetes was more than double in Croatia at 21%; it was even greater in Norway and Greece, at 26%, and in Austria, at 31%.

Health loss from stroke declined in several EU/EFTA countries, such as Portugal (47%), the Czech Republic (42%), and Hungary (41%), but stroke remained the region's third-leading cause of DALYs, highlighting the significant burden from stroke in the region. An important contributor to stroke is high blood pressure, the second biggest risk factor to health in 2010. While ischemic heart disease – reduced blood supply to the heart, usually due to coronary artery disease – was a leading cause of health loss in all EU and EFTA countries, several of these countries also suffered a dual burden of hypertensive heart disease, brought on by high blood pressure's impact on the heart. As a cause of YLLs, hypertensive heart disease was up by only 5% in the EU and EFTA region as a whole, but this condition posed a much more severe threat in individual countries, including Romania (up 52%) and Bulgaria (up 55%).

Four types of cancer, another major non-communicable disease, appear among the leading causes of DALYs in the EU and EFTA region. These include lung cancer, colorectal cancer, breast cancer, and stomach cancer. As seen in the DALYs arrow diagram visualization tool online, breast cancer and stomach cancer DALYs declined by 7% and 35%, respectively, while colorectal cancer increased by 10% and lung cancer by 1%.

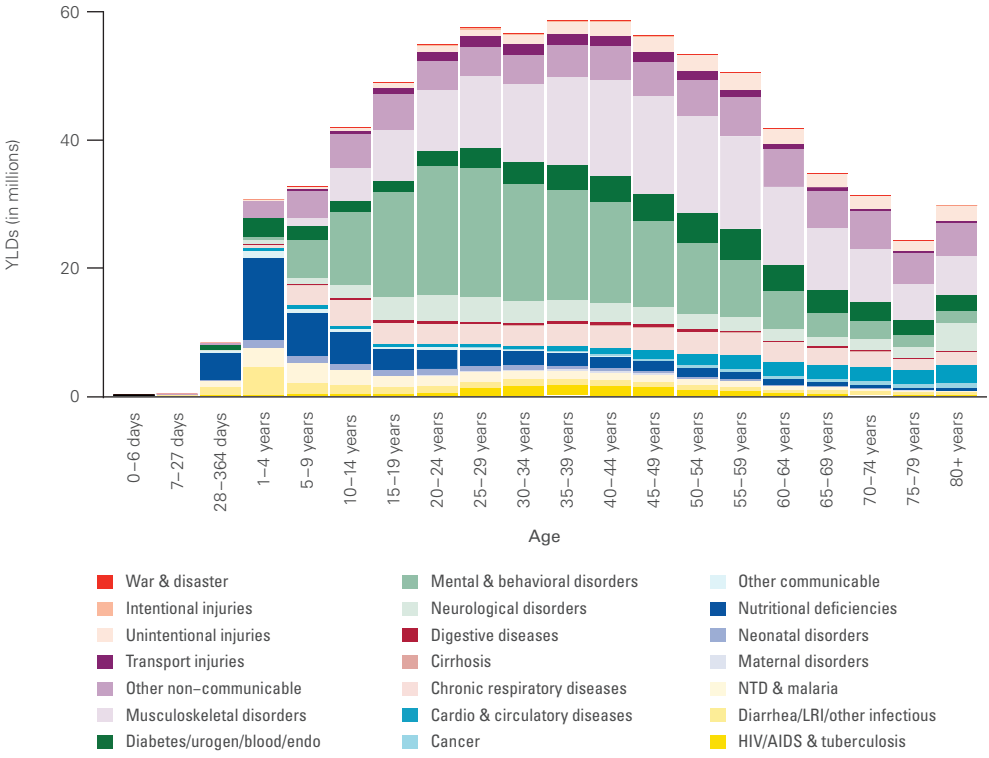
Countries where the declines in breast cancer DALYs were greater include Belgium, Germany, Norway, Switzerland, and the UK. On colorectal cancer, several countries showed less progress than the region as a whole in reducing DALYs. There were only slight declines in some countries, but in Greece the disease burden for this cancer jumped by 61%, and it was up by 47% in Croatia, 40% in Poland, and 38% in the Netherlands. DALYs due to lung cancer climbed 27% in Greece, 25% in France, and 22% in Spain. The burden of stomach cancer decreased in many EU and EFTA countries.

DISABILITY INCREASES IN MIDDLE- AND HIGH-INCOME COUNTRIES

As people are living longer and experiencing more non-communicable disease, they are living with a greater range of disabilities as well. 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, however, 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.

Figure 7 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.

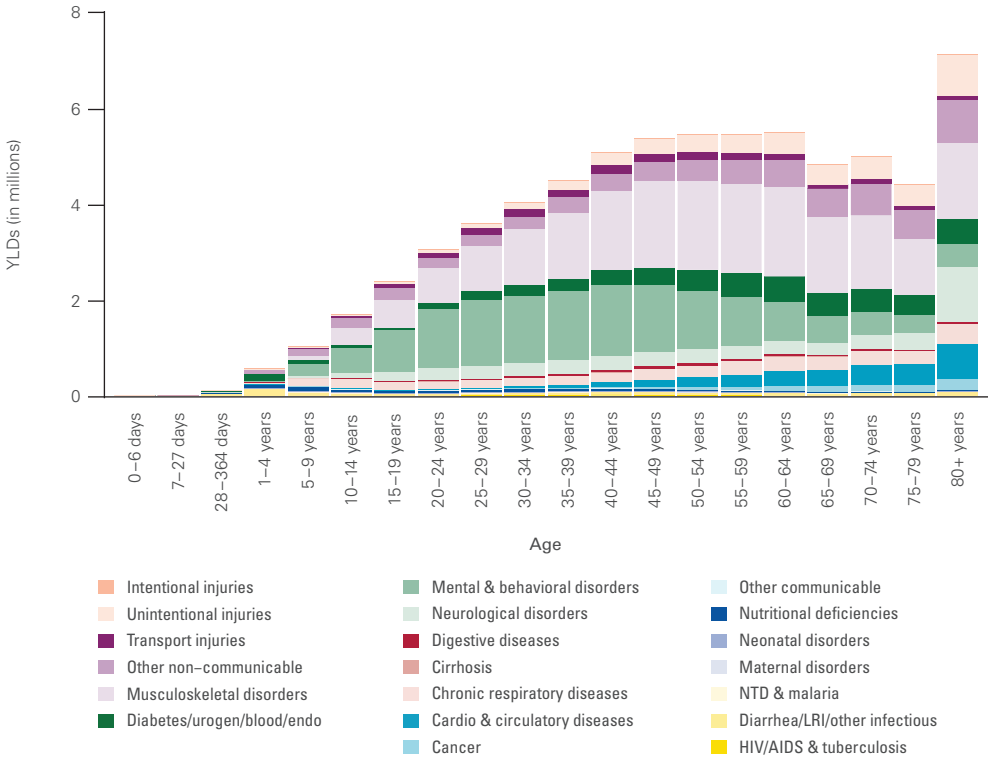
Figure 7: Global disability patterns by broad cause group and age, 2010



Note: The size of the colored portion in each bar represents the number of YLDs attributable to each cause. The height of each bar shows YLDs by 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: ihme.org/gbdcausepattern.

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 combined in these age groups. These findings have far-reaching implications for health systems.

Figure 8: Disability patterns by broad cause group and age, EU and EFTA, 2010



Note: The size of the colored portion in each bar represents the number of YLDs attributable to each cause. The height of each bar shows YLDs by 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: ihme.org/gbdcausepattern.

Figure 8 shows the causes of disability in EU and EFTA countries in 2010. Similar to global trends, mental and behavioral disorders had the greatest impact on young to middle-aged adults. Given the longer life expectancy of people living in the EU and EFTA region compared to the world as a whole, years lived with disability in the 80 and older age group were much more pronounced in this region compared to global patterns.

Low back pain was the primary cause of disability in most countries in the region. This condition can inhibit people's ability to perform different types of work both inside 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 countries. Another musculoskeletal disorder, osteoarthritis, appeared in the top 20 causes of disability in every country.

Major depressive disorder is also an important cause of disability; it was one of the top three causes of disability in every EU and EFTA country, as seen in the country profiles section of this report showing the shift in top causes of DALYs. This condition can cause fatigue, decreased ability to work or attend school, and suicide. Dysthymia, a mild but chronic form of depression, ranked in the top 25 causes of disability in most of these countries. Anxiety, a different type of mental disorder, was the seventh cause of

disability globally and ranked higher in almost half of EU and EFTA countries. Additionally, schizophrenia was among the top 20 causes of disability in the region while bipolar disorder was in the top 20 for all EU and EFTA countries except France and Malta, where it ranked 21st.

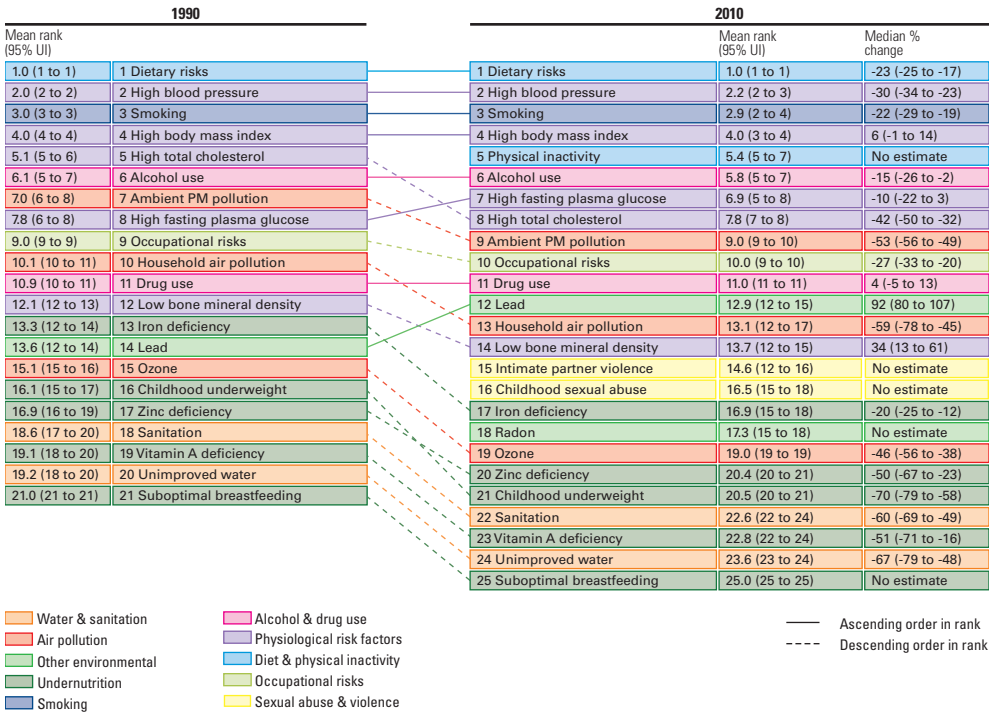
Using GBD tools to identify leading causes of disability can help guide health system planning and medical education. Decision-makers can use GBD findings to ensure that health care systems are designed to address the primary drivers of disability in a cost-effective way.

RISK FACTOR TRANSITION IN EU/EFTA REGION

Data on potentially avoidable 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 9 shows changes in the leading risk factors for premature death and disability, or DALYs, between 1990 and 2010 in the EU and EFTA region.

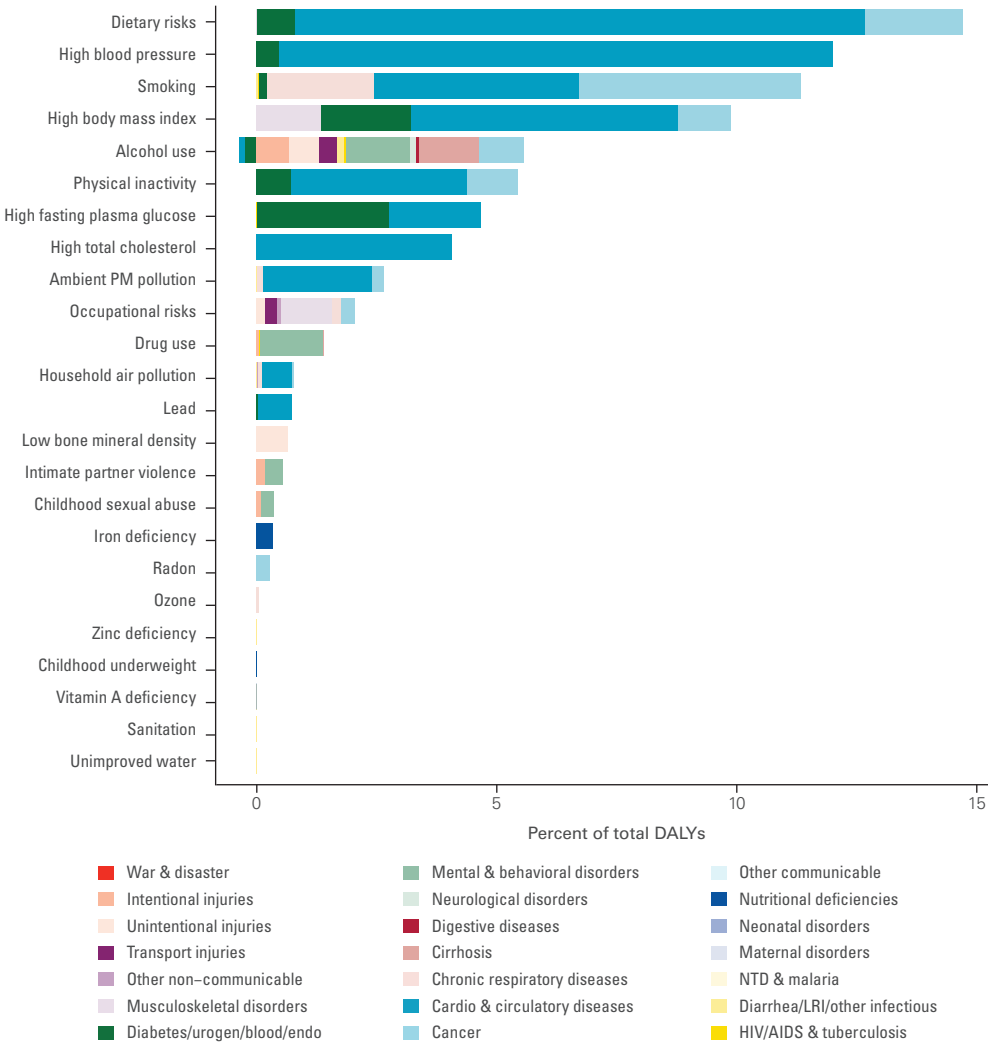
Figure 9: Shifts in DALYs attributable to leading risk factors, EU and EFTA, 1990–2010



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. To view an interactive version of this figure, visit IHME's website: ihmeuw.org/gbdarrowdiagram.

As most risk factors for communicable diseases in children have declined, many risks associated with non-communicable diseases remain unchanged in their rankings. In 1990, dietary risks, high blood pressure, smoking, and high body mass index (BMI) were the top four risk factors in the EU and EFTA region, and the same was true in 2010. DALYs attributable to high BMI increased by 6% since 1990. High BMI is typically used as an indicator of overweight and obesity as well as a leading risk factor for cardiovascular and circulatory diseases and diabetes.

Figure 10: DALYs attributable to leading risk factors, both sexes, all ages, EU and EFTA, 2010



Note: Percentages less than zero reflect causes where alcohol use can reduce DALYs for certain risk factors.

Figure 10 shows the percent of DALYs attributable to various risk factors, with dietary risks as the leading contributor to cardiovascular and circulatory disease, cancer, and diabetes.

Dietary risks include components such as high sodium intake and lack of fruit, nuts and seeds, and whole grains in the diet. GBD found 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.

Looking at risk factors in a stacked bar chart illustrates how health loss from cardiovascular and circulatory diseases, cancer, chronic respiratory diseases, and diabetes can be attributed to the other leading risk factors beyond dietary risks, including high blood pressure, smoking, high body mass index, physical inactivity, high fasting plasma glucose, and high total cholesterol.

GBD found that factors such as population growth, longer lives, and decreasing mortality are driving up DALYs 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.

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

USING GBD TO ASSESS COUNTRIES' HEALTH PROGRESS

Benchmarking is particularly useful in EU and EFTA countries to show regional comparisons as seen in Figure 11, where the columns across the top are ordered by YLLs in EU and EFTA countries relative to the regional average in 2010.

