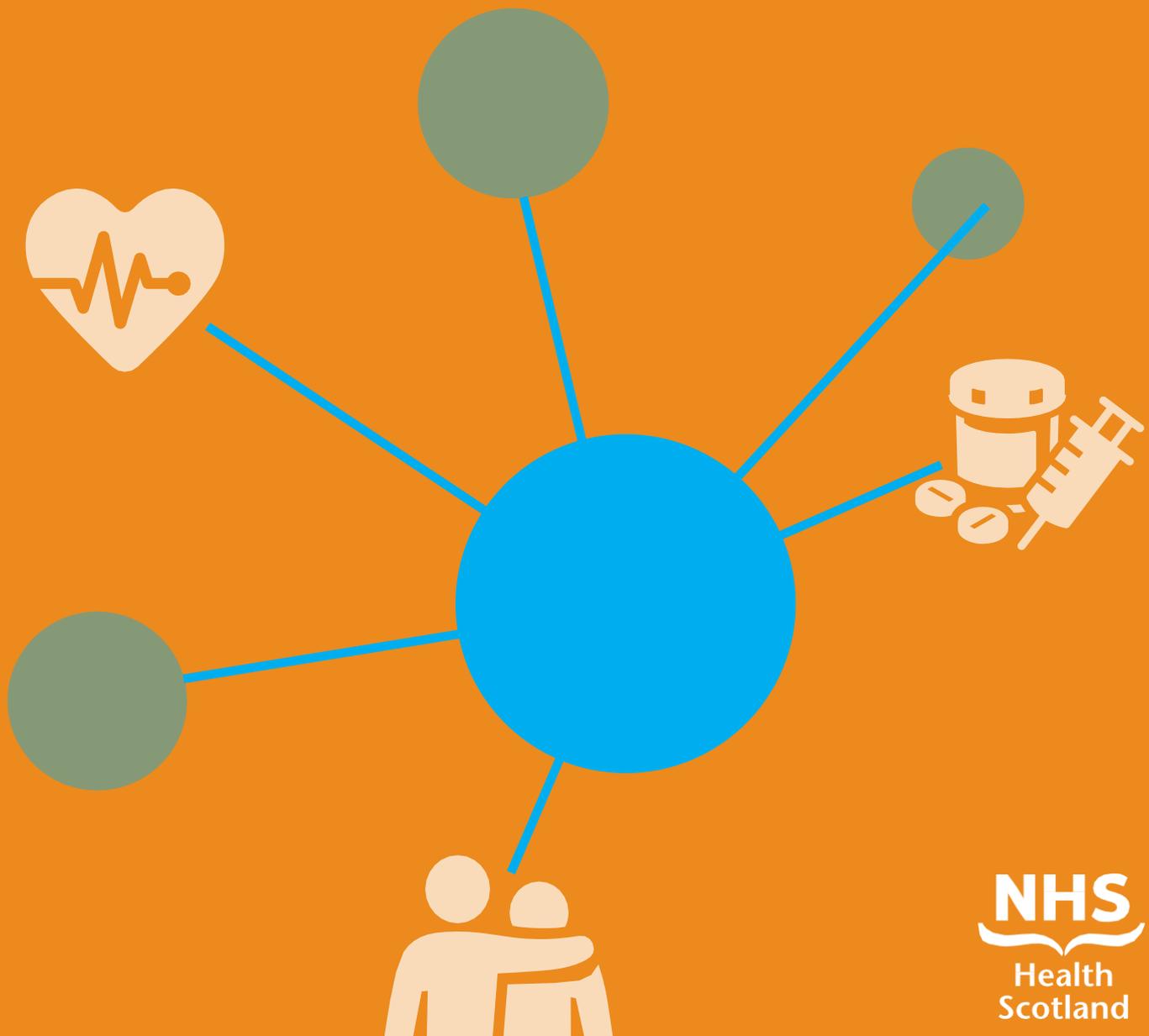


# The Scottish Burden of Disease Study, 2016

Falls technical overview



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# Background

The Scottish Burden of Disease (SBoD) study team have published comprehensive estimates of the burden of disease and injury in Scotland for 2016 [1]. The purpose of this technical overview is to provide background information on the data and methodology used, noting any caveats associated with estimating the burden of falls in SBoD.

