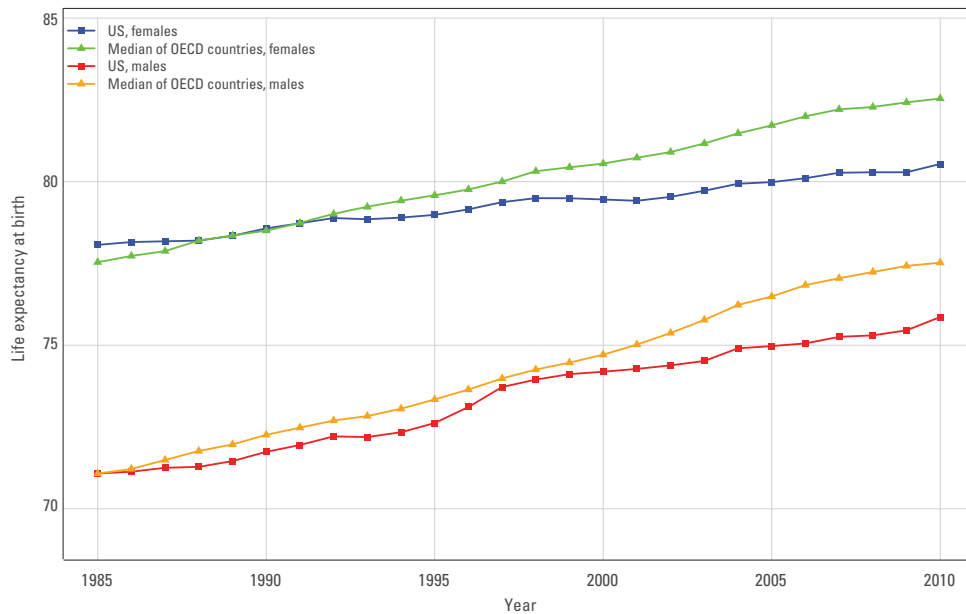


## GBD RESULTS FOR THE UNITED STATES

One of the simplest measures for understanding overall health outcomes is life expectancy at birth. If a country is generally expanding its longevity, it usually means that people are not dying prematurely at high rates. Worldwide, GBD found that life expectancy is increasing. In 1970, global life expectancy at birth for males was just 56 years, and 61 years for females. By 2010, life expectancy at birth increased to 68 years for males and 73 years for females. In the US, life expectancy at birth grew at a much slower rate, from 67 years for males and 75 years for females in 1970 to 76 and 81 years, respectively, in 2010.

Although Americans are living longer, life expectancy gains in the US have not kept pace with other prosperous countries, as measured by comparisons to other OECD members. Figure 1 compares increases in US life expectancy to the median life expectancy of OECD countries from 1985 to 2010. In the 1980s, US male and female life expectancy nearly matched the OECD median, but in the 1990s, the OECD male and female median life expectancy started to exceed the US male and female life expectancy and has continued to do so every successive year. Since 2000, the gap between US life expectancy and median OECD life expectancy has greatly expanded.

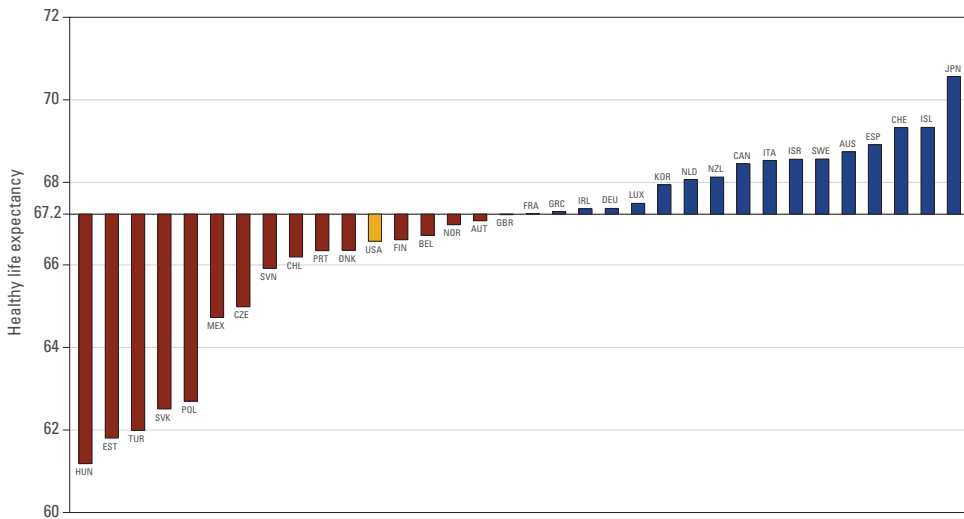
**Figure 1: US life expectancy compared to median of OECD countries, males and females, 2010**



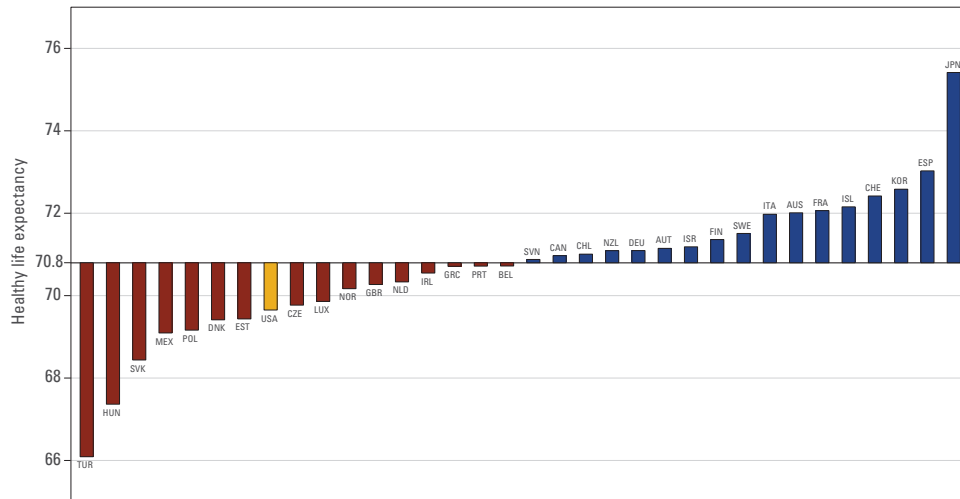
While life expectancy can be used to measure a country's health, it does not reflect the health loss throughout a person's lifespan. For this reason, GBD calculates healthy life expectancy, or health-adjusted life expectancy (HALE), which reflects the number of years that a person can expect to live in optimal health. The difference between life expectancy and healthy life expectancy is the number of years lived with disability. As people live longer lives, the number of years lived with disability tends to increase. As life expectancy increased in the US, for example, the number of years that the average American male could anticipate living with disability increased from 8.7 in 1990 to 9.6 in 2010, while it increased from 10.4 to 11 years for American females during this time.