With respect to DALYs, ischemic heart disease and low back pain were the first- or second-leading causes in Denmark, Finland, Iceland, Norway, and Sweden. The number of years of healthy life lost from low back pain increased in all of these countries while it declined in all of the countries for ischemic heart disease.

For injuries – falls, road injury, and self-harm – only DALYs due to falls increased in these countries. The increase ranged from slight, 8% in Denmark; to moderate, between 24% and 31% in Norway, Sweden, and Finland; to significant, 56% in Iceland. Between 1990 and 2010, Denmark experienced some of the biggest declines in health loss from road injury, at 32%, and self-harm, at 51%. However, Denmark posted the smallest decline in lower respiratory infections, the only communicable, maternal, neonatal, or nutritional condition in the top 25 causes of disease burden in the Nordic subregion. Its 7% decrease was well below the range of 44% to 63% in the other four countries.

To further illustrate how benchmarking can be implemented at the country level, IHME launched a unique collaboration with public health experts in the UK 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.

In December 2012, GBD researchers presented their initial findings for disease burden in the UK to a group of policymakers and researchers from government agencies and universities. This presentation sparked an ongoing collaboration between GBD and UK researchers that has revealed new insights into the data. Working with decision-makers at the National Health Service and Public Health England, the UK benchmarking study examined 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. The results of the study were published in March 2013 in *The Lancet*.

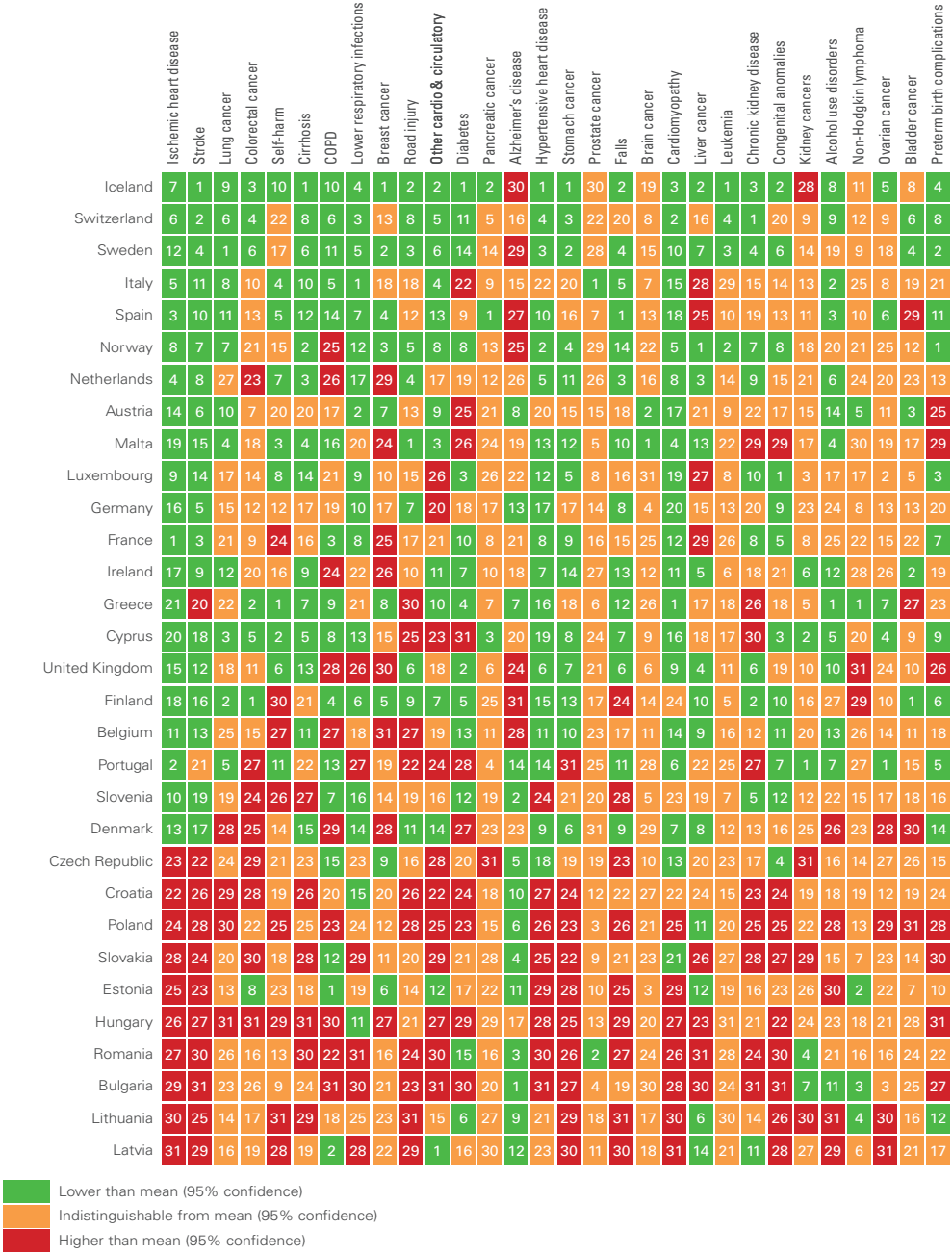
For the UK, GBD estimates of life expectancy and healthy life expectancy, years lost due to premature mortality (YLLs), years lived with disability (YLDs), and healthy life lost (DALYs) provided a detailed and comprehensive picture of changes in health outcomes over time.

Comparing GBD estimates across countries elucidated 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.

Researchers found that, although overall health in the UK improved significantly between 1990 and 2010, the UK performed worse than the 15 original members of the European Union, Australia, Canada, Norway, and the United States (EU15+) on certain key measures.

Looking just at age-specific mortality for nearly every age group, as shown in Figures 12a, 12b, and 12c, the UK's performance relative to its peer countries was worse in 2010 than in 1990. For example, in female 25- to 29-year-olds, the UK ranked fourth for mortality rates in 1990 and in 2010 ranked 16th. In male 25- to 29-year-olds, the UK ranked third for mortality rates in 1990, and in 2010 ranked 10th.

Figure 11: Leading causes of years of life lost, EU and EFTA countries relative to region average, 2010



Note: Countries are ordered from top to bottom in order of (least to greatest) all-cause age-standardized YLLs.

Figure 12a: Percent change in UK age-specific mortality by sex,1990–2010

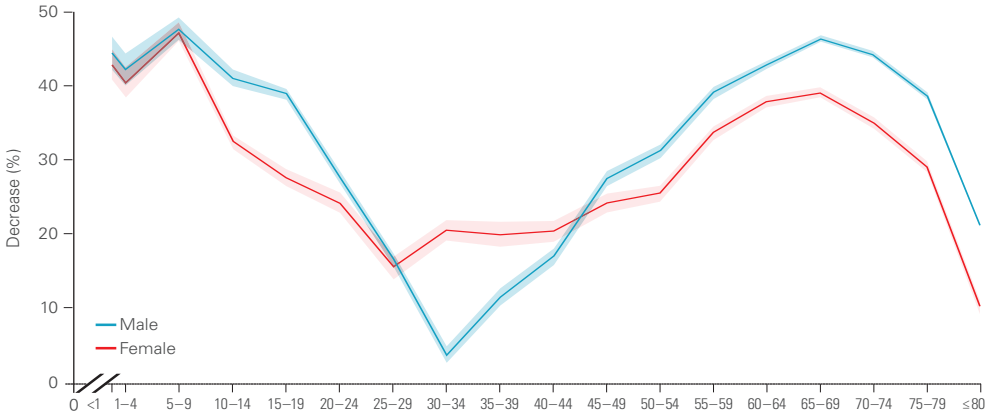


Figure 12b: UK rank in male age-specific mortality when compared with the 15 original members of the EU, Australia, Canada, the US, and Norway

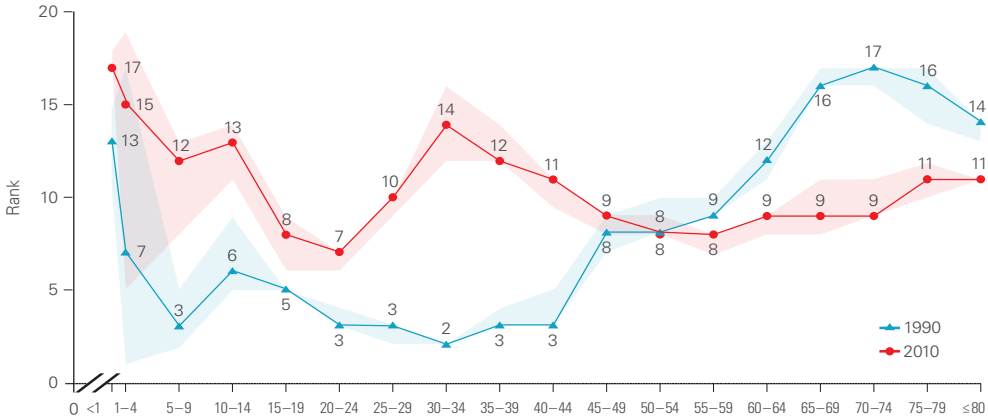
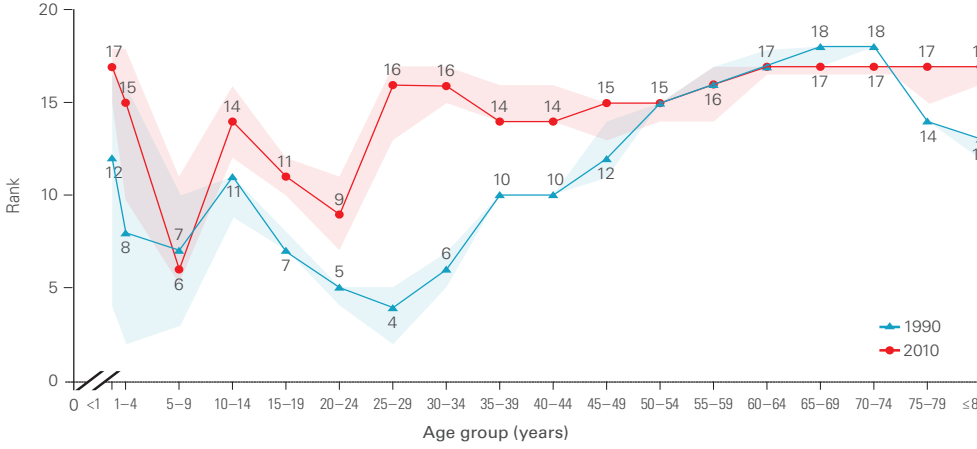


Figure 12c: UK rank in female age-specific mortality when compared with the 15 original members of the EU, Australia, Canada, the US, and Norway



Note: Shaded areas indicate uncertainty intervals.

While life expectancy has increased in the UK, the country falls behind its peers with respect to premature mortality for both sexes aged 20 to 54, and the mortality rate for men aged 30 to 34 has shown virtually no improvement.

YLLs for diabetes, liver cancer, chronic kidney disease, and road injury were significantly lower in the UK than in the EU15+. Rates of age-standardized YLLs were higher in the UK than the EU15+ for ischemic heart disease, aortic aneurysm, breast cancer, esophageal cancer, chronic obstructive pulmonary disease (COPD), lower respiratory infections, other cardiovascular and circulatory disorders, preterm birth complications, and congenital anomalies.

At the same time, the rankings for the leading risk factors in the UK have stayed largely unchanged over 20 years. Dietary risks, smoking, high blood pressure, and high BMI remained in the top five. Alcohol and drug use both increased between 1990 and 2010, with drug use up 31% and alcohol use up 73%.

People in France, Italy, the Netherlands, Spain, and 17 other countries enjoy longer and healthier lives than Britons.

In response to the study's findings, which revealed that the UK was lagging behind other European countries for numerous causes of premature death, multiple policymakers in the country pledged action, including Kevin Fenton, Director of Health and Wellbeing at Public Health England, who stated, "This report is both a wakeup call and an opportunity for the UK…. The results from the study identify where we need to improve and where existing and future resources will need to be realigned to meet the needs of our demographically changing population."

Public Health England is working with IHME on a new collaboration to develop disease burden estimates for nine regions of England.

In addition to the benchmarking work being done in the UK, officials in several other countries, including the US and Australia, are also using GBD data to conduct their own subnational analysis.

In the US, First Lady Michelle Obama leads an initiative called Let's Move!, aimed at decreasing childhood obesity and increasing physical activity. White House advisors working with Mrs. Obama learned about GBD 2010 and, in February 2013, expressed interest in knowing how the GBD approach could be applied locally.

IHME researchers collected estimates at the county level for life expectancy, obesity, and physical activity. A study on the overall state of US health was published in July 2013 in the *Journal of the American Medical Association*. A study on life expectancy and a separate study on obesity and physical activity were published the same month as well in *Population Health Metrics*. Findings from all of the studies were presented at a White House event attended by local officials from around the US who are involved in the Let's Move! campaign.

The study on the state of US health found that while life expectancy and healthy life expectancy both increased between 1990 and 2010, all-cause death rates at all ages and age-specific rates of years lived with disability, or YLDs, remained stable during the same period. The study also found that despite increased life expectancy, the US is not keeping pace with health advances in 34 Organisation for Economic Co-operation and Development (OECD) countries.

Researchers found that the US rank declined to 27th or 28th between 1990 and 2010 in relation to the OECD countries. People living in countries with substantially lower gross domestic product and health expenditure per capita, such as Portugal and Slovenia, had lower mortality rates than those in the US in 2010.

The study on obesity and physical activity revealed another dimension of health challenges in the US. Although the percentage of physical activity reported by people in counties across the country has increased since 2001, that has not been enough to stem obesity rates. Obesity has increased in all US counties, and dietary risks, high blood pressure, and smoking are still among the leading causes of health loss.

Australia is also using its national-level GBD study as an opportunity to launch local studies. In May 2013, IHME, the University of Queensland, Australia, and the University of Melbourne School of Population Health hosted a national health symposium in Melbourne on the GBD 2010 findings for Australia.

Australians live more years in good health than people in most countries – men rank fifth in terms of healthy life expectancy and women rank 10th – and they enjoy more healthy years than Americans, Britons, and New Zealanders.

The top causes of disability for Australians were low back pain, major depressive disorders, other musculoskeletal problems, neck pain, falls, and anxiety. Ischemic heart disease was the top cause of Australian disease burden in 2010, and some of the top causes of disability were also among the top 10 causes of burden. Because mortality rates are improving at a faster pace than disability rates, these disabling conditions count for an increasing proportion of total health loss.

Participants at the May symposium discussed and debated the policy implications of the new results and participated in a training session on the methods, assumptions, and innovations of GBD 2010. Following the event, Secretary of the Department of Health and Ageing Jane Halton announced AUD $5 million in funding for a new Australian GBD study that will estimate disease burden at the local level among all Australians and separately measure health disparities in Aboriginal Australians.

This new study will allow Australian policymakers to understand how much health progress has been made since the last Australian Burden of Disease estimates were published for the year 2003. Officials will use the updated estimates to gauge progress in addressing health disparities in the wake of policy initiatives launched after the 2003 study, including an AUD $15 million grant to reduce the estimated 50% smoking prevalence among Australian Aboriginals.

The first annual update will be GBD 2013, which will be released in 2014 and is being undertaken in a strategic partnership with *The Lancet*. Subject to successful peer review, GBD 2013 results will be published in May 2014. More frequent updates will allow decision-makers to assess and act upon the most pressing health challenges in their countries in faster, more strategic, and cost-effective ways.

As seen in the country profiles that follow, health trends in EU and EFTA countries in 2010 mirrored the global picture in several respects. The leading causes of premature death – ischemic heart disease, stroke, and cancers – were similar, as were the top risk factors: dietary risks, tobacco smoking, high blood pressure, and high BMI.

Major depressive disorder, low back pain, and neck pain were among the leading causes of disability globally and in the EU and EFTA region, but the lists vary greatly after that. Causes affecting maternal and child health, such as preterm birth complications and congenital anomalies, that appeared in the top 25 causes of DALYs globally did not appear among the top 25 causes of years of healthy life lost in EU and EFTA countries as a region. Certain conditions affecting adults, however, such as alcohol use disorders, drug use disorders, chronic kidney disease, and osteoarthritis, appeared in the top 25 for DALYs in EU and EFTA countries as a whole but not globally.

Diabetes is the only leading condition that had a smaller increase in DALYs in EU and EFTA countries than globally, up 10% compared to 70%.

