


# The Scottish Burden of Disease Study, 2015

Overview report



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# Introduction

Burden of disease is a measure of the health of the population. It aims to quantify the difference between living to old age in good health, and the situation in which healthy life is shortened by illness, injury, disability and early death.

By combining information on fatal burden with the burden of living in less than ideal health (non-fatal burden), planners and policymakers have a better idea of the contribution that different diseases, conditions and injuries make to the total burden of disease. This in turn provides information to support decisions about where prevention and service activity should be focused. It also provides a way of looking at the proportion of the burden that can be explained by a range of exposures in the population such as poverty or smoking.

Burden of disease studies use a single measure which combines fatal burden [i.e. years lost because of early death – years of life lost (YLL)] and non-fatal burden [i.e. years lost because they are lived in less than ideal health – years lived with disability (YLD)]. The measure used to describe the overall burden of disease is called the disability-adjusted life year (DALY).

Figure 1: How to measure the total DALY for all diseases, conditions and injuries in one year.

## Imagine a block of flats where 10 people live. In 2015...



One **20-year-old man** died suddenly from a heart attack while exercising. His life expectancy was **77.6 years**, so he lost **57.6 years of life**.

$$\begin{array}{ccc} 77.6 & - & 20 \\ \text{Life expectancy} & & \text{current age} \end{array}$$

$$= 57.6$$

Years of life lost



One **80-year-old woman** died of a stroke. Having lived to this age, her life expectancy was **89**, so she lost **9 years of life**.

$$\begin{array}{ccc} 89 & - & 80 \\ \text{Life expectancy} & & \text{current age} \end{array}$$

$$= 9$$

Years of life lost



One **45-year-old man** had a type of meningitis which limited his activities a great deal. He took **seven weeks** to recover, but didn't suffer any long-term effects after that. This amounted to **0.02 lost years** of healthy life in 2015.

**Seven weeks** of illness with a high level of impairment.

$$= 0.02$$

Years lived with disability



One **60-year-old woman** had severe COPD that limited her a great deal all year round. This amounted to **0.41 lost years** of healthy life in 2015.

**12 months** lived with a severe condition and a high level of impairment.

$$= 0.41$$

Years lived with disability

**Total DALYs (Years of life lost + years lived with disability) added to the overall disease burden for Scotland by the people in this block of flats in 2015:**

$$57.6 + 9 + 0.02 + 0.41 = 67.03$$

**Figure 1** shows the overall DALY for people living in a block of flats for illustrative purposes. In this study we look at DALYs by each disease, condition and injury separately, and by different demographics (such as age or gender).

In any given year, the DALY counts up the years lost due to people dying early in that year and the proportion of that year lost due to living in less than ideal health. The latter is calculated based on duration, severity and the level of disability attributed to that illness. So, in the example above there are  $57.6 + 9 = 66.6$  years lost due to people dying early (YLL) and  $0.02 + 0.41 = 0.43$  of a year (around 5 months in 2015) where the residents of the block of flats are living in less than ideal health (YLD).

# Methods

## How we calculated the burden of disease for Scotland in 2015

We calculated the burden of disease for 132 disease, condition and injury categories as defined by the international **Global Burden of Disease** (GBD) study. The total burden (DALY) for each category was calculated by adding together the YLL (fatal burden) and YLD (non-fatal burden) for each disease, condition or injury.

### Fatal burden

**Fatal burden (YLL)** was calculated as the years of life lost due to dying earlier than someone in full health. To estimate how many years were lost, we subtracted the age at death from each person's remaining life expectancy at that age (for this study, we got these data from **Scottish life tables**).

We extracted cause of death from the death certificate, and where the cause given was not specific enough to allocate to one meaningful category, we redistributed those deaths into other causes (see the **technical report** for further information).

### Non-fatal burden

**Non-fatal burden (YLD)** is the years lost through living in less than ideal health. This was calculated as:



We only count the YLD within the year we are reporting on, so the maximum YLD an individual can contribute for that year is theoretically one year, although in reality, it will always be lower than this.