Figures 2a and 2b compare HALE in males and females in OECD countries – including the US – to the median for all OECD countries in 2010. In countries falling below the x-axis, children born in 2010 can expect to live fewer years in full health than the median healthy life expectancy for OECD countries. In countries rising above the x-axis, it is expected that a person born in 2010 will enjoy more years of healthy life than the OECD median. Both American males and females had lower healthy life expectancies than the OECD median, but the healthy life expectancy of American males was closer to the OECD median than American females. Females in countries with much lower income levels, such as Chile, the Czech Republic, and Slovenia, were closer to median OECD healthy life expectancy than females in the US.

**Figure 2a: Deviation from median healthy life expectancy in OECD countries, males, 2010**



Note: AUS: Australia, AUT: Austria, BEL: Belgium, CAN: Canada, CHE: Switzerland, CHL: Chile, CZE: Czech Republic, DEU: Germany, DNK: Denmark, ESP: Spain, EST: Estonia, FIN: Finland, FRA: France, GBR: United Kingdom, GRC: Greece, HUN: Hungary, IRL: Ireland, ISL: Iceland, ISR: Israel, ITA: Italy, JPN: Japan, KOR: Korea, LUX: Luxembourg, MEX: Mexico, NLD: Netherlands, NOR: Norway, NZL: New Zealand, POL: Poland, SVN: Slovenia, PRT: Portugal, SVK: Slovakia, SWE: Sweden, TUR: Turkey, USA: United States

**Figure 2b: Deviation from median healthy life expectancy in OECD countries, females, 2010**

Note: AUS: Australia, AUT: Austria, BEL: Belgium, CAN: Canada, CHE: Switzerland, CHL: Chile, CZE: Czech Republic, DEU: Germany, DNK: Denmark, ESP: Spain, EST: Estonia, FIN: Finland, FRA: France, GBR: United Kingdom, GRC: Greece, HUN: Hungary, IRL: Ireland, ISL: Iceland, ISR: Israel, ITA: Italy, JPN: Japan, KOR: Korea, LUX: Luxembourg, MEX: Mexico, NLD: Netherlands, NOR: Norway, NZL: New Zealand, POL: Poland, SVN: Slovenia, PRT: Portugal, SVK: Slovakia, SWE: Sweden, TUR: Turkey, USA: United States

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

Around the world, people are living longer on average and populations are growing older. In much of the world, GBD found that the average age of death is increasing; since 1970, it has increased globally by 20 years. In East Asia, which includes China, North Korea, and Taiwan, the average age of death was 36 years in 1970, increasing to 66 years in 2010. The average age of death increased from 31 to 63 in tropical Latin America, which includes Brazil and Paraguay. In the Middle East and North Africa, the average age of death was 30 years higher in 2010 than it was in 1970. Sub-Saharan Africa has not made nearly as much progress as other developing regions, however. In western, southern, and central sub-Saharan Africa, the average age at death rose by less than 10 years, and the average age of death was 12 years higher in 2010 in eastern sub-Saharan Africa than it was in 1970. Over the past decade, though, many countries in sub-Saharan Africa have made substantial progress in improving health outcomes.

Figure 3 shows changes in the average age of death in select high-income countries. In the US, the average age of death increased by nine years between 1970 and 2010, but the increase was even greater in other countries. Of the countries shown in Figure 3, only the Czech Republic, Estonia, Hungary, Poland, and Slovakia had average ages of death that were lower than the US in 2010. The smaller changes in the mean age of death in

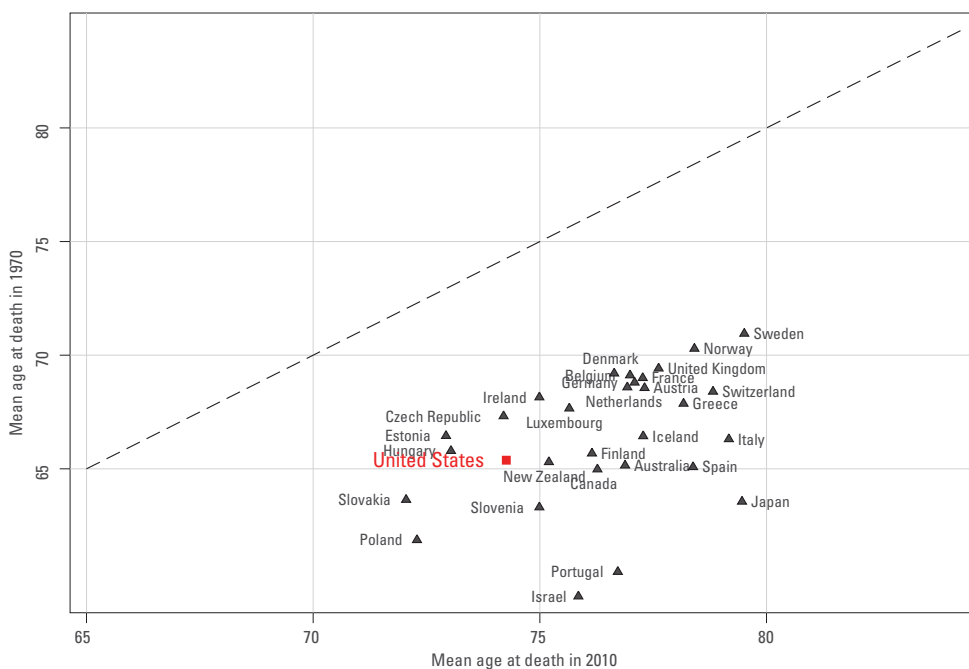
the US are likely due to two main factors: the US has higher fertility rates than most countries in the OECD and it also has higher levels of immigration of young people.