AUSTRIA

In terms of the number of years of life lost (YLLs) due to premature death in Austria, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

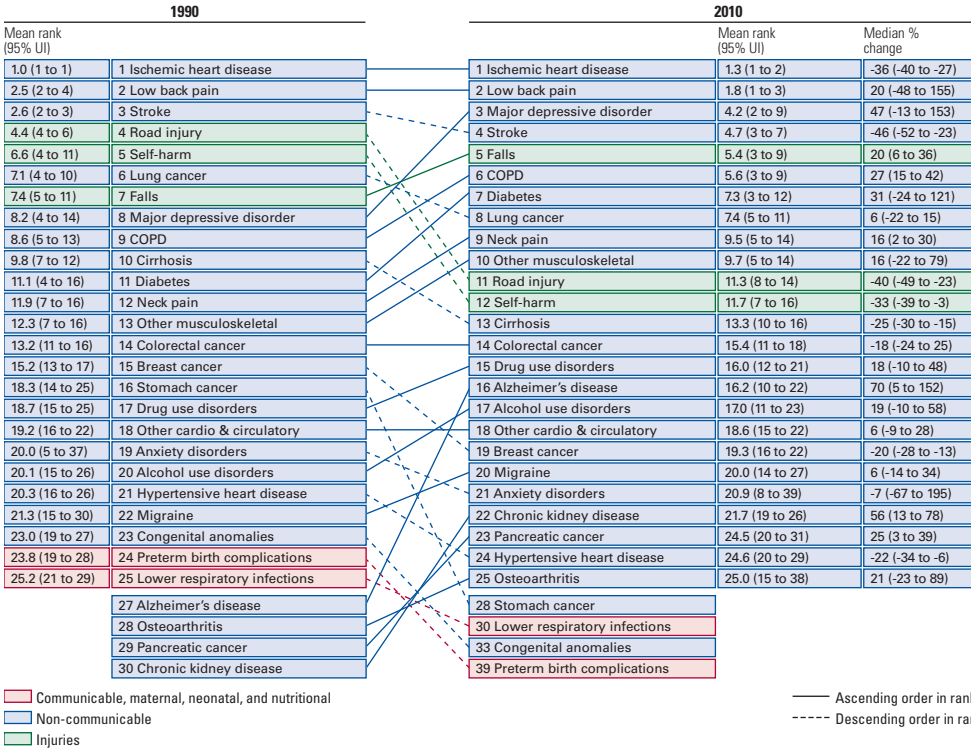
The top five leading causes of years lived with disability (YLDs) in Austria were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In Austria, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and major depressive disorder. The causes that were in the 10 leading causes of DALYs in 2010 and not 1990 were diabetes, neck pain, and other musculoskeletal disorders.

Of the 25 most important causes of burden, as measured by DALYs, cerebrovascular disease, or stroke, showed the largest decrease, falling by 46% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Austria were dietary risks, tobacco smoking, and high blood pressure. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and alcohol use, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Austria, 1990–2010



BELGIUM

In terms of the number of years of life lost (YLLs) due to premature death in Belgium, ischemic heart disease; trachea, bronchus, and lung cancers; and cerebrovascular disease, or stroke, were the highest-ranking causes in 2010.

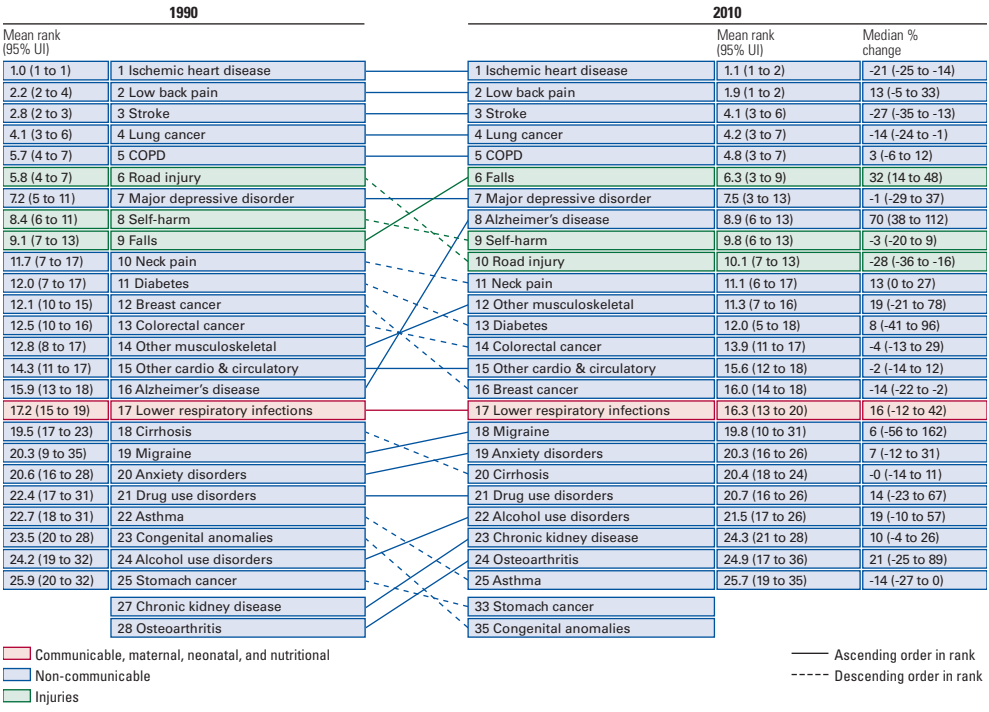
The top five leading causes of years lived with disability (YLDs) in Belgium were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In Belgium, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and cerebrovascular disease, or stroke. The only cause to appear in the 10 leading causes of DALYs in 2010 and not 1990 was Alzheimer's disease and other dementias.

Of the 25 most important causes of burden, as measured by DALYs, road injury showed the largest decrease, falling by 28% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Belgium were dietary risks, tobacco smoking, and high body mass index. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and alcohol use, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Belgium, 1990–2010



BULGARIA

In terms of the number of years of life lost (YLLs) due to premature death in Bulgaria, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

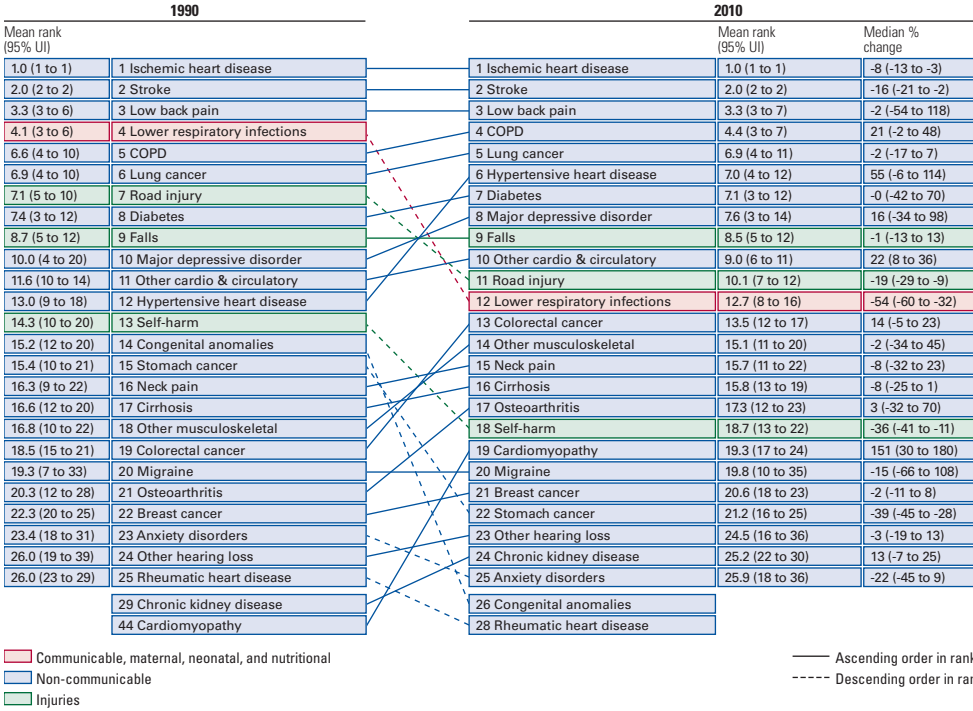
The top five leading causes of years lived with disability (YLDs) in Bulgaria were low back pain, major depressive disorder, falls, other musculoskeletal disorders, and neck pain.

In Bulgaria, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease; cerebrovascular disease, or stroke; and low back pain. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were hypertensive heart disease and other cardiovascular and circulatory diseases.

Of the 25 most important causes of burden, as measured by DALYs, lower respiratory infections showed the largest decrease, falling by 54% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Bulgaria were high blood pressure, dietary risks, and tobacco smoking. The leading risk factors for children under 5 and adults aged 15 to 49 years were household air pollution from solid fuels and dietary risks, respectively, in 2010.

Shifts in top 25 causes of DALYs, Bulgaria, 1990–2010



CROATIA

In terms of the number of years of life lost (YLLs) due to premature death in Croatia, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

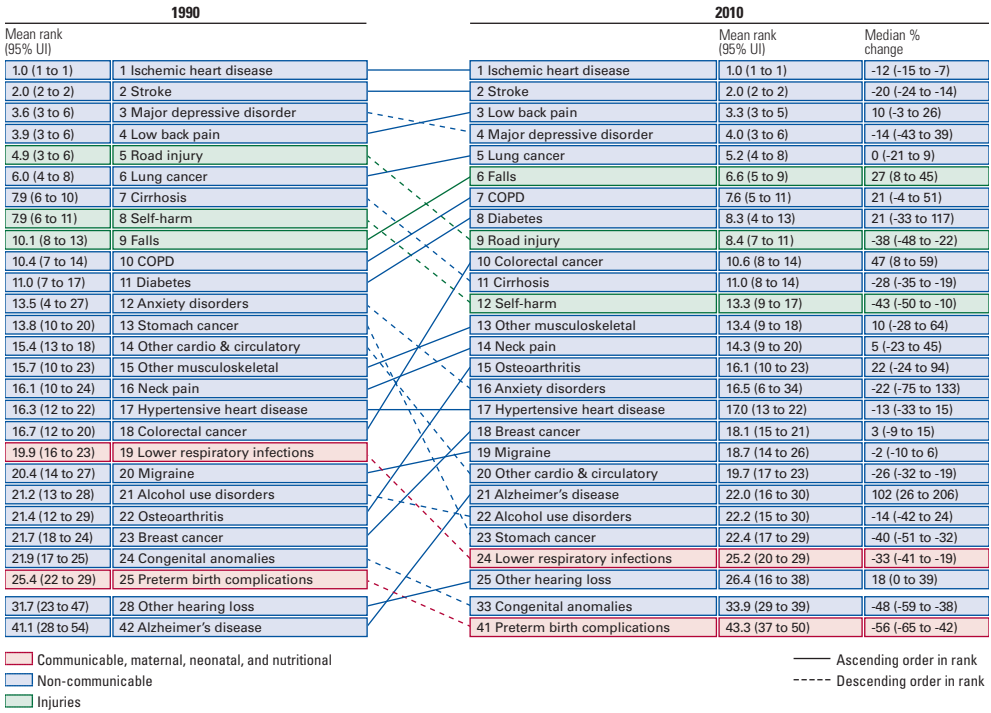
The top five leading causes of years lived with disability (YLDs) in Croatia are low back pain, major depressive disorder, falls, other musculoskeletal disorders, and neck pain.

In Croatia, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, cerebrovascular disease, and low back pain. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were diabetes and colon and rectum cancers.

Of the 25 most important causes of burden, as measured by DALYs, self-harm showed the largest decrease, falling by 43% from 1990 to 2010.

Overall, the three risk factors that account for the most disease burden in Croatia are dietary risks, high blood pressure, and tobacco smoking. The leading risk factors for children under 5 and adults aged 15 to 49 years were iron deficiency and alcohol use, respectively, in 2010.

Shifts in top 25 causes of DALYs, Croatia, 1990–2010



CYPRUS

In terms of the number of years of life lost (YLLs) due to premature death in Cyprus, ischemic heart disease; cerebrovascular disease, or stroke; and diabetes were the highest-ranking causes in 2010.

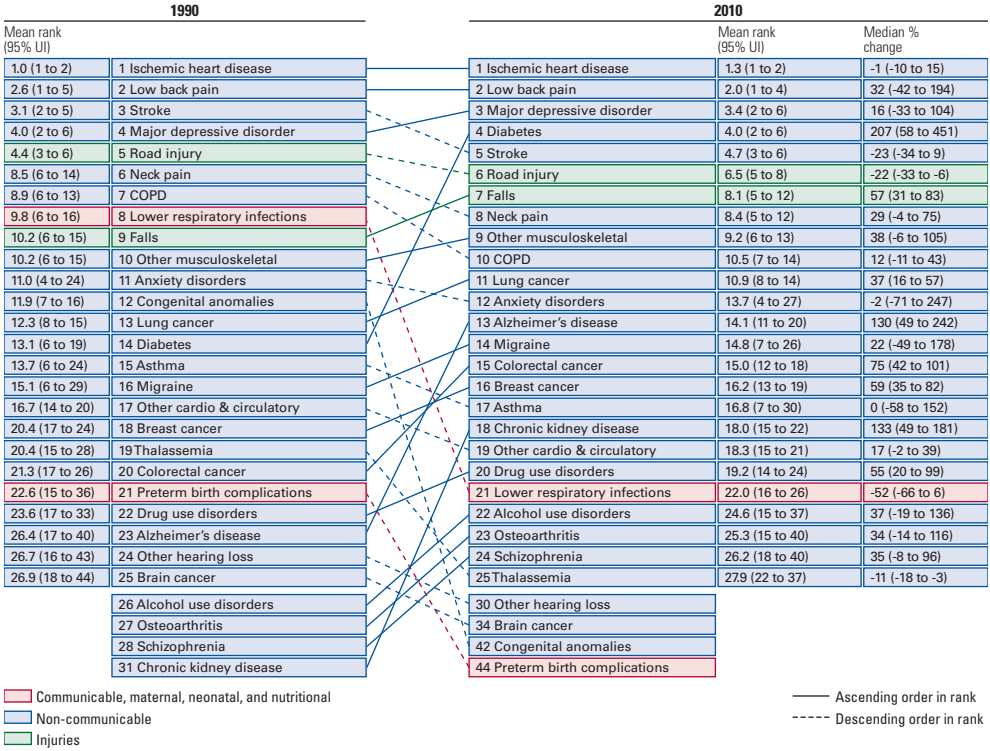
The top five leading causes of years lived with disability (YLDs) in Cyprus were low back pain, major depressive disorder, neck pain, falls, and other musculoskeletal disorders.

In Cyprus, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and major depressive disorder. The only cause to appear in the 10 leading causes of DALYs in 2010 and not 1990 was diabetes.

Of the 25 most important causes of burden, as measured by DALYs, lower respiratory infections showed the largest decrease, falling by 52% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Cyprus were dietary risks, high body mass index, and high blood pressure. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and dietary risks, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Cyprus, 1990–2010



CZECH REPUBLIC

In terms of the number of years of life lost (YLLs) due to premature death in the Czech Republic, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

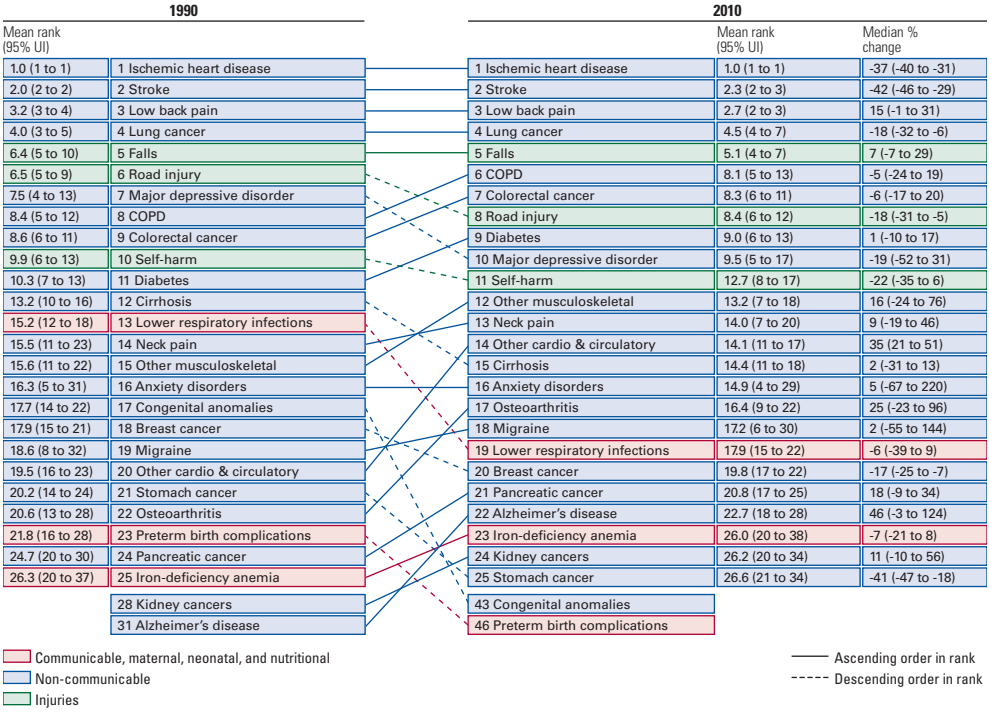
The top five leading causes of years lived with disability (YLDs) in the Czech Republic were low back pain, falls, major depressive disorder, other musculoskeletal disorders, and neck pain.