## Prevalence

The prevalence is a count of how many people have each disease, condition or injury at a specific point in time. To get these data for the whole of Scotland, we extracted information from hospital, GP and prescribing recording systems, and also disease registers. Where necessary, we also used information from surveys, research studies or expert-informed estimates.

To measure the YLD accurately, some diseases, conditions and injuries were counted as 'acute' when people had a level of disability for a short (sometimes multiple) burst of time (e.g. upper respiratory infections). Others were counted as 'chronic' when people had a disability or illness for a longer period of time and sometimes for the rest of their lifetime. For example, we assumed that, on average, back pain caused disability for a year after diagnosis but that a stroke caused a life-long disability. Some diseases, conditions and injuries had an acute period and then a chronic period, with different levels of disability.

## Severity

The severity distribution is an assumption about what proportion of people we would expect to have mild, moderate and severe disability for each disease, condition and injury. As information on severity was not generally available, we used severity distributions from the GBD study in most instances. As an example, the GBD study estimates that for people living with rheumatoid arthritis, 49.5% have mild disability, 38.1% have moderate disability and 12.4% have severe disability. For each level of severity, we assigned a different level of disability.

## Disability weight

The disability weight is the level of disability that the GBD study team have attributed to each disease, condition and injury at each severity level. The weights give a level of disability graded between 0 (no disability) and 1 (death). For example, the disability caused by mild distance vision impairment has a very low disability weight of 0.004 whereas active-phase schizophrenia has a very high disability weight of 0.763. The GBD team used three large-scale surveys and expert panels to produce the weights.

## Multi-morbidity adjustment

Finally, if someone had more than one disease, the burden they lived with was counted only once in our calculations. We used statistical techniques to make a 'multi-morbidity adjustment', which assumes that a certain proportion of people will have multiple diseases and adjusts the disability accordingly. This means that if someone has had a stroke and has diabetes, their non-fatal burden across both of these will sum to their total non-fatal burden. It ensures that it is not possible for someone to have 60% disability due to stroke and 70% disability due to diabetes, as these would add to more than 100% disability.