Another way to understand changes in demographic trends is to explore reductions in mortality rates by sex and age group. Figure 4 shows how death rates in OECD countries have declined in all age groups between 1970 and 2010, but the decrease in female death rates exceeded male death rates in many age groups, particularly between the ages of 20 and 39, most likely due to the persistence of higher mortality from alcohol and tobacco use among men.

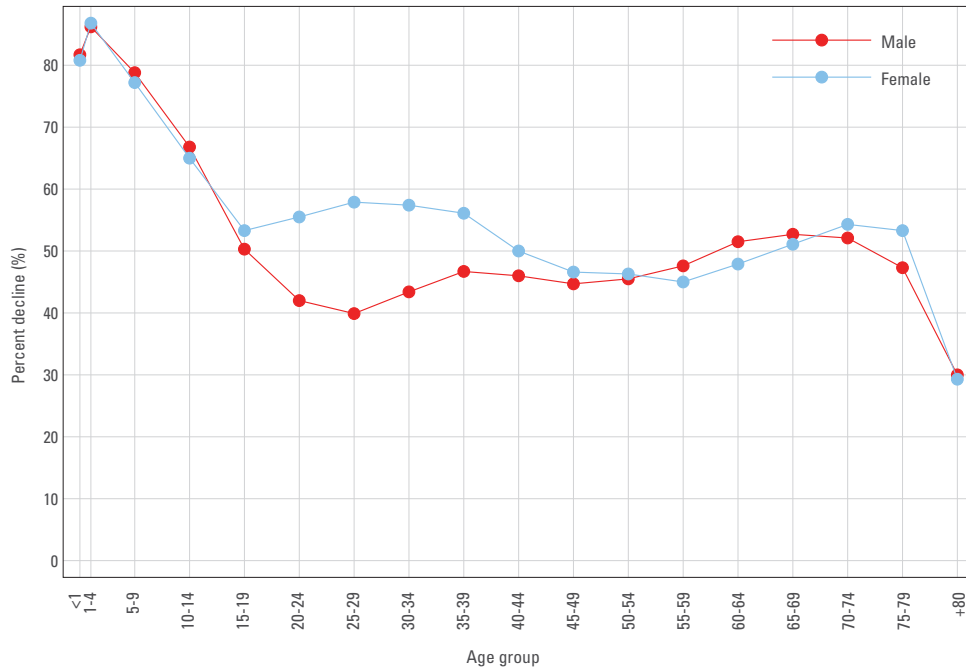
Mortality declined in every sex and age group in the US between 1970 and 2010, as shown in Figure 5. Compared to OECD countries as a whole, US males made similar progress in improving their mortality rates in most age groups. US women, however, made less progress than the OECD average in many age groups from 1970 to 2010. For example, overall, females in the OECD improved their mortality rates by approximately 60% in people aged 20 to 29, but US females only improved their mortality rates by a little more than 40% in these same age groups.

In contrast to OECD trends, US males made more progress in reducing mortality than females in most age groups. Also, while female life expectancy increased at the national level in the US, there were many US counties where female life expectancy did not improve. The lack of progress among females in certain US counties is explored in more detail elsewhere in this report.

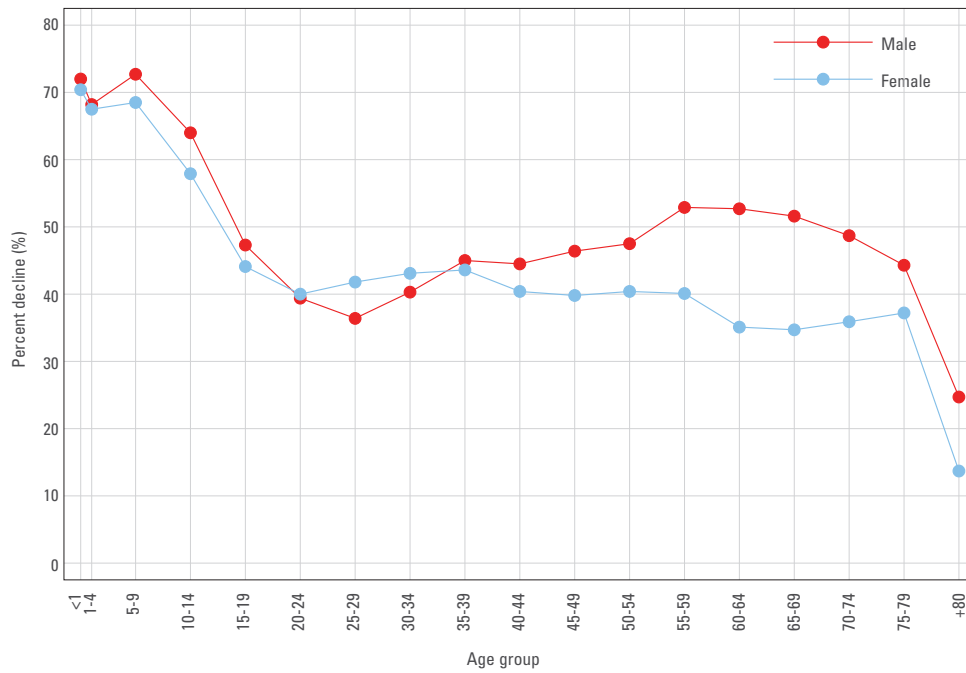
**Figure 3: Average age of death in select high-income countries, 1970 compared with 2010**