In the Czech Republic, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease; cerebrovascular disease, or stroke; and low back pain. The only cause to appear in the 10 leading causes of DALYs in 2010 and not 1990 was diabetes.

Of the 25 most important causes of burden, as measured by DALYs, cerebrovascular disease, or stroke, showed the largest decrease, falling by 42% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in the Czech Republic were dietary risks, high blood pressure, and high body mass index. The leading risk factors for children under 5 and adults aged 15 to 49 years were iron deficiency and dietary risks, respectively, in 2010.

Shifts in top 25 causes of DALYs, Czech Republic, 1990–2010



DENMARK

In terms of the number of years of life lost (YLLs) due to premature death in Denmark, ischemic heart disease; trachea, bronchus, and lung cancers; and cerebrovascular disease, or stroke, were the highest-ranking causes in 2010.

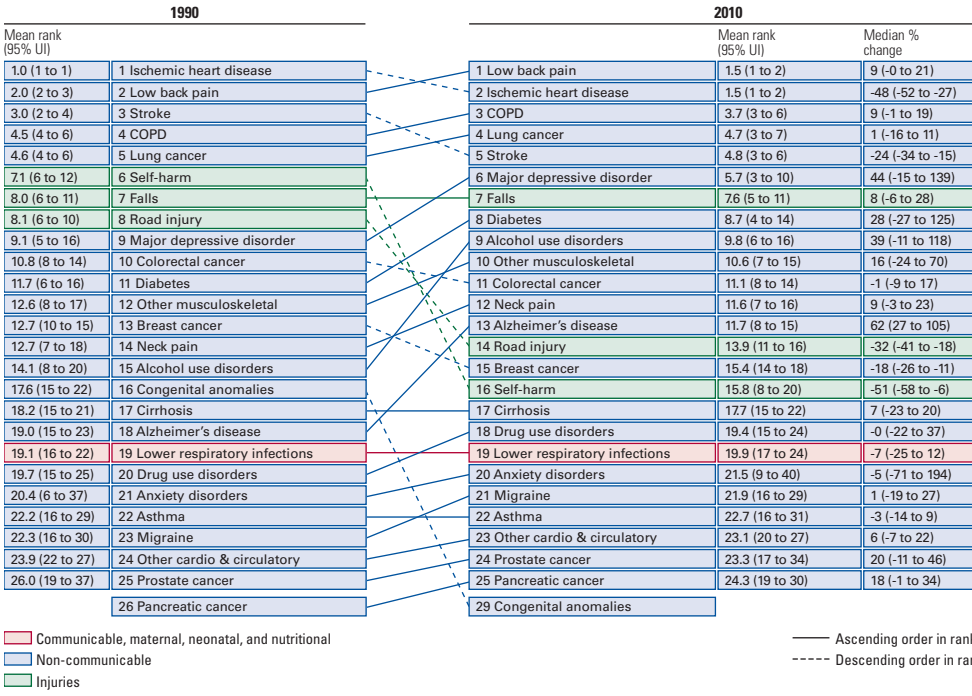
The top five leading causes of years lived with disability (YLDs) in Denmark were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In Denmark, the top three causes of disability-adjusted life years (DALYs) in 2010 were low back pain, ischemic heart disease, and chronic obstructive pulmonary disease. The causes that were in the 10 leading causes of DALYs in 2010 and not 1990 were diabetes, alcohol use disorders, and other musculoskeletal disorders.

Of the 25 most important causes of burden, as measured by DALYs, self-harm showed the largest decrease, falling by 51% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Denmark were tobacco smoking, dietary risks, and high blood pressure. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and alcohol use, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Denmark, 1990–2010



ESTONIA

In terms of the number of years of life lost (YLLs) due to premature death in Estonia, ischemic heart disease; cerebrovascular disease, or stroke; and HIV/AIDS were the highest-ranking causes in 2010.

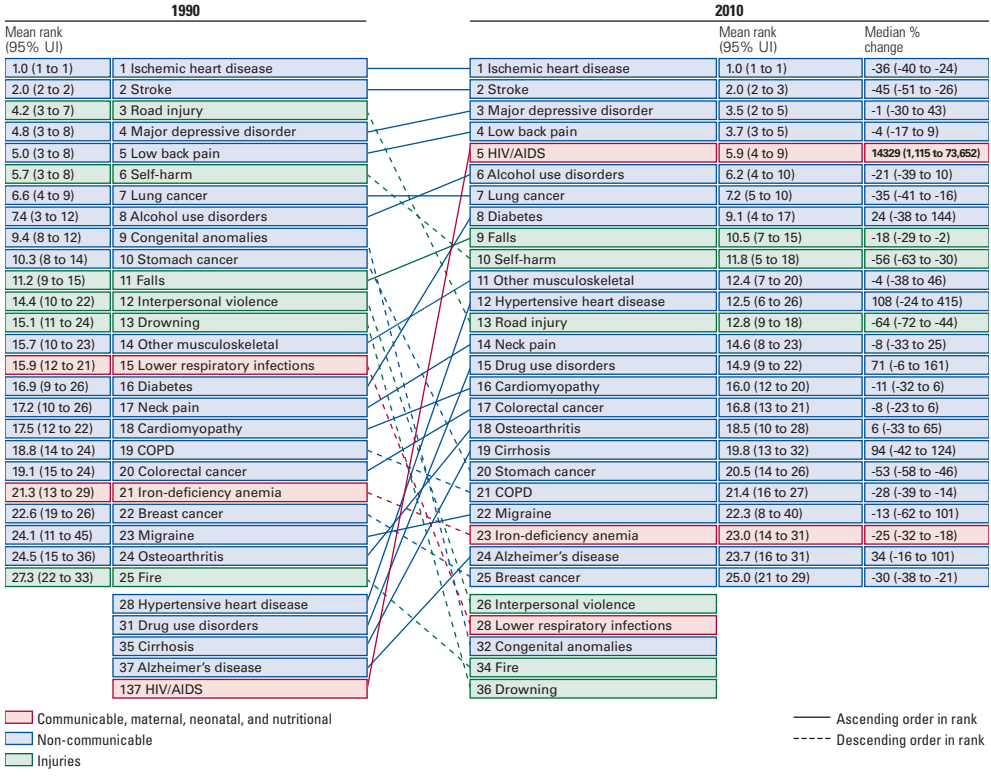
The top five leading causes of years lived with disability (YLDs) in Estonia were major depressive disorder, low back pain, other musculoskeletal disorders, neck pain, and diabetes.

In Estonia, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease; cerebrovascular disease, or stroke; and major depressive disorder. The causes that were in the 10 leading causes of DALYs in 2010 and not 1990 were HIV/AIDS, diabetes, and falls.

Of the 25 most important causes of burden, as measured by DALYs, road injury showed the largest decrease, falling by 64% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Estonia were dietary risks, high blood pressure, and high body mass index. The leading risk factors for children under 5 and adults aged 15 to 49 years were iron deficiency and alcohol use, respectively, in 2010.

Shifts in top 25 causes of DALYs, Estonia, 1990–2010



FINLAND

In terms of the number of years of life lost (YLLs) due to premature death in Finland, ischemic heart disease; cerebrovascular disease, or stroke; and Alzheimer's disease and other dementias were the highest-ranking causes in 2010.

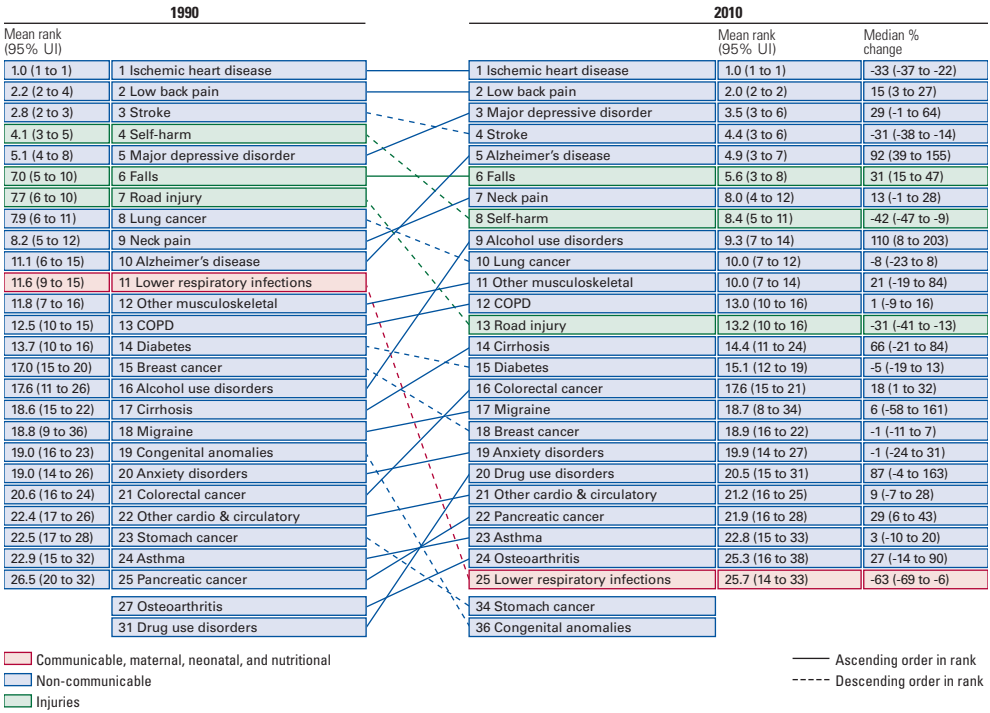
The top five leading causes of years lived with disability (YLDs) in Finland were low back pain, major depressive disorder, neck pain, falls, and other musculoskeletal disorders.

In Finland, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and major depressive disorder. The only cause to appear in the 10 leading causes of DALYs in 2010 and not 1990 was alcohol use disorders.

Of the 25 most important causes of burden, as measured by DALYs, lower respiratory infections showed the largest decrease, falling by 63% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Finland were dietary risks, high blood pressure, and high body mass index. The leading risk factors for children under 5 and adults aged 15 to 49 years were childhood underweight and alcohol use, respectively, in 2010.

Shifts in top 25 causes of DALYs, Finland, 1990–2010



FRANCE

In terms of the number of years of life lost (YLLs) due to premature death in France, ischemic heart disease; trachea, bronchus, and lung cancers; and cerebrovascular disease, or stroke, were the highest-ranking causes in 2010.

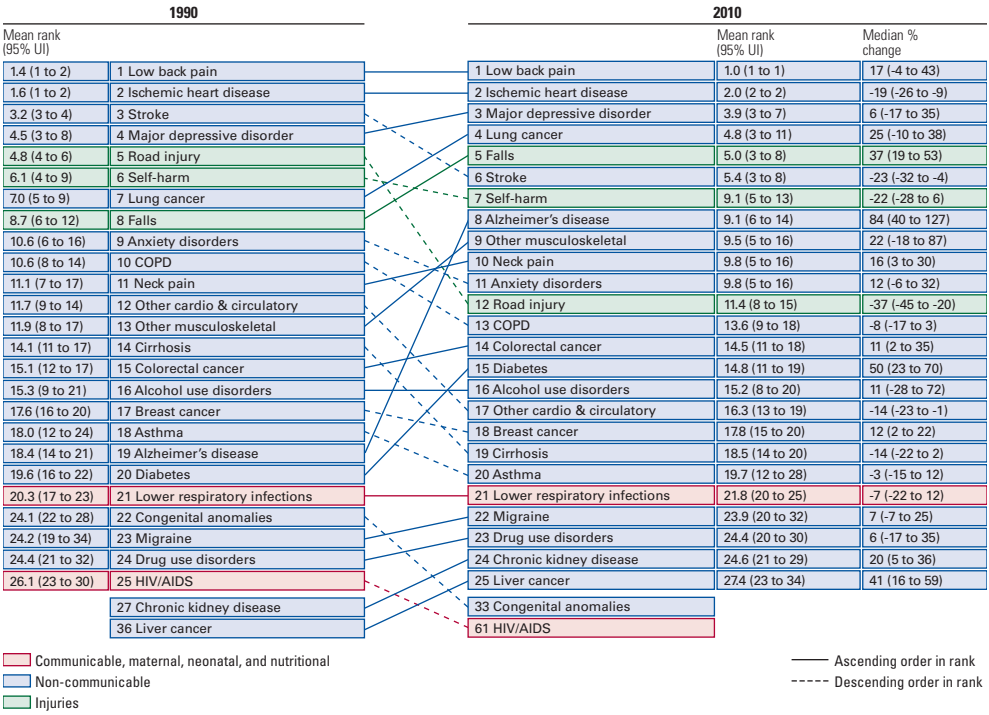
The top five leading causes of years lived with disability (YLDs) in France were low back pain, major depressive disorder, falls, neck pain, and anxiety disorders.

In France, the top three causes of disability-adjusted life years (DALYs) in 2010 were low back pain, ischemic heart disease, and major depressive disorder. The causes that were in the 10 leading causes of DALYs in 2010 and not 1990 were Alzheimer's disease and other dementias, other musculoskeletal disorders, and neck pain.

Of the 25 most important causes of burden, as measured by DALYs, road injury showed the largest decrease, falling by 37% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in France were dietary risks, tobacco smoking, and high blood pressure. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and alcohol use, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, France, 1990–2010



GERMANY

In terms of the number of years of life lost (YLLs) due to premature death in Germany, ischemic heart disease; trachea, bronchus, and lung cancers; and cerebrovascular disease, or stroke, were the highest-ranking causes in 2010.

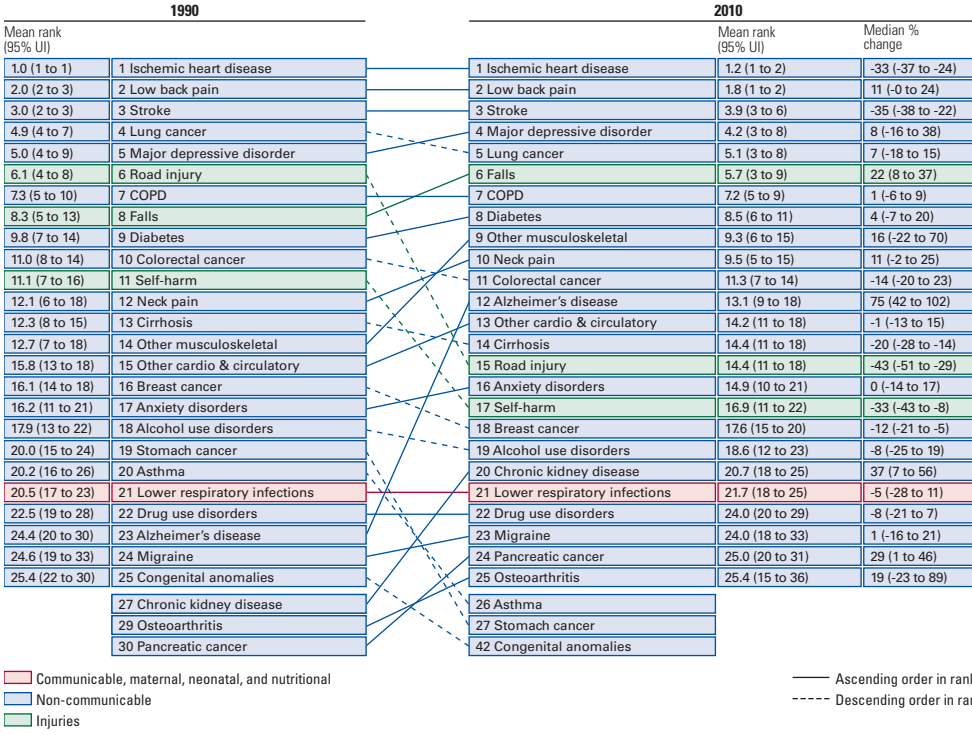
The top five leading causes of years lived with disability (YLDs) in Germany were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In Germany, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and cerebrovascular disease, or stroke. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were other musculoskeletal disorders and neck pain.