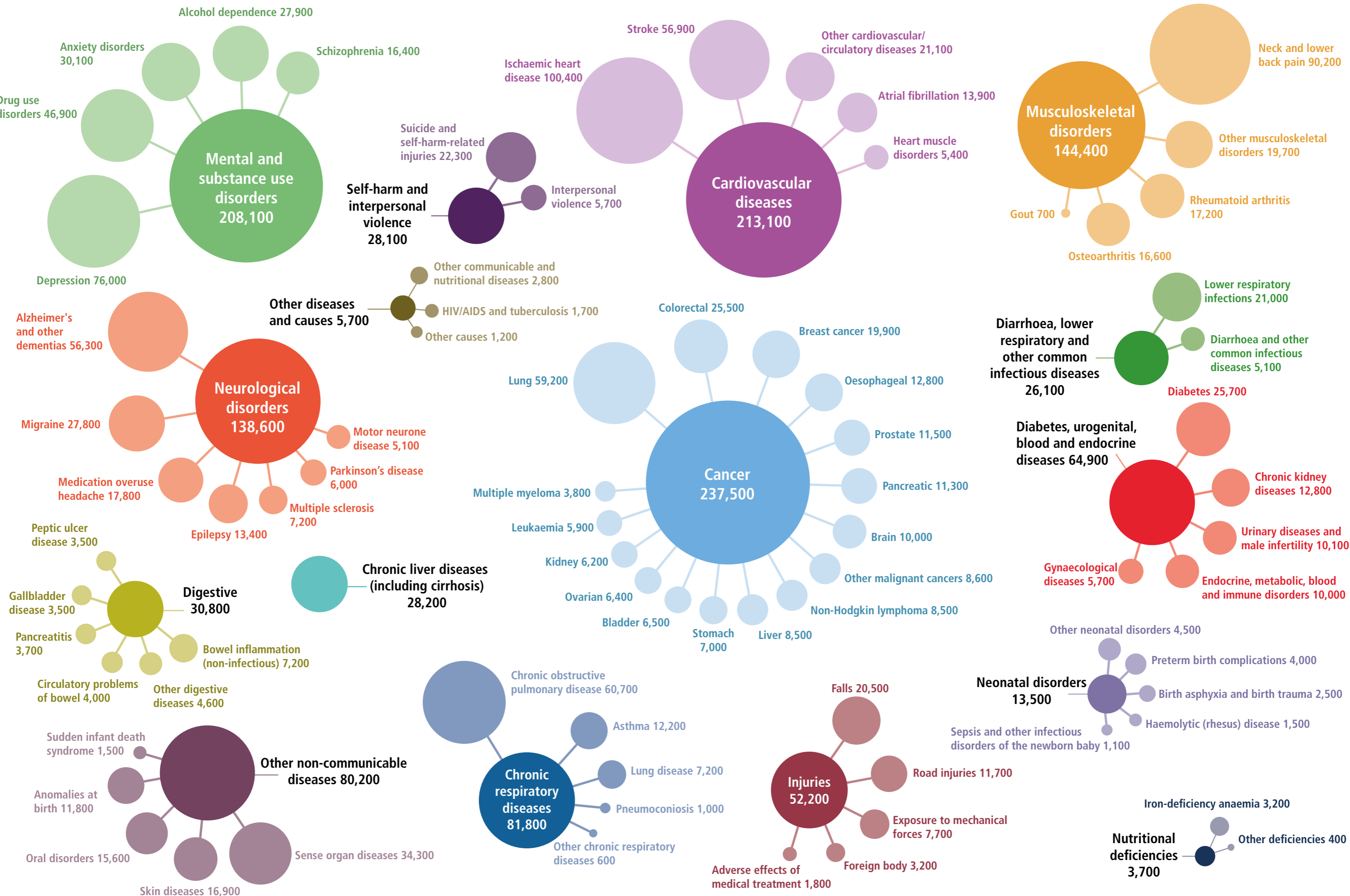
# Results

## What was the burden of disease in 2015 in Scotland?

The leading causes of burden in 2015 are shown in **Figure 2**. Overall, when looking at broad **groups** of diseases, conditions and injuries, cancer (neoplasms) caused the