**Figure 4: Decline in age-specific mortality rate in OECD countries, 1970-2010**



**Figure 5: Decline in age-specific mortality rate in the US, 1970-2010**

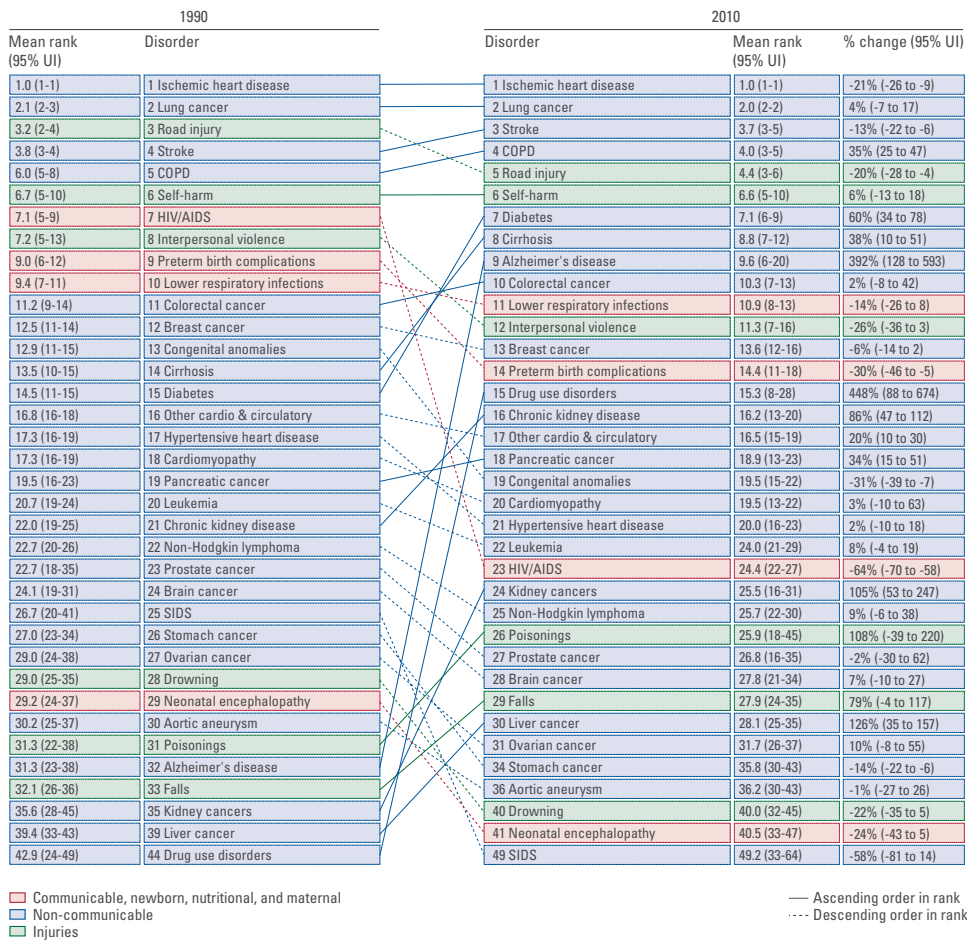


## PROGRESS AND CHALLENGES IN CAUSES OF PREMATURE DEATH

In an ideal world, people everywhere would live the maximum life expectancy possible. A fundamental part of the GBD 2010 analysis is tracking deaths that occur before that maximum life expectancy, referred to as years of life lost (YLLs).

Figure 6 shows changes in the leading causes of premature death in the US in both sexes from 1990 to 2010. Communicable, newborn, maternal, and nutritional causes are shown in red, non-communicable diseases in blue, and injuries in green. Dotted

**Figure 6: Years of life lost ranks in the US, top 30 causes, and percentage change, 1990-2010**



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

lines indicate causes that have fallen in rank during this period, while solid lines signal causes that have risen in rank.

Ischemic heart disease and stroke were the first and third causes of YLLs in the US in 2010, but YLLs from both causes decreased between 1990 and 2010. Two causes linked to smoking, lung cancer and COPD, increased in terms of YLLs primarily due to population growth and aging. Premature death due to road injury and self-harm were the fifth and sixth leading causes in 2010, but both causes ranked much higher in males compared to females (third and fourth for males versus eighth and 16th for women, respectively). Premature death from road injury includes YLLs from bicycle, motorcycle, vehicle, and pedestrian accidents. The next three causes – diabetes, cirrhosis, and Alzheimer’s disease – increased substantially as causes of premature death in the US between 1990 and 2010, growing by 60%, 38%, and 392% each. Ranks 10 through 20 featured three types of cancers: colorectal cancer (10th), breast cancer (13th), and pancreatic cancer (18th).

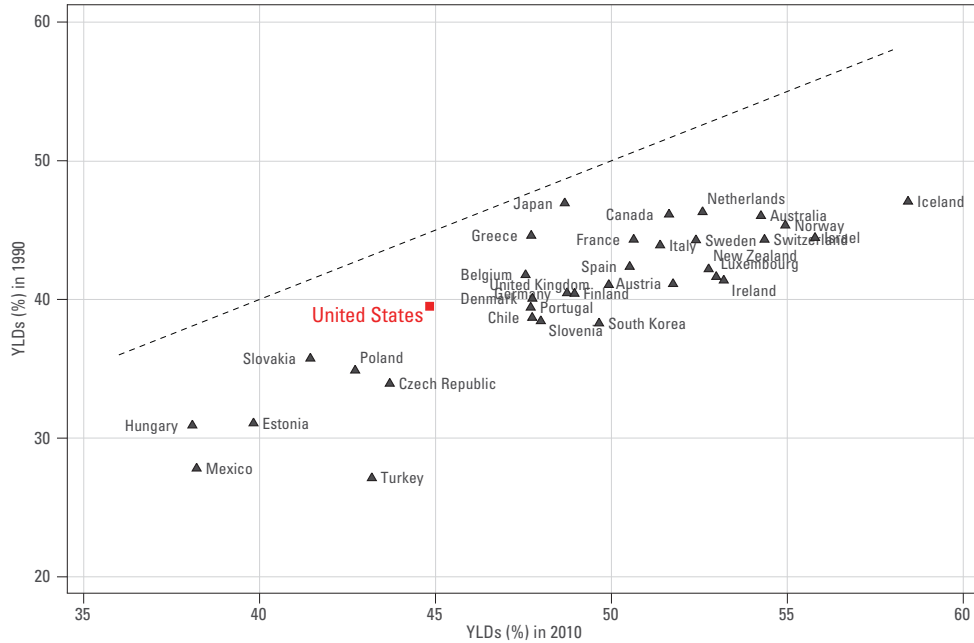
In addition to Alzheimer’s disease, the conditions shown in Figure 6 that experienced increases greater than 100% between 1990 and 2010 in the US were drug use disorders, kidney cancers, poisonings, and liver cancer. Another cause that increased by a large amount between 1990 and 2010 was falls, which rose by 79%. Causes such as interpersonal violence, preterm birth complications, congenital anomalies, HIV/AIDS, and sudden infant death syndrome (SIDS) dropped by more than 25% since 1990.