Of the 25 most important causes of burden, as measured by DALYs, road injury showed the largest decrease, falling by 43% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Germany were dietary risks, high body mass index, and high blood pressure. The leading risk factors for children under 5 and adults aged 15 to 49 years were zinc deficiency and alcohol use, respectively, in 2010.

Shifts in top 25 causes of DALYs, Germany, 1990–2010



GREECE

In terms of the number of years of life lost (YLLs) due to premature death in Greece, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

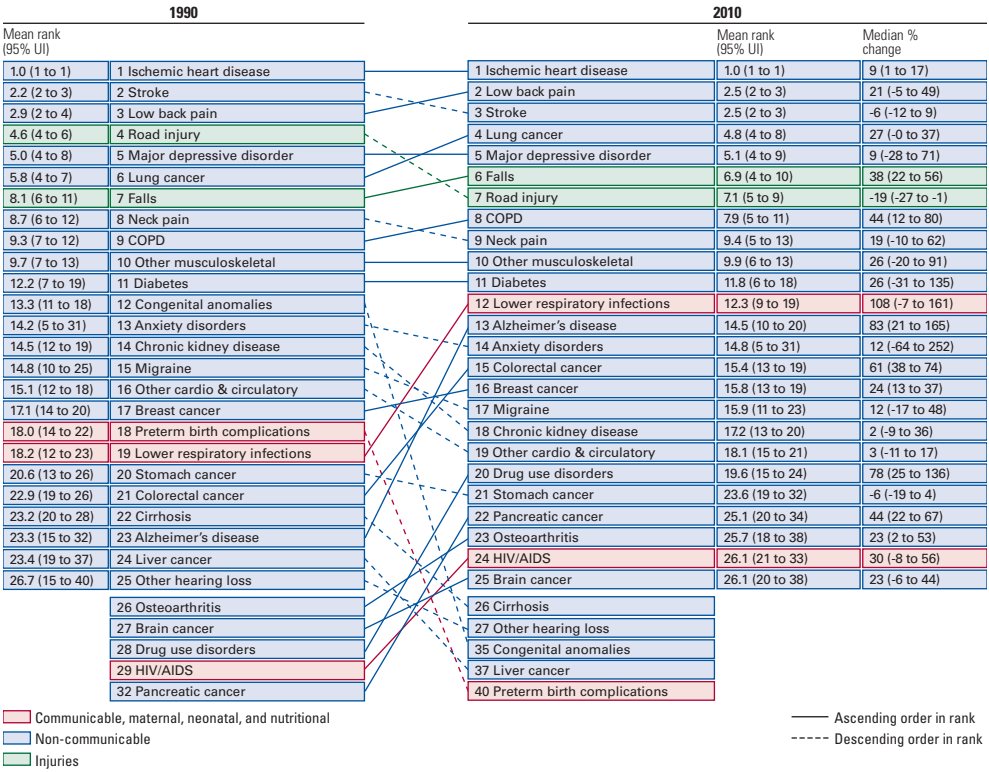
The top five leading causes of years lived with disability (YLDs) in Greece were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In Greece, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and cerebrovascular disease, or stroke.

Of the 25 most important causes of burden, as measured by DALYs, road injury showed the largest decrease, falling by 19% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Greece were dietary risks, tobacco smoking, and high blood pressure. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and occupational risks, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Greece, 1990–2010



HUNGARY

In terms of the number of years of life lost (YLLs) due to premature death in Hungary, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

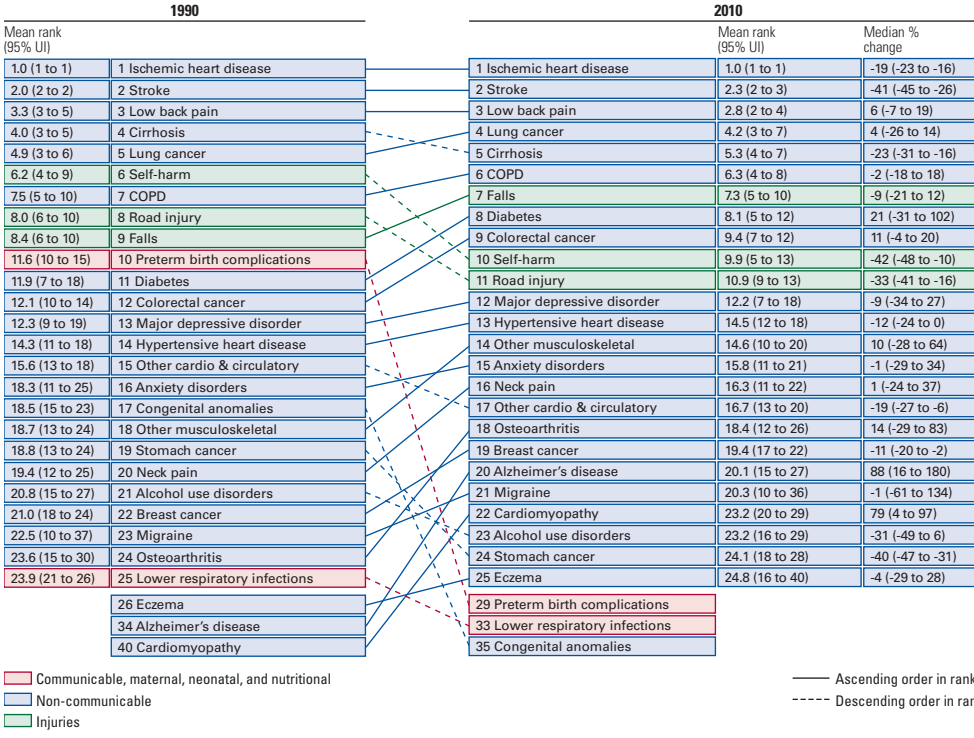
The top five leading causes of years lived with disability (YLDs) in Hungary were low back pain, major depressive disorder, falls, diabetes, and other musculoskeletal disorders.

In Hungary, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease; cerebrovascular disease, or stroke; and low back pain. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were diabetes and colon and rectum cancers.

Of the 25 most important causes of burden, as measured by DALYs, self-harm showed the largest decrease, falling by 42% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Hungary were dietary risks, high blood pressure, and tobacco smoking. The leading risk factors for children under 5 and adults aged 15 to 49 years were iron deficiency and alcohol use, respectively, in 2010.

Shifts in top 25 causes of DALYs, Hungary, 1990–2010



ICELAND

In terms of the number of years of life lost (YLLs) due to premature death in Iceland, ischemic heart disease; trachea, bronchus, and lung cancers; and cerebrovascular disease, or stroke, were the highest-ranking causes in 2010.

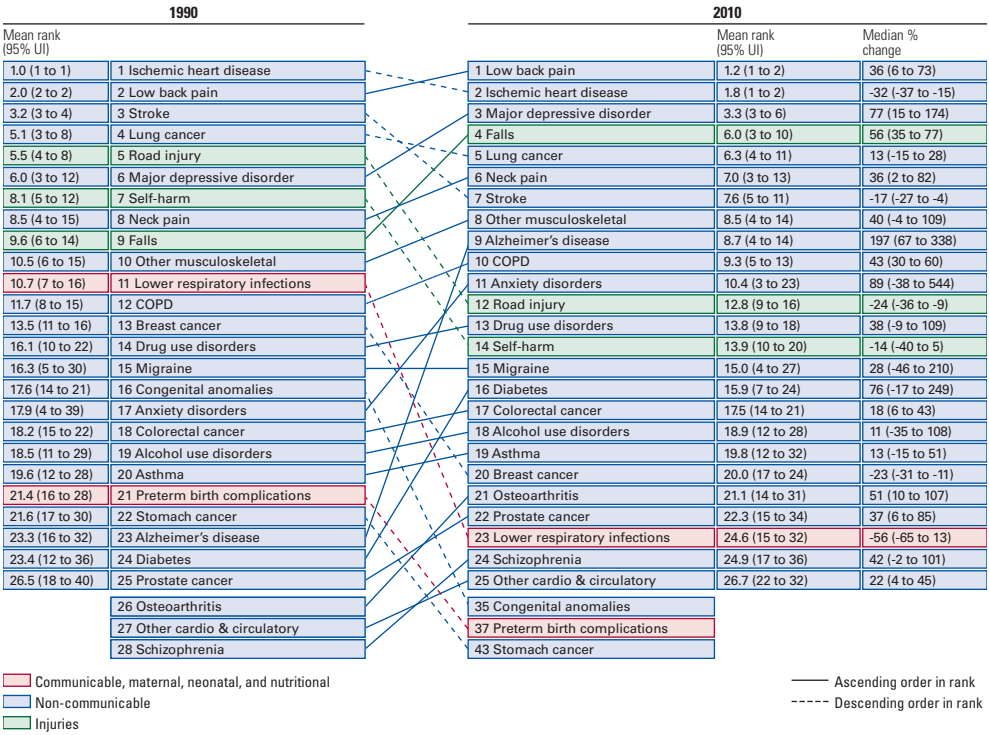
The top five leading causes of years lived with disability (YLDs) in Iceland were low back pain, major depressive disorder, neck pain, falls, and other musculoskeletal disorders.

In Iceland, the top three causes of disability-adjusted life years (DALYs) in 2010 were low back pain, ischemic heart disease, and major depressive disorder. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were Alzheimer's disease and other dementias and chronic obstructive pulmonary disease.

Of the 25 most important causes of burden, as measured by DALYs, lower respiratory infections showed the largest decrease, falling by 56% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Iceland were dietary risks, high body mass index, and tobacco smoking. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and occupational risks, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Iceland, 1990–2010



IRELAND

In terms of the number of years of life lost (YLLs) due to premature death in Ireland, ischemic heart disease; trachea, bronchus, and lung cancers; and cerebrovascular disease, or stroke, were the highest-ranking causes in 2010.

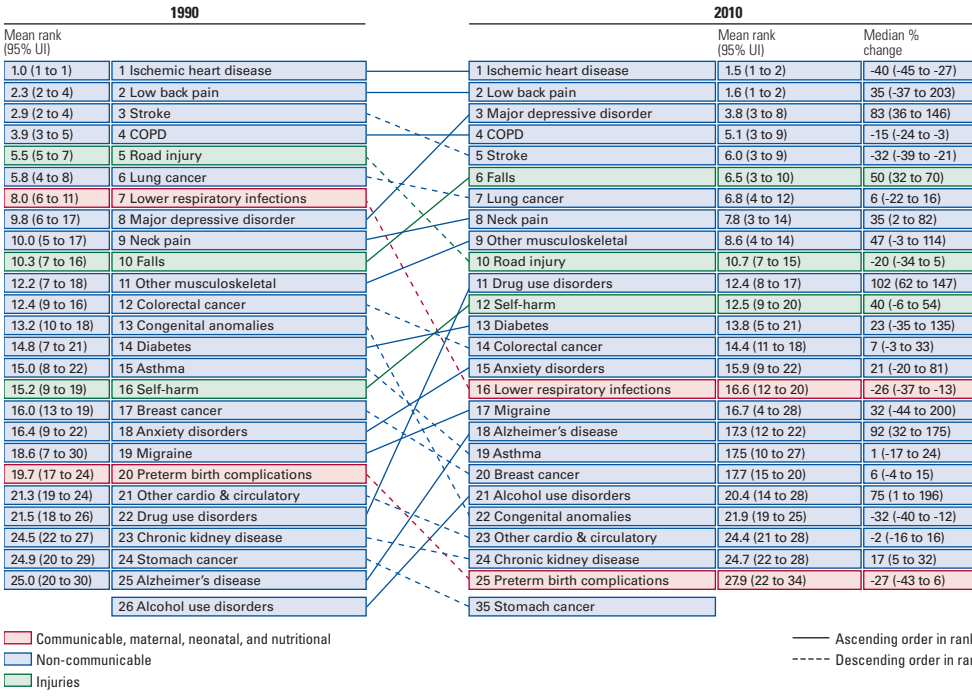
The top five leading causes of years lived with disability (YLDs) in Ireland were low back pain, major depressive disorder, neck pain, other musculoskeletal disorders, and falls.

In Ireland, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and major depressive disorder. The only cause to appear in the 10 leading causes of DALYs in 2010 and not 1990 was other musculoskeletal disorders.

Of the 25 most important causes of burden, as measured by DALYs, ischemic heart disease showed the largest decrease, falling by 40% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Ireland were dietary risks, tobacco smoking, and high blood pressure. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and dietary risks, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Ireland, 1990–2010



ITALY

In terms of the number of years of life lost (YLLs) due to premature death in Italy, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

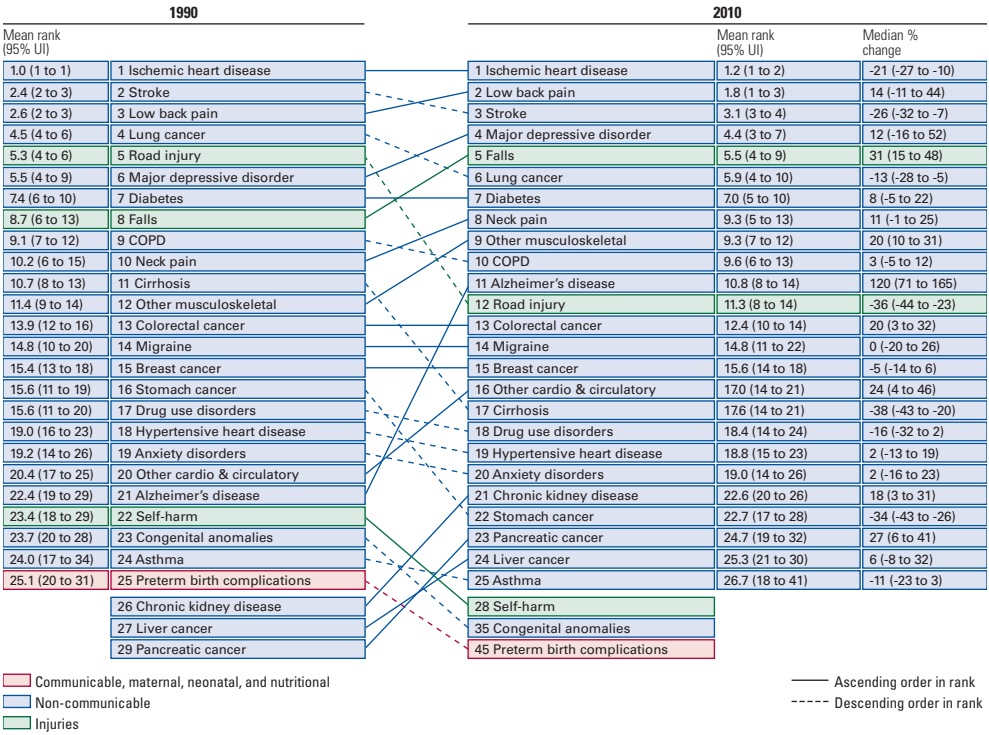
The top five leading causes of years lived with disability (YLDs) in Italy were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In Italy, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and cerebrovascular disease, or stroke. The only cause to appear in the 10 leading causes of DALYs in 2010 and not 1990 was other musculoskeletal disorders.

Of the 25 most important causes of burden, as measured by DALYs, cirrhosis of the liver showed the largest decrease, falling by 38% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Italy were dietary risks, high blood pressure, and tobacco smoking. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and alcohol use, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Italy, 1990–2010



LATVIA

In terms of the number of years of life lost (YLLs) due to premature death in Latvia, ischemic heart disease; cerebrovascular disease, or stroke; and cardiomyopathy and myocarditis were the highest-ranking causes in 2010.