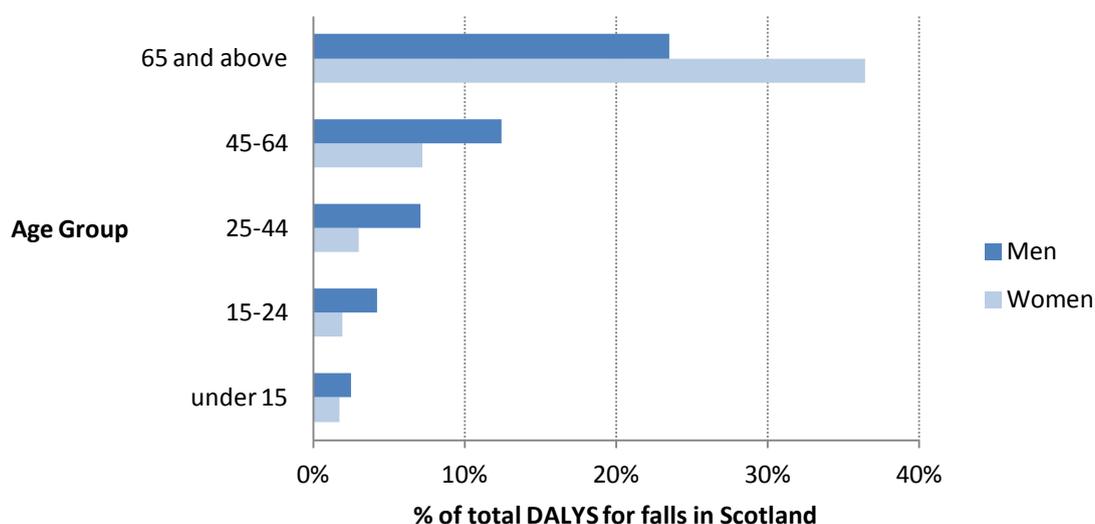
Burden of disease studies aim to estimate the difference between ideal and actual health in a country or region at a specific point in time. Individuals can suffer non-fatal health loss due to suffering disability attributable to a disease, condition or injury, or suffer fatal health loss which is early death due to a disease, condition or injury. To quantify the total burden, non-fatal and fatal health loss are combined to produce a single metric called the Disability-Adjusted Life Year (DALY).

In SBoD 2016, all data are presented as three year averages for period 2014-2016. A three year period is used to smooth out most of the effect if the mortality or morbidity of a single year happens to be unusual. Further information about the SBoD study, including a more thorough explanation of the methodology used, overview reports, detailed results and other specific disease briefings, can be found on the website of the Scottish Public Health Observatory (ScotPHO) [1].

## Estimated burden due to falls

Falls were the 25<sup>th</sup> most common cause of disease burden in Scotland in 2016, resulting in a total of approximately 14,500 DALYs. Of this total burden, 48% was due to premature mortality attributed to falls and 52% was attributed to the short and long term physical impact of fall-related injuries.

**Figure 1 Percentage of total DALYs by gender and age-group for fall-related injuries**

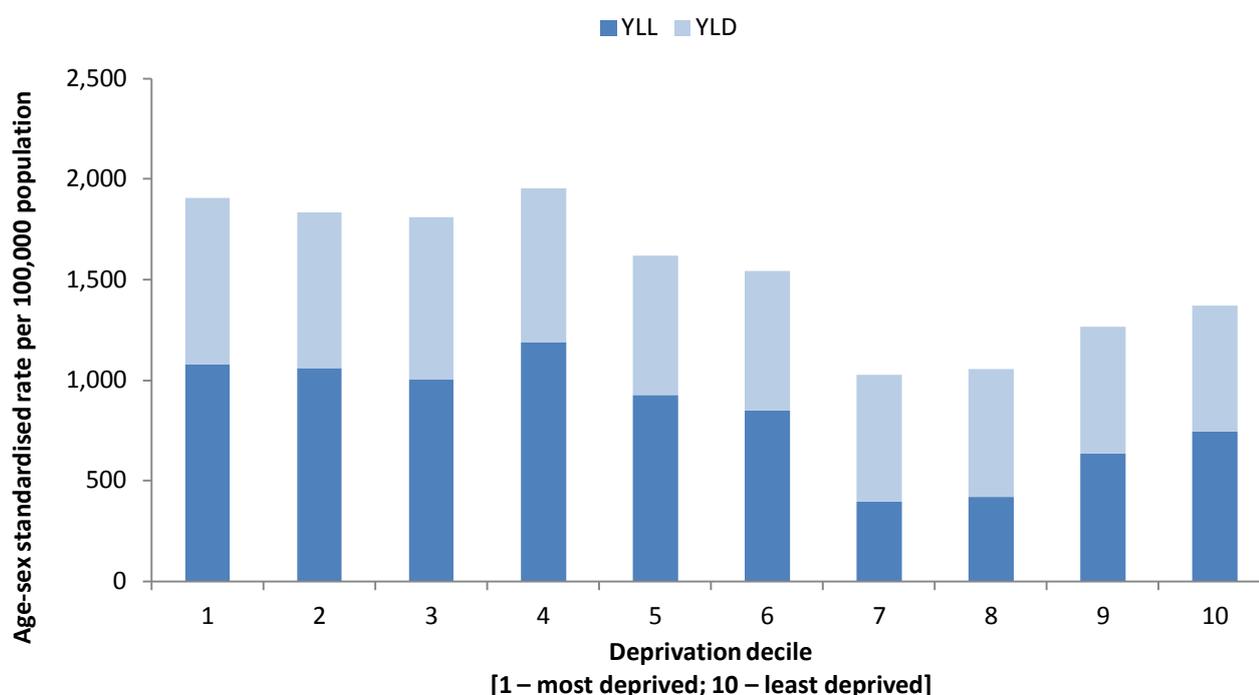


Men and Women contributed similarly to the burden of falls (49.7% and 50.3% respectively). However, women aged 65 and over are the largest single contributor, representing 36% of the burden, as outlined in

Figure 1. The distribution of the burden of falls is noticeably different by gender and age: while the impact for women is relatively small before the age of 65 years; for men, the burden is highest in the age group 45 to 64 years. Note that the burden we are describing is the absolute burden and has not been adjusted for the age/gender case-mix.