biggest burden, followed by cardiovascular disease, and mental and substance use disorders. These three groups combined cover 69% of overall burden.



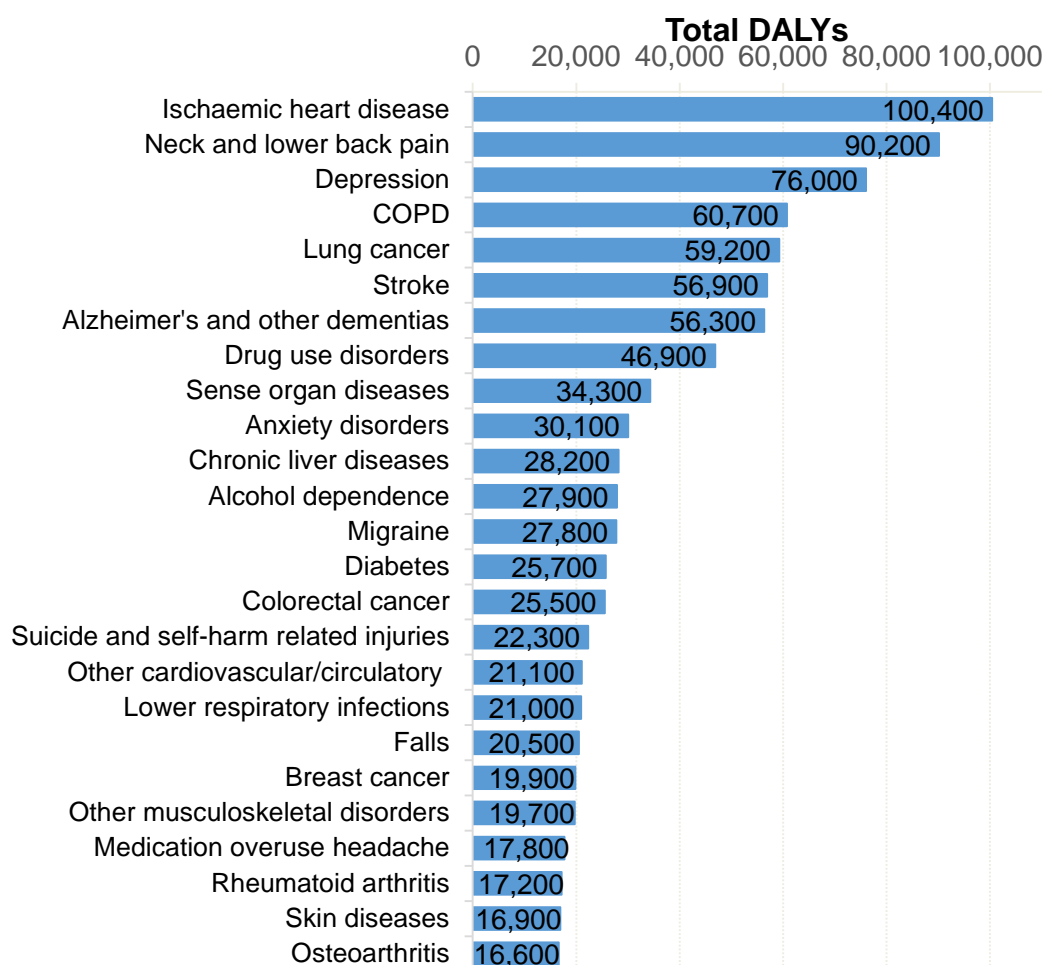
**Figure 2: Total burden of disease for groups of diseases, conditions and injuries.**