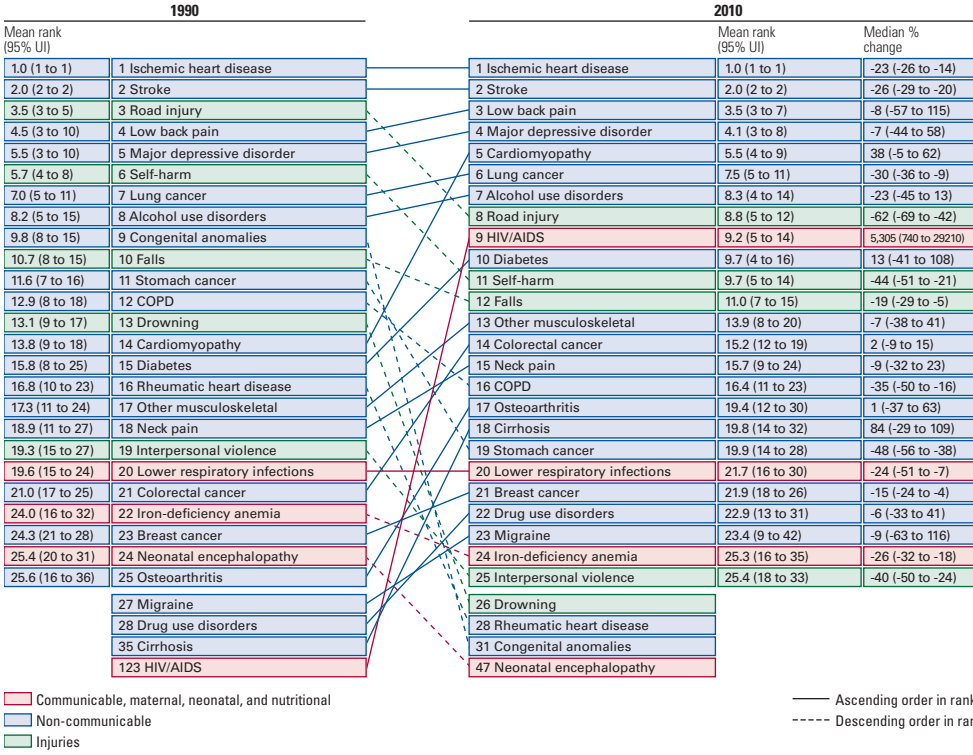
The top five leading causes of years lived with disability (YLDs) in Latvia were low back pain, major depressive disorder, other musculoskeletal disorders, neck pain, and diabetes.

In Latvia, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease; cerebrovascular disease, or stroke; and low back pain. The causes that were in the 10 leading causes of DALYs in 2010 and not 1990 were cardiomyopathy and myocarditis, HIV/AIDS, and diabetes.

Of the 25 most important causes of burden, as measured by DALYs, road injury showed the largest decrease, falling by 62% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Latvia were dietary risks, high blood pressure, and high body mass index. The leading risk factors for children under 5 and adults aged 15 to 49 years were iron deficiency and alcohol use, respectively, in 2010.

Shifts in top 25 causes of DALYs, Latvia, 1990–2010



LITHUANIA

In terms of the number of years of life lost (YLLs) due to premature death in Lithuania, ischemic heart disease; cerebrovascular disease, or stroke; and self-harm were the highest-ranking causes in 2010.

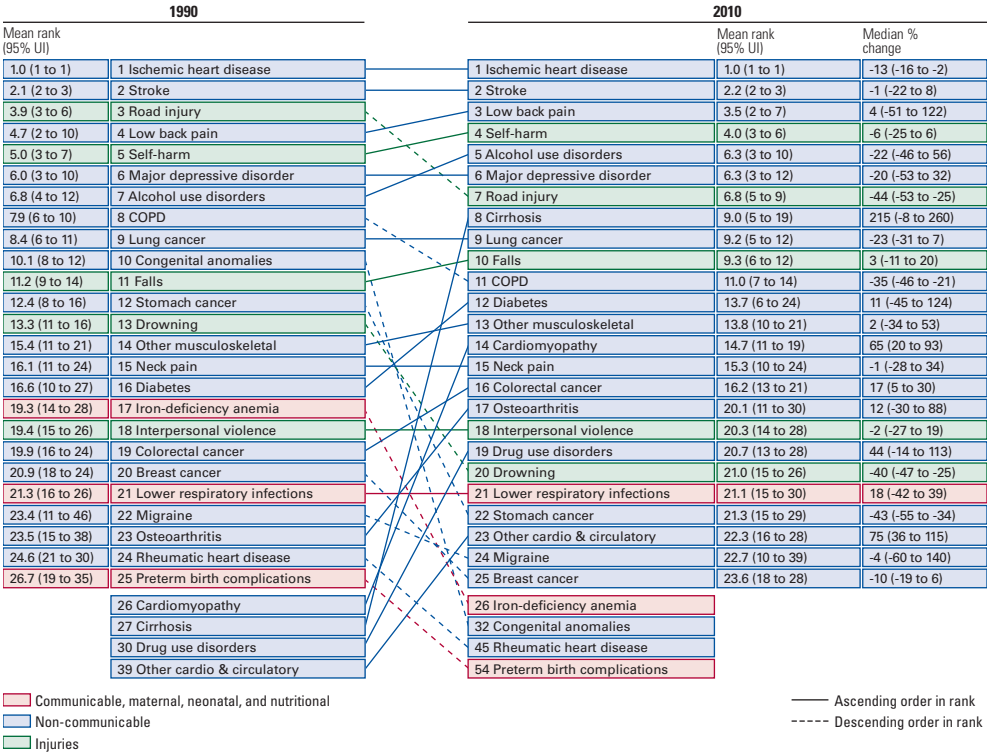
The top five leading causes of years lived with disability (YLDs) in Lithuania were low back pain, major depressive disorder, other musculoskeletal disorders, neck pain, and diabetes.

In Lithuania, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease; cerebrovascular disease, or stroke, and low back pain. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were cirrhosis of the liver and falls.

Of the 25 most important causes of burden, as measured by DALYs, road injury showed the largest decrease, falling by 44% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Lithuania were dietary risks, high blood pressure, and alcohol use. The leading risk factors for children under 5 and adults aged 15 to 49 years were iron deficiency and alcohol use, respectively, in 2010.

Shifts in top 25 causes of DALYs, Lithuania, 1990–2010



LUXEMBOURG

In terms of the number of years of life lost (YLLs) due to premature death in Luxembourg, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

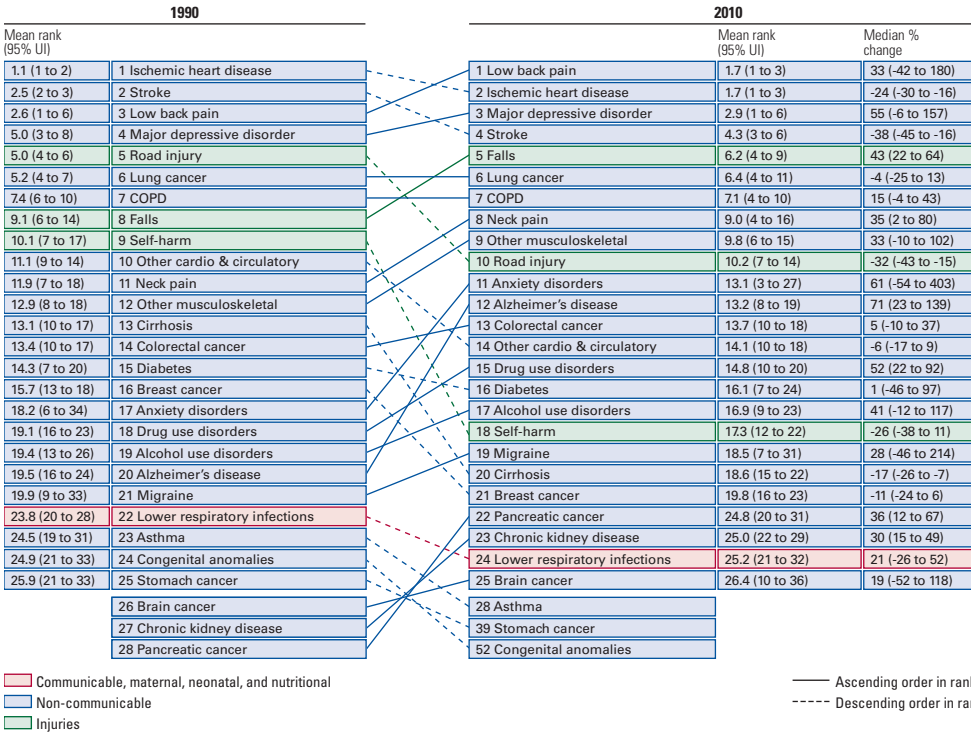
The top five leading causes of years lived with disability (YLDs) in Luxembourg were low back pain, major depressive disorder, neck pain, falls, and other musculoskeletal disorders.

In Luxembourg, the top three causes of disability-adjusted life years (DALYs) in 2010 were low back pain, ischemic heart disease, and major depressive disorder. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were neck pain and other musculoskeletal disorders.

Of the 25 most important causes of burden, as measured by DALYs, cerebrovascular disease, or stroke, showed the largest decrease, falling by 38% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Luxembourg were dietary risks, tobacco smoking, and high body mass index. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and alcohol use, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Luxembourg, 1990–2010



MALTA

In terms of the number of years of life lost (YLLs) due to premature death in Malta, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

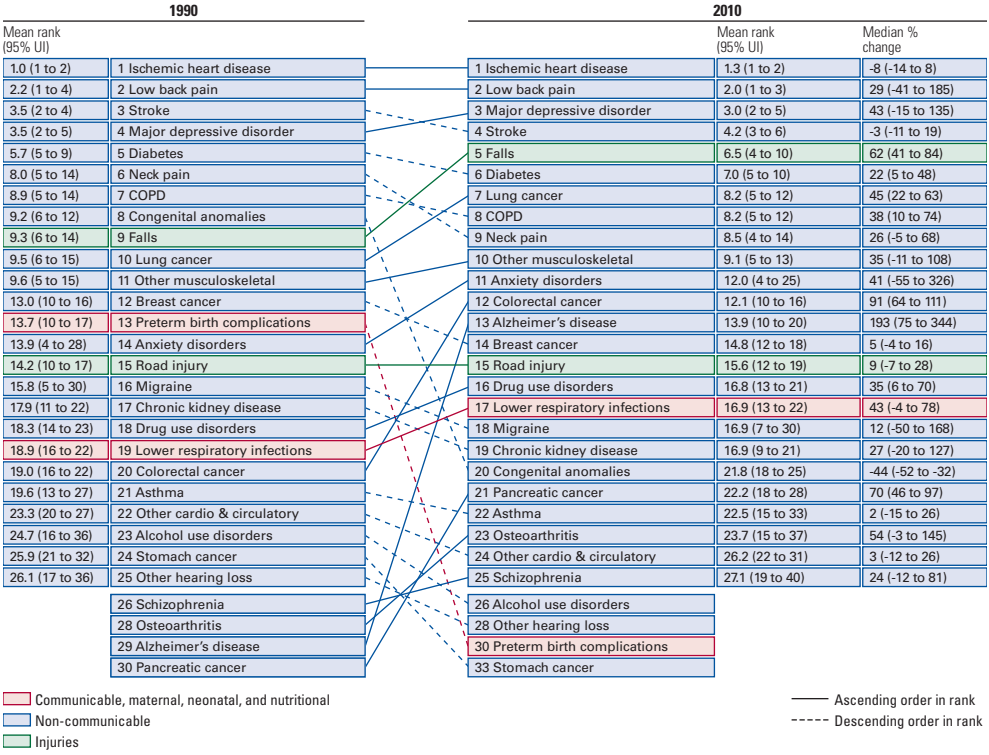
The top five leading causes of years lived with disability (YLDs) in Malta were low back pain, major depressive disorder, neck pain, falls, and other musculoskeletal disorders.

In Malta, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and major depressive disorder. The only cause to appear in the 10 leading causes of DALYs in 2010 and not 1990 was other musculoskeletal disorders.

Of the 25 most important causes of burden, as measured by DALYs, congenital anomalies showed the largest decrease, falling by 44% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Malta were dietary risks, high body mass index, and high blood pressure. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and dietary risks, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Malta, 1990–2010



NETHERLANDS

In terms of the number of years of life lost (YLLs) due to premature death in the Netherlands, ischemic heart disease; trachea, bronchus, and lung cancers; and cerebrovascular disease, or stroke, were the highest-ranking causes in 2010.

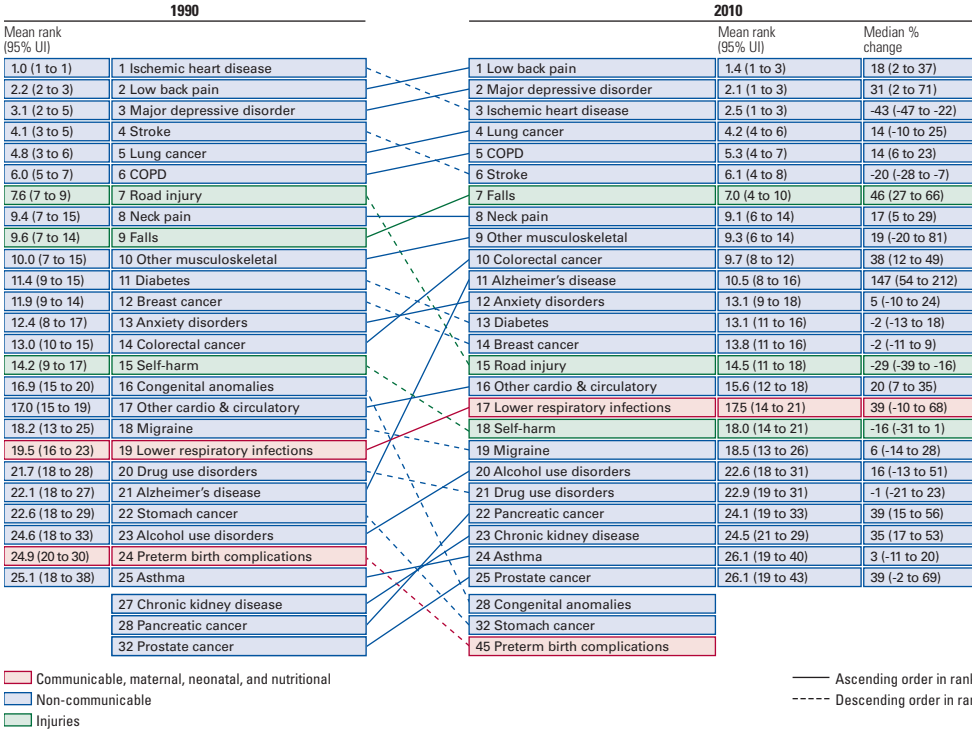
The top five leading causes of years lived with disability (YLDs) in the Netherlands were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In the Netherlands, the top three causes of disability-adjusted life years (DALYs) in 2010 were low back pain, major depressive disorder, and ischemic heart disease. The only cause to appear in the 10 leading causes of DALYs in 2010 and not 1990 was colon and rectum cancers.