## **DISABILITY INCREASES AS THE POPULATION GROWS OLDER**

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

DALYs (healthy years lost) are calculated by adding together YLDs (years lived with disability) and YLLs (years of life lost to premature death). Between 1990 and 2010, YLDs increased as a percentage of total DALYs in most areas of the world. Figure 7 shows YLDs as a percentage of DALYs in 1990 and 2010 in OECD countries. In the US, YLDs increased from 40% of total DALYs in 1990 to 45% in 2010. In 1990, the US ranked 23rd among the 34 OECD countries in terms of YLDs as a percentage of total DALYs. Due to its lagging performance in reducing premature mortality (YLLs), the US dropped to 27th place among OECD countries in 2010 for its percentage of YLDs.

Figure 8 illustrates the different types of disability that affect people of every age group in the US. 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

**Figure 7: YLDs as a percentage of DALYs in OECD countries, 1990 and 2010**

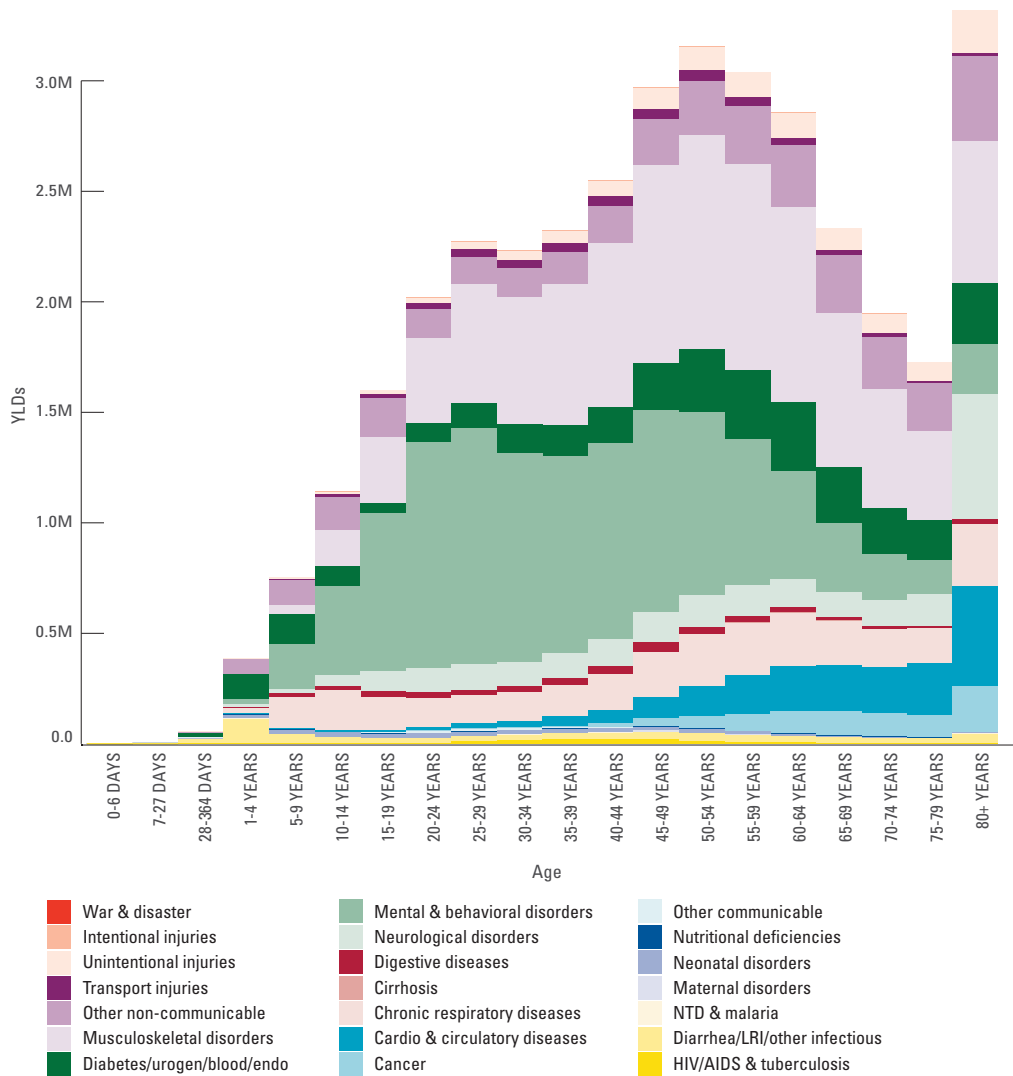
that condition. Similar to the world as a whole, mental and behavioral disorders, such as depression, anxiety, and drug use, led to the loss of many years of healthy life among young people in the US, accounting for as much as 50% of YLDs in 20- to 24-year-olds. As the population of the US has grown, the burden of mental and behavioral disorders has increased. Figure 8 sheds light on other diseases and injuries that cause disability in the US. Starting at age 40 and extending through age 74, musculoskeletal disorders, which include low back pain and neck pain, caused approximately 30% of YLDs. Cardiovascular and circulatory diseases (including ischemic heart disease and stroke) and cancers played a prominent role in causing disability among older people in the US. Other non-communicable diseases caused over 10% of YLDs up to age 20, mainly due the inclusion of skin disorders in this category. It also includes sensory organ diseases such as hearing loss and vision loss, which explains why this category causes roughly 10% of YLDs in people aged 60 and over in the US. Diabetes, urogenital, and other endocrine disorders were also important causes of YLDs in the US.