Note: Values have been rounded to the nearest 100

Looking in more detail at the most common **individual** diseases, conditions and injuries, the largest burden was from ischaemic heart disease followed by neck and lower back pain, depression, chronic obstructive pulmonary disease (COPD) and lung cancer. The 25 diseases, conditions and injuries, which cover almost 70% of the burden of disease in Scotland, are shown in **Figure 3**.

**Figure 3:** Burden of disease (DALY) ranked by individual diseases with the highest burden, Scotland 2015.



Note: DALYs have been rounded to the nearest 100. The data shown in this figure is also available in **Excel format**.

# The difference between fatal and non-fatal burden

Understanding burden has important implications for prevention activities and for planning the services that will care for the growing number of patients. Having the ability to look at fatal and non-fatal burden<sup>1</sup> together allows us to capture the impact of disease, conditions and injury that is lost when looking at mortality alone.

The health problems that cause the most fatal burden (YLL) in Scotland are already well documented, and include early deaths due to ischaemic heart disease, lung cancers, COPD, cerebrovascular disease (predominantly stroke), Alzheimer's disease and other dementias (see **Figure 4**).

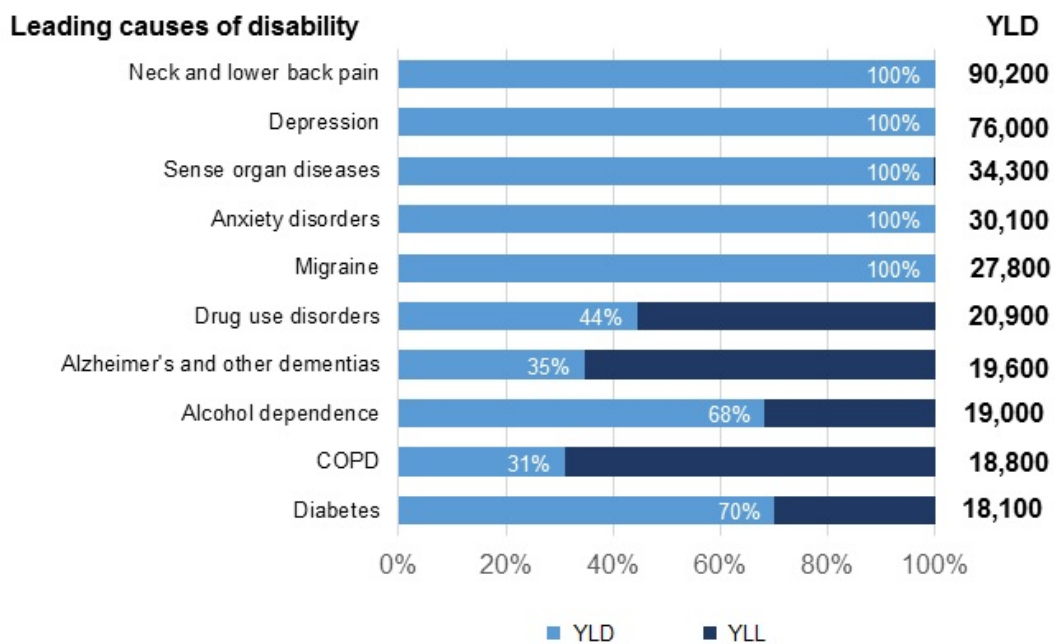
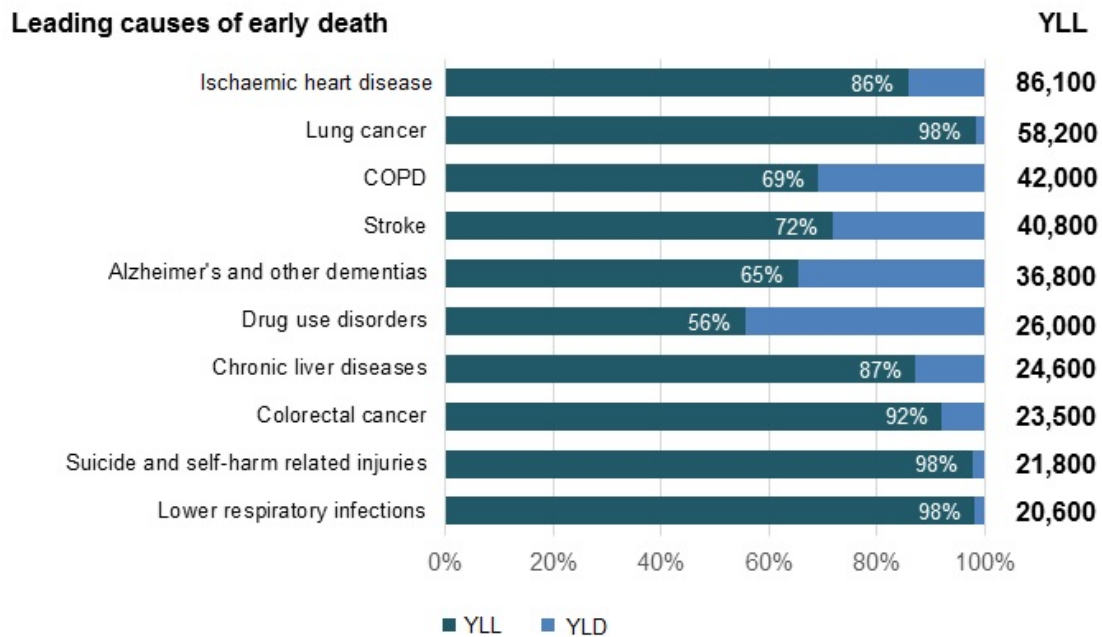
The health problems which cause the most non-fatal burden (proportion of the year lived with disability – YLD), include disability associated with anxiety, depression and dementia, along with diseases caused by our inability to live in ways that create and sustain health (food, exercise, tobacco, alcohol and drugs), and those caused by our living longer.

There were more person-years lived in less than ideal health due to neck and lower back pain in 2015 than there were lost to early heart disease deaths, and more person-years lived in less than ideal health due to depression than lost to early lung cancer deaths. A stark reminder that living longer does not necessarily equate to a healthy, happy life. It is right that investment is made in prevention and services to tackle killer diseases, like ischaemic heart disease and lung cancer. But it is equally important to address the burden of living in less than ideal health.

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<sup>1</sup> Non-fatal burden is not the same as prevalence of a disease. So, for example, when we say that 98% of suicide and self-harm is fatal, what we mean is that of the people who self-harm, 98% of the burden in that year is due to early death and 2% is due to the physical consequences of having self-harmed at some point in the past. We are **not** saying that 98% of people who self-harm die as a result of self-harming.

**Figure 4:** Leading causes of early death (YLL) and disability (YLD), Scotland 2015.



Note: YLLs and YLDs have been rounded to the nearest 100. The data shown in this figure is also available in **Excel format** or visit our **web pages** for more detailed results.