Of the 25 most important causes of burden, as measured by DALYs, ischemic heart disease showed the largest decrease, falling by 43% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in the Netherlands were tobacco smoking, dietary risks, and high blood pressure. The leading risk factor for both children under 5 and adults aged 15 to 49 years was tobacco smoking in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Netherlands, 1990–2010



NORWAY

In terms of the number of years of life lost (YLLs) due to premature death in Norway, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

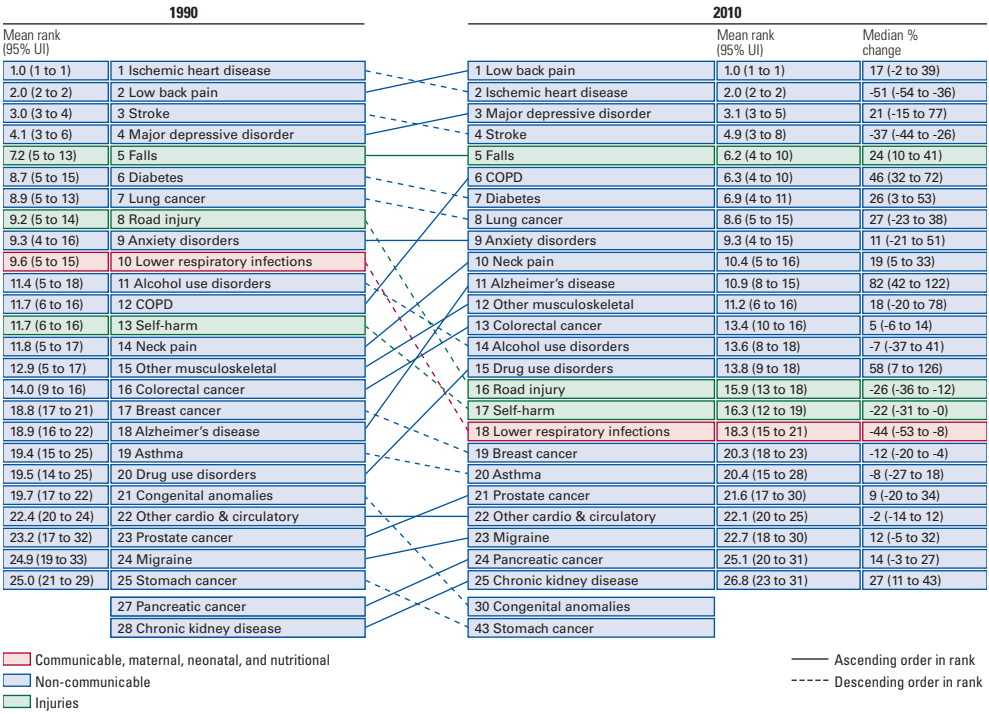
The top five leading causes of years lived with disability (YLDs) in Norway are low back pain, major depressive disorder, anxiety disorders, neck pain, and falls.

In Norway, the top three causes of disability-adjusted life years (DALYs) in 2010 were low back pain, ischemic heart disease, and major depressive disorder. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were chronic obstructive pulmonary disease and neck pain.

Of the 25 most important causes of burden, as measured by DALYs, ischemic heart disease showed the largest decrease, falling by 51% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Norway were dietary risks, tobacco smoking, and high blood pressure. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and occupational risks, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Norway, 1990–2010



POLAND

In terms of the number of years of life lost (YLLs) due to premature death in Poland, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

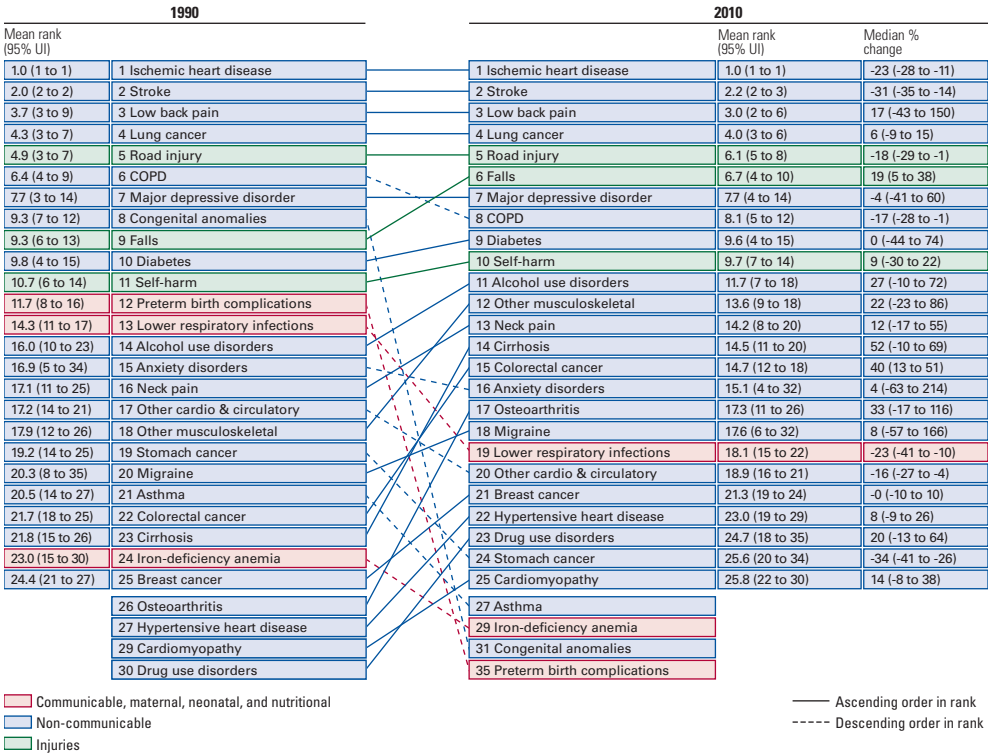
The top five leading causes of years lived with disability (YLDs) in Poland were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In Poland, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease; cerebrovascular disease, or stroke; and low back pain. The only cause to appear in the 10 leading causes of DALYs in 2010 and not 1990 was self-harm.

Of the 25 most important causes of burden, as measured by DALYs, stomach cancer showed the largest decrease, falling by 34% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Poland were dietary risks, high blood pressure, and tobacco smoking. The leading risk factors for children under 5 and adults aged 15 to 49 years were iron deficiency and dietary risks, respectively, in 2010.

Shifts in top 25 causes of DALYs, Poland, 1990–2010



PORTUGAL

In terms of the number of years of life lost (YLLs) due to premature death in Portugal, cerebrovascular disease, or stroke; ischemic heart disease; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

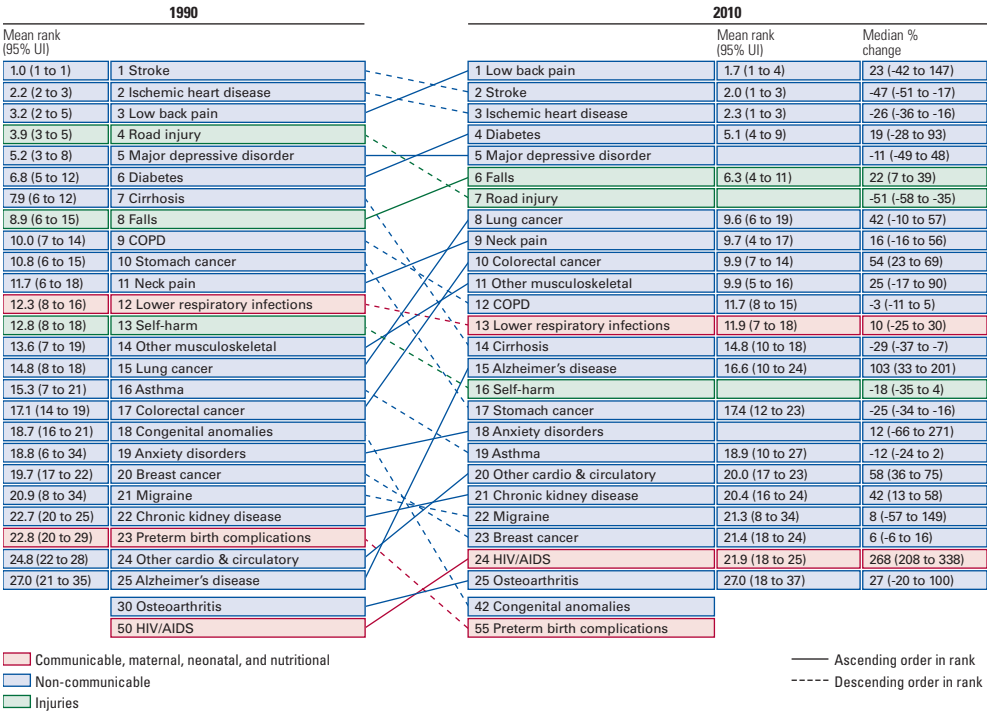
The top five leading causes of years lived with disability (YLDs) in Portugal were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In Portugal, the top three causes of disability-adjusted life years (DALYs) in 2010 were low back pain; cerebrovascular disease, or stroke; and ischemic heart disease. The causes that were in the 10 leading causes of DALYs in 2010 and not 1990 were trachea, bronchus, and lung cancers; neck pain; and colon and rectum cancers.

Of the 25 most important causes of burden, as measured by DALYs, road injury showed the largest decrease, falling by 51% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Portugal were dietary risks, high blood pressure, and high body mass index. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and alcohol use, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Portugal, 1990–2010



ROMANIA

In terms of the number of years of life lost (YLLs) due to premature death in Romania, ischemic heart disease; cerebrovascular disease, or stroke; and cirrhosis of the liver were the highest-ranking causes in 2010.

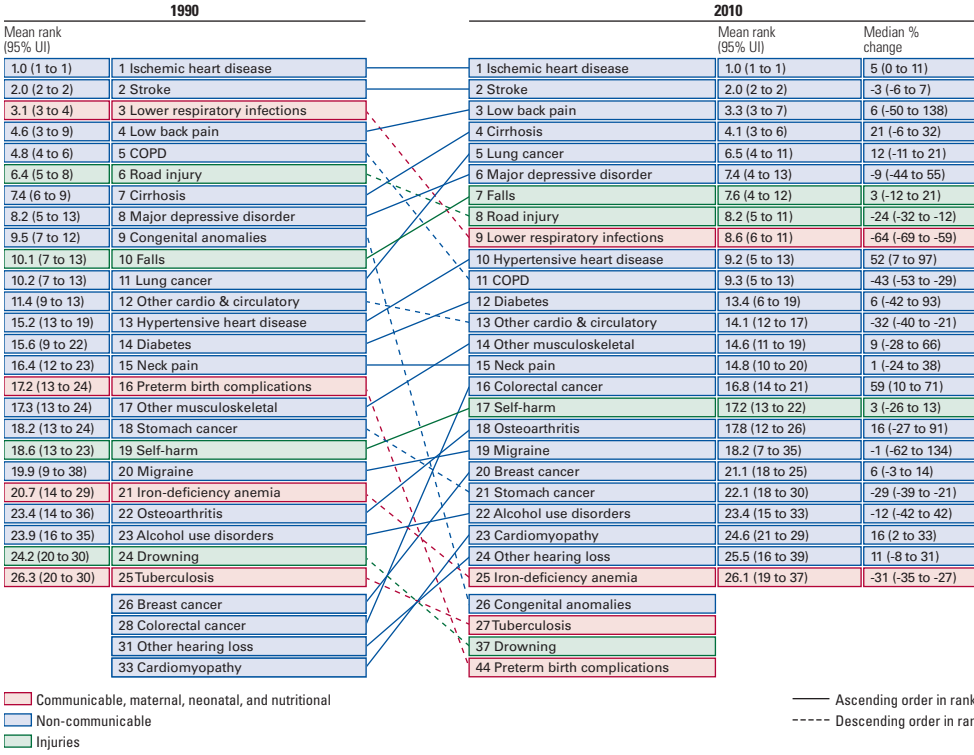
The top five leading causes of years lived with disability (YLDs) in Romania were low back pain, major depressive disorder, falls, other musculoskeletal disorders, and neck pain.

In Romania, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease; cerebrovascular disease, or stroke; and low back pain. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were trachea, bronchus, and lung cancers and hypertensive heart disease.

Of the 25 most important causes of burden, as measured by DALYs, lower respiratory infections showed the largest decrease, falling by 64% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Romania were dietary risks, high blood pressure, and tobacco smoking. The leading risk factors for children under 5 and adults aged 15 to 49 years were household air pollution from solid fuels and alcohol use, respectively, in 2010.

Shifts in top 25 causes of DALYs, Romania, 1990–2010



SLOVAKIA

In terms of the number of years of life lost (YLLs) due to premature death in Slovakia, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

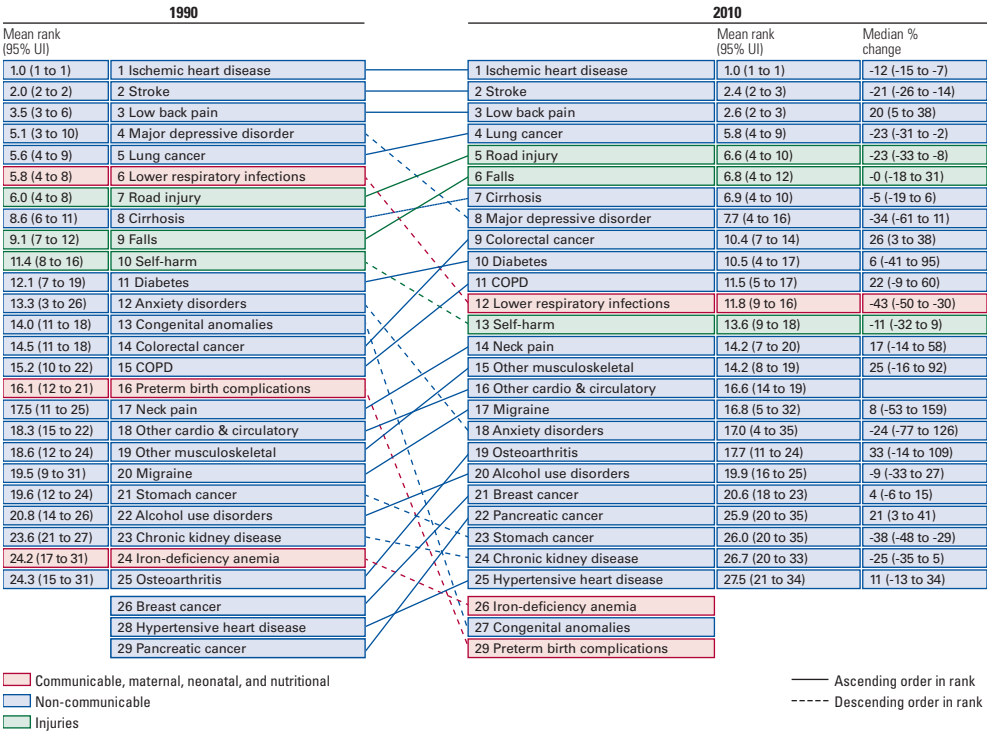
The top five leading causes of years lived with disability (YLDs) in Slovakia were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In Slovakia, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease; cerebrovascular disease, or stroke; and low back pain. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were colon and rectum cancers and diabetes.

Of the 25 most important causes of burden, as measured by DALYs, lower respiratory infections showed the largest decrease, falling by 43% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Slovakia were dietary risks, high blood pressure, and tobacco smoking. The leading risk factors for children under 5 and adults aged 15 to 49 years were iron deficiency and alcohol use, respectively, in 2010.

Shifts in top 25 causes of DALYs, Slovakia, 1990–2010



SLOVENIA

In terms of the number of years of life lost (YLLs) due to premature death in Slovenia, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

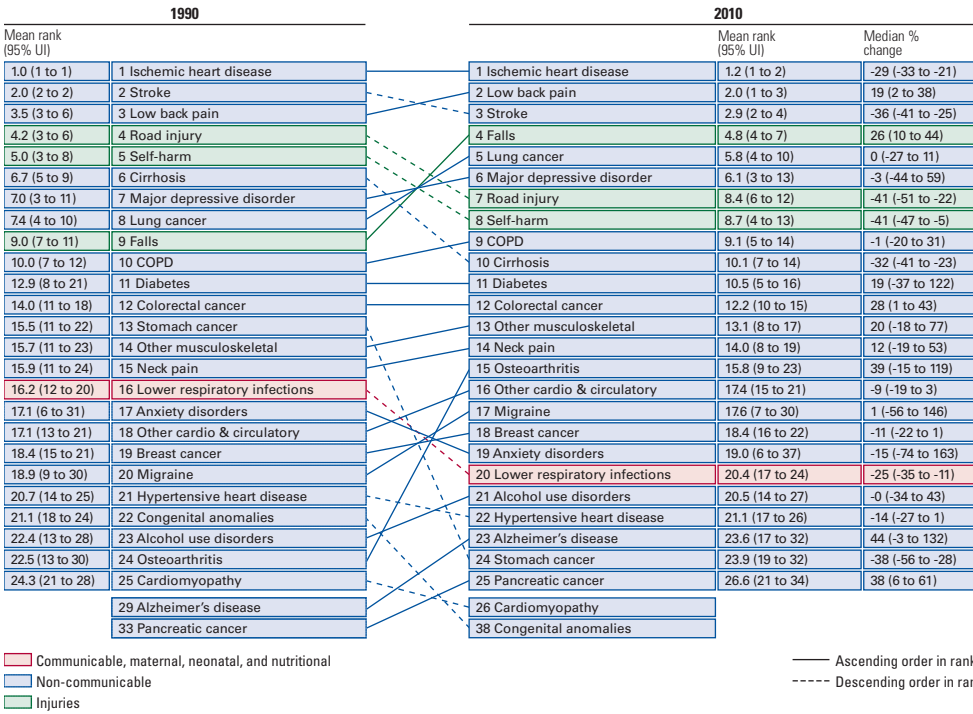
The top five leading causes of years lived with disability (YLDs) in Slovenia were low back pain, major depressive disorder, falls, other musculoskeletal disorders, and neck pain.