Population growth and aging are the main reasons that years lived with disability are increasing in the US. When researchers remove the effect of these demographic changes using a metric called age-standardized rates, however, certain patterns emerge. The US has made very little progress in reducing the number of people affected by these different causes of disability, underscoring the need for further



research into the prevention and treatment of conditions that prevent Americans from living lives in full health, such as depression, anxiety, and low back and neck pain. Even more disturbing, after taking population growth and aging into account, GBD 2010 found that YLDs from stroke, drug use disorders, and eating disorders increased by 20% or more from 1990 to 2010 in the US.

**Figure 8: Disability patterns by broad cause group and age in the US, 2010**

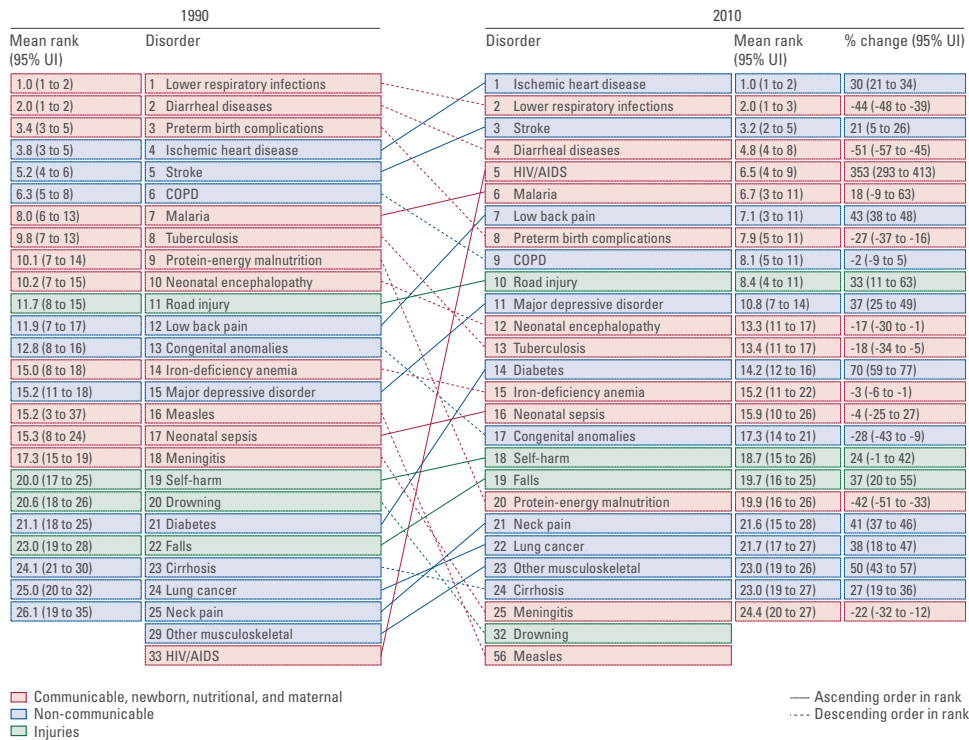


Note: The size of the colored portion in each bar represents the number of YLDs attributable to each cause for a given age group. The height of each bar shows total YLDs for a given age group in 2010. The causes are aggregated. For example, musculoskeletal disorders include low back pain and neck pain.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

## RANKING CAUSES OF HEALTHY YEARS LOST GLOBALLY AND IN THE US

Adding together years of life lost and years lived with disability produces a metric – the disability-adjusted life year (DALY) – that decision-makers can use to compare health loss from fatal and non-fatal causes, such as breast cancer versus depression. GBD 2010 found that the leading causes of DALYs have evolved dramatically over the past 20 years. Figure 9 shows global changes in the leading causes of DALYs in 1990 and 2010. Causes associated with ill health and death in adults, such as ischemic heart disease, stroke, and low back pain, increased in rank between 1990 and 2010, while causes that primarily affect children, such as lower respiratory infections, diarrhea, preterm birth complications, and protein-energy malnutrition, decreased in rank. Unlike most of the leading communicable causes, HIV/AIDS and malaria increased by 353% and 18%, respectively. Since 2005, however, premature