# Discussion

The **GBD study**, which describes fatal and non-fatal burden from major diseases, injuries and risk factors to health at global, national and regional levels, is the most comprehensive worldwide observational epidemiological study to date. It uses a wide range of data sources from across the world and then uses modelling techniques to estimate mortality and prevalence for every country in the world, including Scotland. The models take into account a range of country-specific factors including the mortality data, per capita income, average years of schooling, lifestyle factors and fertility/birth information.

## What does our study add?

The GBD mortality estimates for Scotland are very similar to our own because of the excellent recording of death information in Scotland. However, there is no routinely available information on **prevalence** of disease, conditions and injury for GBD to use, which is why they use a modelling approach. Scotland has excellent health management systems that allow us to make our own estimates of prevalence based on **counts** of people we can identify as having different diseases, conditions or injuries, which is what we used in this study. The prevalence estimates we have produced will help GBD further refine their prevalence estimates for Scotland in future.

## Impact of this study

The Scottish burden of disease team has worked with a wide range of disease experts to produce the best estimates possible for this first release of burden of disease in Scotland. We are clear about the impact our calculation decisions have on the final estimates (see our **disease-specific technical reports** for more detail). The results should be easy to understand and we have confidence in our interpretation of the results. We have used a colour scheme in our disease-specific technical reports to indicate how relevant and

accurate each DALY estimate is, and to indicate where we will focus our future efforts on improving the estimates.

## Limitations

We have to make assumptions about severity, the disabilities incurred and the 'undiagnosed' proportion of the population for each disease, condition or injury. GBD's published methods have been invaluable in making our calculations.

The GBD results are a very valuable source for comparison with other countries, but please be aware that some diseases that we highlight as a significant burden in Scotland do not appear as prominently in the GBD results for Scotland owing to differences in a modelling approach (GBD) compared with counting approach (Scottish Burden of Disease team). The biggest differences are for depression, anxiety disorders, alcohol dependence, asthma, arthritis, migraine, medication overuse headache and skin diseases. We are working with the GBD team and the European Burden of Disease Network in the ongoing mission to get more precise estimates of burden and a broader range of exposures.

# What's next?

Publishing comprehensive burden of disease estimates for Scotland provides a starting point for informed health-related policy debate.

Our next step is to publish estimates of burden by local area and by levels of deprivation. We will also provide projections of burden up to 2025. This will allow local health and social care planners to assess the composition of their workforce and services against the demands likely to face them. The information will also allow national workforce planners to assess how our public and third sectors are set up to cope with the projected burden. Hospital and prescribing costs could also be calculated to aid planning decisions.

This report focuses on **crude** burden (the absolute numbers). We will also produce **standardised** burden, so changing burden over time and between areas can be assessed and understood. We will also start to look at multi-morbidity and the impact this has on burden for individuals and the health service.

These results also lay the foundation for work to commence around the economics of prevention. This will involve estimating the contribution of a range of exposures in the population (including income, smoking, obesity and alcohol consumption) in explaining the burden of disease in Scotland. This can then be used to estimate the reduction in burden arising from prevention strategies (i.e. their potential effectiveness), quantified in terms of the reduction in length of time people spend in ill health. This can then be compared with the cost of these strategies and any reduction in demand for and cost of public services and resources. We will work with health economists and others to develop a programme of work of this kind.

## How can I find out more?

Visit our web pages at [www.scotpho.org.uk/comparative-health/burden-of-disease/overview](http://www.scotpho.org.uk/comparative-health/burden-of-disease/overview) to find other reports in our Scottish burden of disease series, technical information and detailed results for all 132 diseases and injuries.

Contact the Scottish burden of disease team: [nhs.healthscotland-sbod-team@nhs.net](mailto:nhs.healthscotland-sbod-team@nhs.net)

## The team

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We would also like to acknowledge the original funding from the Chief Scientist's Office (CSO) for the pilot phase of the project, the continuing support from our steering group chaired by Professor Harry Campbell, the **disease experts** who have spared their time to advise us, Mag McFadden who helped us set up the study, Catherine Bromley for advice and Lorraine Gourlay for our infographics and Sandra Crombie for editing this report.