In Slovenia, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and cerebrovascular disease, or stroke.

Of the 25 most important causes of burden, as measured by DALYs, road injury and self-harm showed the largest decrease, falling by 41% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Slovenia were dietary risks, high blood pressure, and high body mass index. The leading risk factors for children under 5 and adults aged 15 to 49 years were iron deficiency and alcohol use, respectively, in 2010.

Shifts in top 25 causes of DALYs, Slovenia, 1990–2010



SPAIN

In terms of the number of years of life lost (YLLs) due to premature death in Spain, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

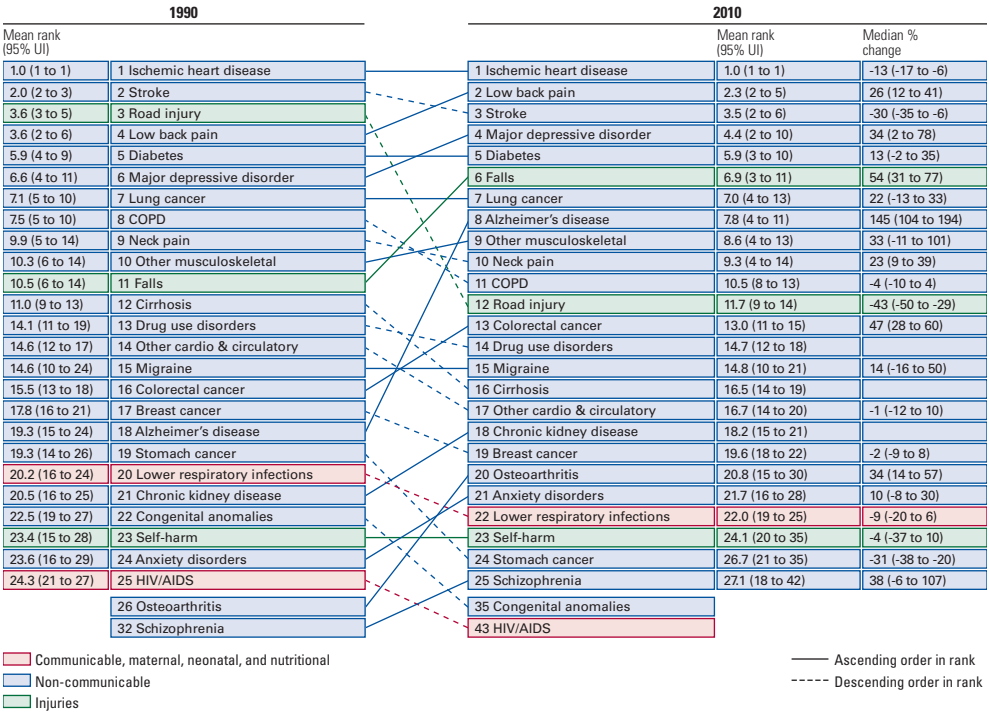
The top five leading causes of years lived with disability (YLDs) in Spain were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In Spain, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and cerebrovascular disease, or stroke. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were falls and Alzheimer's disease and other dementias.

Of the 25 most important causes of burden, as measured by DALYs, road injury showed the largest decrease, falling by 43% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Spain were dietary risks, high body mass index, and tobacco smoking. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and alcohol use, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Spain, 1990–2010



SWEDEN

In terms of the number of years of life lost (YLLs) due to premature death in Sweden, ischemic heart disease; cerebrovascular disease, or stroke; and trachea, bronchus, and lung cancers were the highest-ranking causes in 2010.

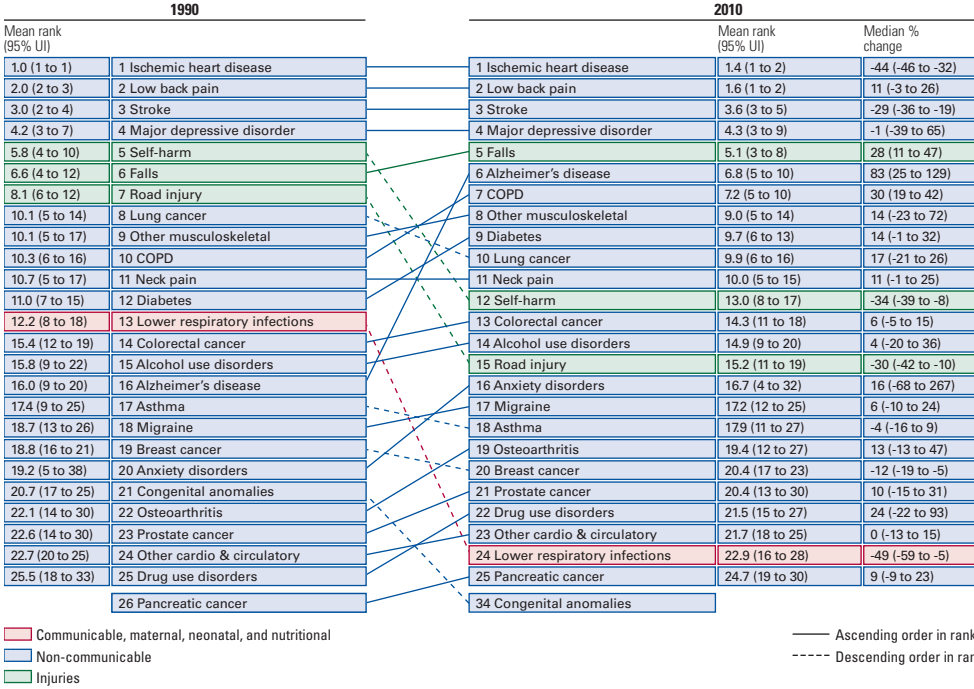
The top five leading causes of years lived with disability (YLDs) in Sweden were low back pain, major depressive disorder, falls, neck pain, and other musculoskeletal disorders.

In Sweden, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and cerebrovascular disease, or stroke. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were Alzheimer's disease and other dementias and diabetes.

Of the 25 most important causes of burden, as measured by DALYs, lower respiratory infections showed the largest decrease, falling by 49% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Sweden were dietary risks, high blood pressure, and high body mass index. The leading risk factors for children under 5 and adults aged 15 to 49 years were zinc deficiency and alcohol use, respectively, in 2010.

Shifts in top 25 causes of DALYs, Sweden, 1990–2010



SWITZERLAND

In terms of the number of years of life lost (YLLs) due to premature death in Switzerland, ischemic heart disease; trachea, bronchus, and lung cancers; and cerebrovascular disease, or stroke, were the highest-ranking causes in 2010.

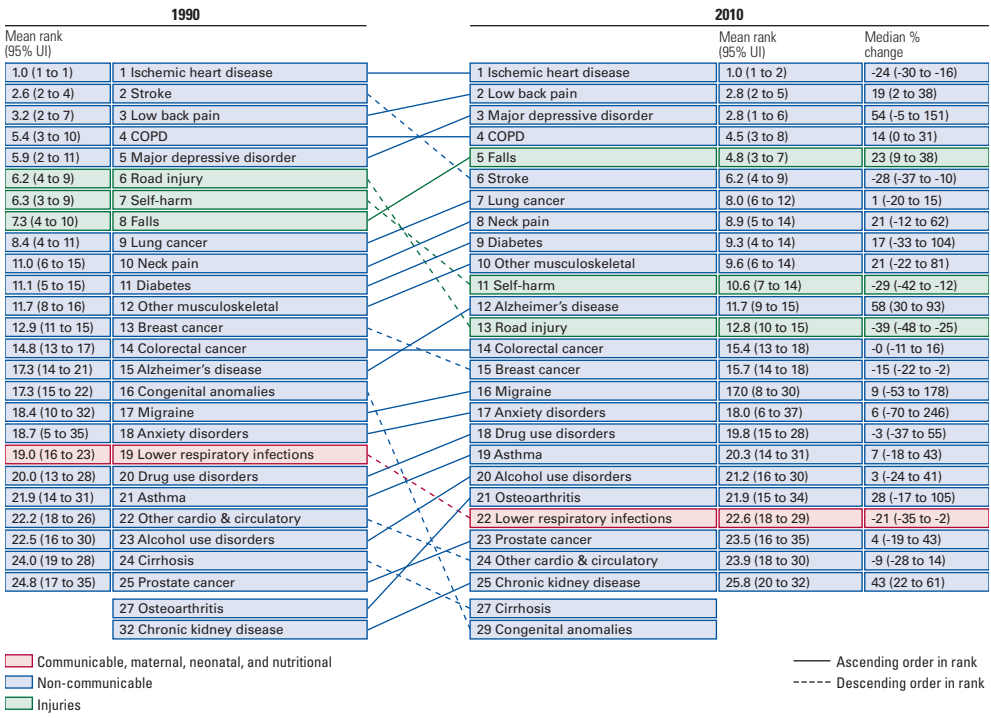
The top five leading causes of years lived with disability (YLDs) in Switzerland were major depressive disorder, low back pain, chronic obstructive pulmonary disease, falls, and neck pain.

In Switzerland, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and major depressive disorder. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were diabetes and other musculoskeletal disorders.

Of the 25 most important causes of burden, as measured by DALYs, road injury showed the largest decrease, falling by 39% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in Switzerland were dietary risks, tobacco smoking, and high blood pressure. The leading risk factors for children under 5 and adults aged 15 to 49 years were tobacco smoking and alcohol use, respectively, in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, Switzerland, 1990–2010



UNITED KINGDOM

In terms of the number of years of life lost (YLLs) due to premature death in the United Kingdom, ischemic heart disease; trachea, bronchus, and lung cancers; and cerebrovascular disease, or stroke, were the highest-ranking causes in 2010.

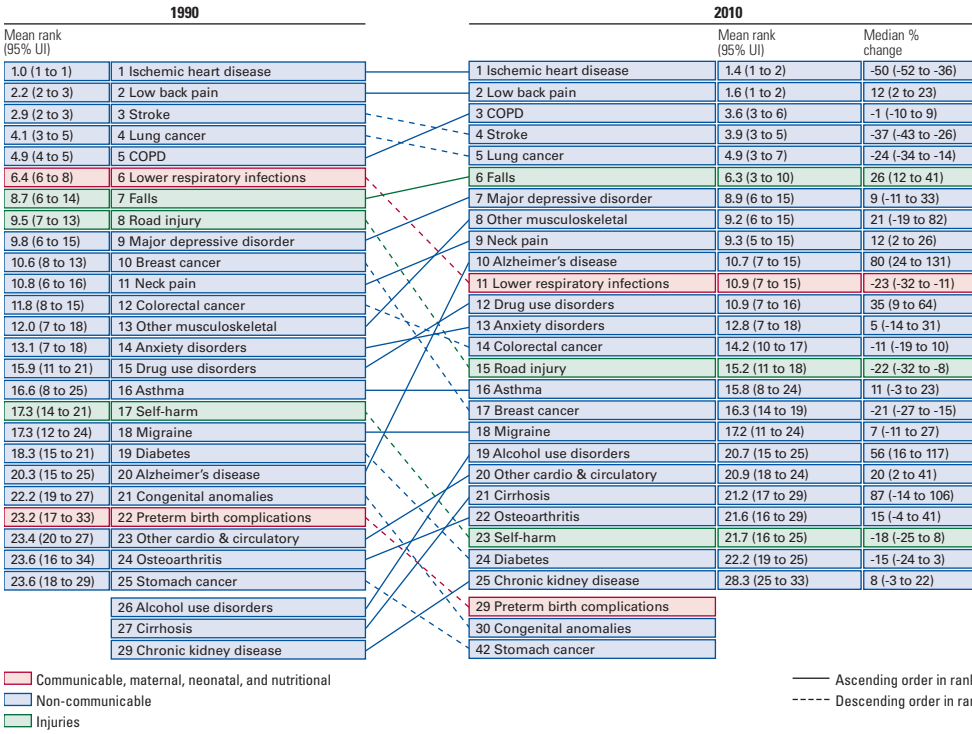
The top five leading causes of years lived with disability (YLDs) in the United Kingdom were low back pain, falls, major depressive disorder, neck pain, and other musculoskeletal disorders.

In the United Kingdom, the top three causes of disability-adjusted life years (DALYs) in 2010 were ischemic heart disease, low back pain, and chronic obstructive pulmonary disease. The causes that were in the 10 leading causes of DALYs in 2010 and not 1990 were other musculoskeletal disorders, neck pain, and Alzheimer's disease and other dementias.

Of the 25 most important causes of burden, as measured by DALYs, ischemic heart disease showed the largest decrease, falling by 50% from 1990 to 2010.

Overall, the three risk factors that accounted for the most disease burden in the United Kingdom were dietary risks, tobacco smoking, and high blood pressure. The leading risk factor for both children under 5 and adults aged 15 to 49 years was tobacco smoking in 2010. Tobacco smoking as a risk factor for children was due to secondhand smoke exposure.

Shifts in top 25 causes of DALYs, United Kingdom, 1990–2010



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: non-communicable diseases and disability caused a greater share of health loss in 2010 compared to 1990 in most regions of the world.

In EU and EFTA countries, as in much of the world, non-communicable diseases pose a growing threat. Disabling conditions such as low back pain, neck pain, and other musculoskeletal disorders accounted for a greater number of healthy years lost in 2010 than in 1990 in EU and EFTA countries.

As disease burden caused by self-harm, interpersonal violence, and road injuries all increased at the global level, the reverse was true for EU and EFTA countries as a region.

While GBD 2010 provides key information about health trends at the 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. Continuous 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 analyses 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/gbd-dissemination.

GBD data visualization tools can display global, 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.

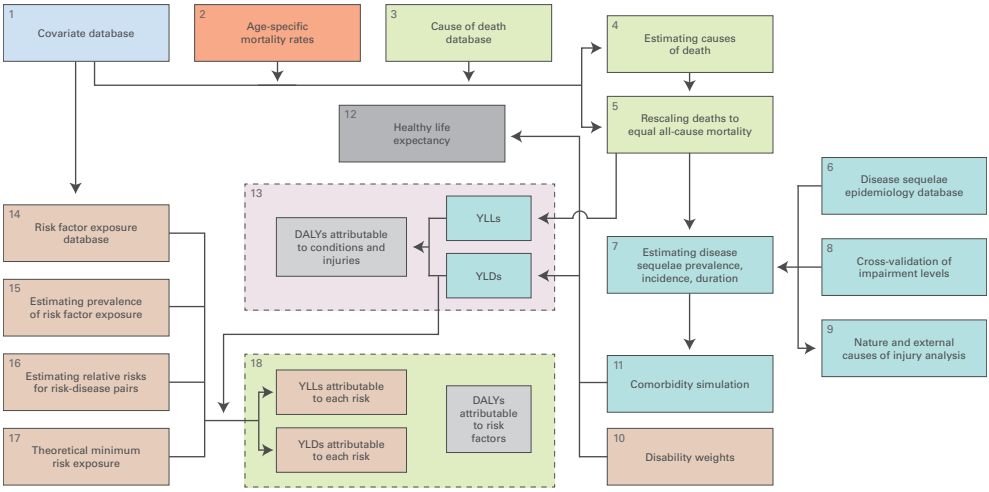
Currently, IHME is working to expand GBD to track expenditure for particular diseases and injuries. Also, IHME is estimating utilization of outpatient and inpatient facilities and other health services for specific diseases and injuries. Side-to-side comparisons of these estimates to the number of DALYs 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.

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 are 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.

Figure A1: The 18 components of GBD and their interrelations



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.

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 (ICD) 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 South Africa 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. For example, malaria represents a greater percentage of total YLLs than total deaths since it is a leading killer of children under age 5 globally. 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 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 worldwide. 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 is calculated as the sum of the YLDs from each sequela arising from that cause.

Estimating disability-adjusted life years

Disability-adjusted life years (DALYs) were calculated by adding together YLLs and YLDs. DALYs are a powerful tool for priority setting as they measure disease burden from nonfatal as well as fatal conditions. Yet another reason why top causes of DALYs differ from leading causes of death is that DALYs give more weight to death in younger ages, as illustrated by the case of neonatal encephalopathy. In contrast, stroke causes a larger percentage of total deaths than DALYs, as it primarily impacts older people.

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.

GBD

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