**Figure 9: Global ranks for top 25 causes of DALYs and percentage change, both sexes, all ages, 1990 and 2010**

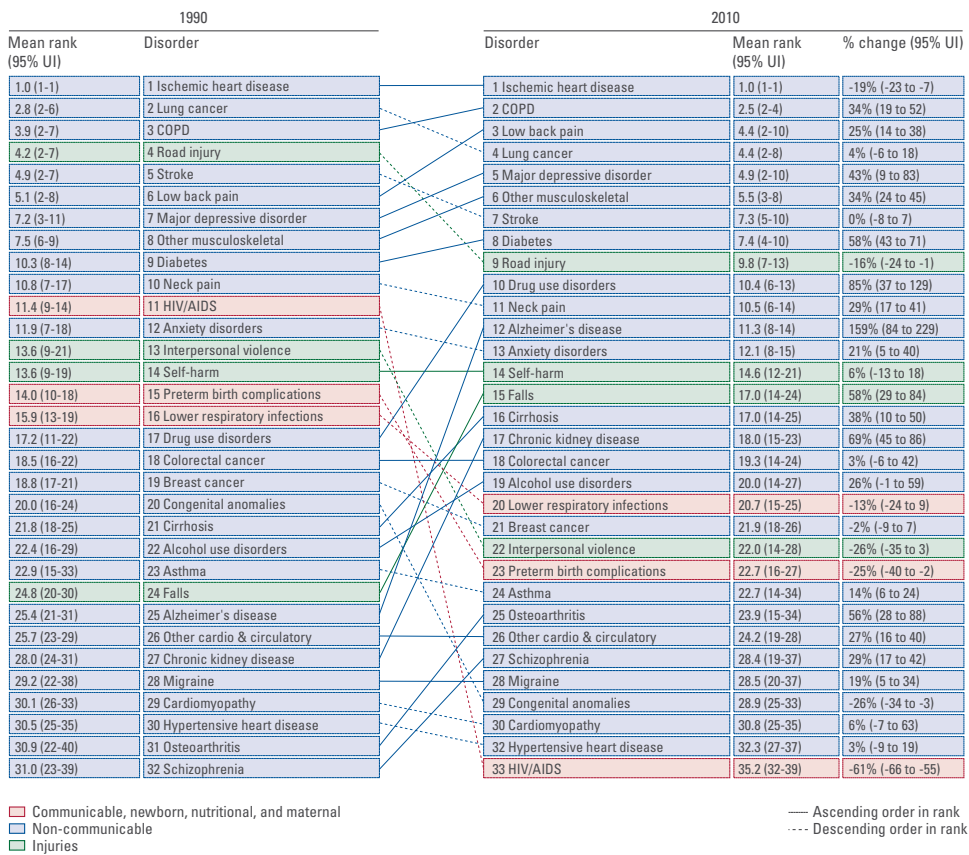


*Note: Solid lines indicate a cause that has moved up in rank or stayed the same. Broken lines indicate a cause that has moved down in rank. The causes of DALYs are color coded, with blue for non-communicable diseases, green for injuries, and red for communicable, newborn, nutritional, and maternal causes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

mortality and disability from these two causes have begun to decline. Four main trends have driven changes in the leading causes of DALYs globally: aging populations, increases in non-communicable diseases, shifts toward disabling causes and away from fatal causes, and changes in risk factors.

In the United States, the leading causes of DALYs shed insight into the evolving challenges faced by the US population and its health care system. Cardiovascular diseases, including ischemic heart disease and stroke, continue to rank among the top 10 leading causes of health loss in 2010 as they did in 1990, but ischemic heart disease dropped by 19% during this period. DALYs due to COPD, which includes emphysema, increased by 34% and moved from a ranking of third to second over the two decades. Figure 10 sheds light on the growing importance of musculoskeletal

**Figure 10: US ranks for top 30 causes of DALYs and percentage change, both sexes, all ages, 1990 and 2010**



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

disorders, exemplified by low back pain increasing from the sixth-leading cause of DALYs in 1990 to the third-leading cause in 2010. Burden from mental and behavioral disorders, including depression and drug use disorders, increased by 43% and 85%, respectively, and diabetes rose by 85%. Health loss from injuries such as road injuries and interpersonal violence dropped during the same period (16% and 26%, respectively), but falls increased dramatically (58%) and self-harm rose slightly (6%).

## HEALTH LOSS DRIVEN BY POTENTIALLY PREVENTABLE RISK FACTORS

Data on potentially modifiable causes of health loss, or risk factors, can help policymakers and donors prioritize prevention strategies to achieve maximum health gains. GBD tools estimate the number of deaths, premature deaths, years lived with disability, and DALYs attributable to 67 risk factors worldwide. GBD 2010 benefited from the availability of new data, such as 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.

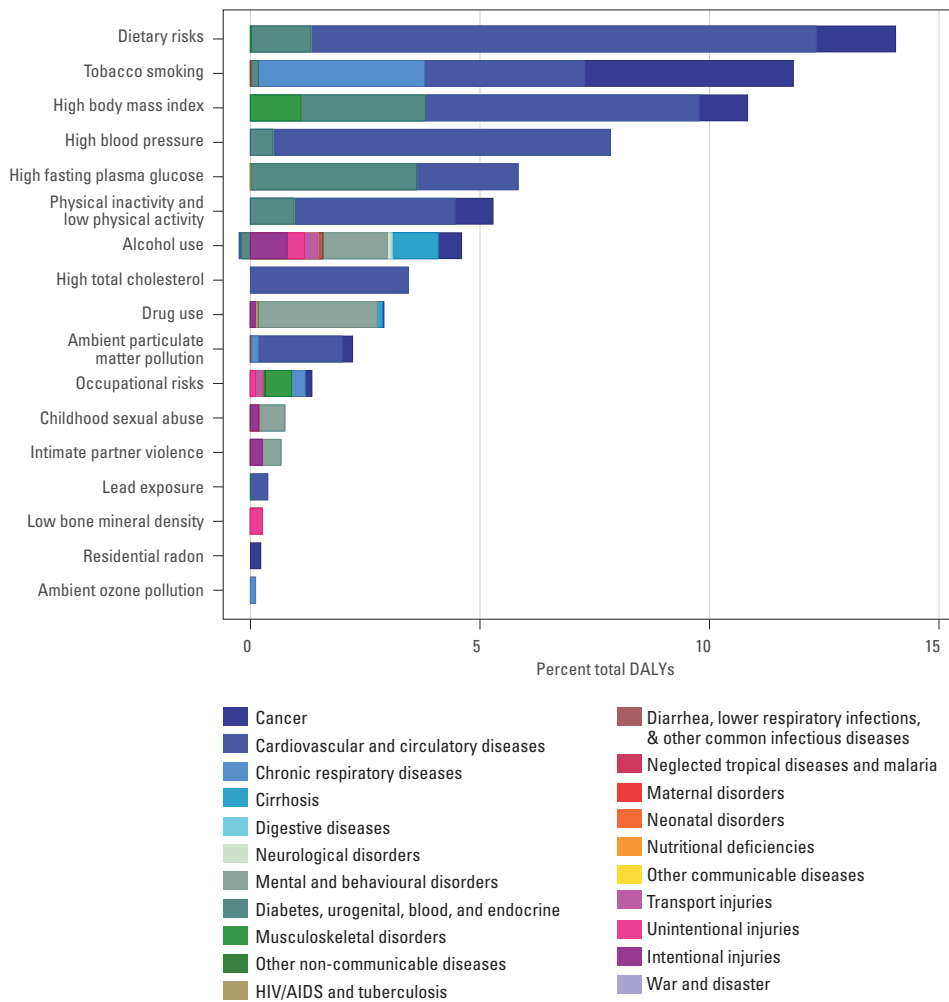
In the US, dietary risks were the leading risk factor in 2010, as shown in Figure 11. Dietary risks include 14 different components ranging from lack of fruit and excessive sodium to high processed meat. Figure 12 provides a detailed breakdown of dietary risks in the US. Diets low in fruits, vegetables, nuts, and seeds and high in sodium, processed meats, and trans fat cause the most health loss in the US. Processed meat includes meat preserved by smoking, curing, salting, or adding chemical preservatives, such as bacon, salami, sausages, or deli or luncheon meats like ham, turkey, and pastrami. Primarily, dietary risks contributed to cardiovascular and circulatory diseases such as ischemic heart disease and stroke. To a lesser extent, dietary risks contributed to cancer, especially diets low in fruits. Two of the top five risk factors, diets high in sodium and diets high in processed meat, also contributed to DALYs from diabetes and urogenital, blood, and endocrine disorders.

Figure 11 shows that, despite the fact that DALYs attributable to smoking decreased by 9% between 1990 and 2010, it still ranked as the second-highest risk factor in the US and caused substantial health loss from cancers including lung cancer, chronic respiratory diseases such as COPD, and cardiovascular and circulatory diseases. Evidence of progress due to increasingly tougher anti-tobacco legislation throughout the country is likely to decrease the ranking of smoking as a risk factor for DALYs as GBD is updated on an annual basis.

High BMI was the third-leading risk factor in the US in 2010. DALYs from this risk factor increased by 45% between 1990 and 2010. In the US, high BMI primarily contributed to DALYs from cardiovascular and circulatory diseases, cancers, and urogenital, blood, and endocrine disorders, a category that includes disorders such as diabetes and chronic kidney disease. High blood pressure, high fasting plasma glucose, and physical inactivity were the next highest ranking risk factors. The US performed better than the OECD average in terms of disease burden attributable to high blood pressure. Alcohol use, which was attributable to DALYs from causes

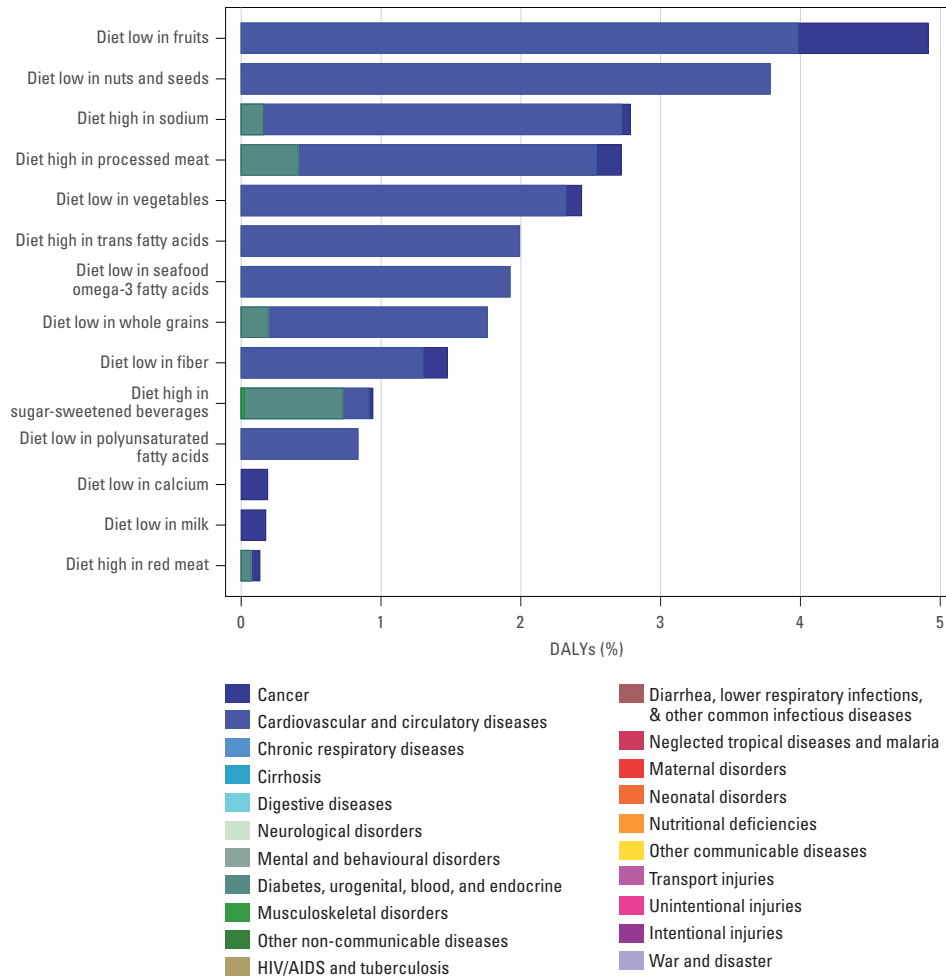
such as mental and behavioral disorders, cirrhosis, self-harm, and interpersonal violence, ranked as the seventh-highest risk factor. While DALYs from high total cholesterol and ambient particulate matter air pollution were among the top 10 risk factors in the US, they declined by 36% and 35%, respectively, between 1990 and 2010. In contrast, DALYs from drug use, the ninth-leading risk factor for DALYs, rose by 64% during this same period.

**Figure 11: Percent of DALYs attributable to the 17 leading risk factors, both sexes, all ages, US, 2010**



*Note: The size of each colored portion of the bars represents the number of DALYs from a particular cause attributable to a given risk factor. DALYs from each risk factor should not be added together.*

**Figure 12: Percent of DALYs attributable to the 14 dietary risk factors, both sexes, all ages, US, 2010**



*Note: The size of each colored portion of the bars represents the number of DALYs from a particular cause attributable to a given risk factor. DALYs from each risk factor should not be added together.*