The age standardised DALY rates for fall related injuries, by deprivation<sup>1</sup> decile, are shown in Figure 2. The DALY burden increased with increasing levels of deprivation: individuals in the most deprived decile experienced a burden is almost 2 times greater than individuals in the least deprived decile.

**Figure 2 DALY (rates per 100,000<sup>2</sup>) of total falls burden by deprivation decile**



<sup>1</sup> We used the Scottish Index of Multiple Deprivation (SIMD 2016) to analyse patterns of inequality in the burden of disease across Scotland. SIMD2016 is categorised into deciles 1 (most deprived) to 10 (least deprived), SIMD2016 calculates deprived areas, not deprived individuals.

<sup>2</sup> Where the data were age-standardised, this was done directly using the 2013 European Standard Population to account for differences in age structure between SIMD deciles.

# How did we produce these estimates?

DALYs attributed to a disease, or injury, are calculated by combining estimates from two individual metrics: Years of Life Lost (YLL) due to premature mortality and Years Lived with Disability (YLD).

## Years of Life Lost (YLL) due to falls

YLL measures the years of life lost due to premature deaths i.e. the fatal component of burden of disease. YLLs are calculated by subtracting the age at each death by fall from the expected remaining life expectancy for a person at that age.

## Estimating the number of deaths

For the period 2014-2016, we estimated an average of 890 deaths per year caused by falls. These deaths were identified from the underlying cause of death on the National Records of Scotland (NRS) register of deaths [2]. To classify deaths the GBD 2015 cause list was used, which has been created using the International Statistical Classification of Diseases and Related Health Problems (ICD-10) [3, 4]. The NRS register of deaths has a Community Health Index (CHI) number attached to each death, which allows for demographic data such as gender, geographical area of residence and age at death to be established for each individual.

Included in the total falls mortality count are deaths that have come from what are termed ill-defined causes of death in burden of disease studies. These ill-defined deaths are causes of death that have been coded with ICD-10 codes in vital registers but for the purposes of burden of disease studies, are not regarded as sufficiently specific causes of death. In SBoD, these ill-defined deaths are redistributed amongst specific causes of death across the burden of disease cause list based on the secondary causes of death recorded on the death certificate. For a small number of cases, where there was no additional information relating to secondary causes of death, the individual's clinical history was evaluated to inform the target cause for redistribution. For falls, approximately 4% of the mortality count comes from these ill-defined deaths. For this reason, the number of deaths due to TLBC which have been reported are different from that of officially reported sources. Further explanation of this method is available in the Invited chapter of The Registrar General's Annual Review of Demographic Trends [5].

## Life expectancy and YLL

Each single death contributes to the total YLL through calculating the difference between the age at death and the life expectancy at that age. Life expectancy was defined using the 2014-2016 gender-specific National Life Tables for Scotland [6]. There were approximately 7,000 YLL due to falls in Scotland in 2016. Dividing the total YLL for falls by the total mortality count indicates that, on average, individuals who die due to falls, die approximately 9 years younger than would be otherwise expected on the basis of the life expectancy of the general population.

## Years Lived with Disability (YLD) due to fall-related Injuries

To estimate the YLD due to falls in 2016, both the long and short term outcomes of the injury caused by the fall were considered:

- The burden of long term outcomes present in 2016 is based on estimates of the number of individuals suffering life-long physical consequences of a fall recorded in the year 2016 or before (the amount of burden a person endures in 2016 is counted, for all individuals still suffering physical consequences of past falls).
- The burden of short term outcomes in 2016 is based on the number of falls recorded in the year 2016. This burden takes into consideration the duration required to recover from the event.

Both long and short term outcomes are classified according to the nature of the injury. A specific health state<sup>3</sup> is assigned to each nature of injury and each health state carries a disability weight [7].

Disability weights reflect the severity of different health states, with a value ranging from one (maximum possible disability) to zero (no disability at all), and have been developed by the Global Burden of Disease Study using surveys of the general public [8]. This allows the burden of different health conditions to be compared.

For instance, a fall may result in someone breaking the neck of the femur. The process of healing impairs the person for a few weeks. In some cases the injury does not heal completely and s/he suffers life-long effects. In this example, the cause of injury is a fall, the nature of injury is a broken femur, the short term outcome is the impairment suffered for a few weeks and the potential long term outcome could be the impact on mobility caused by the injury. Around 80% of the falls YLD comes from the prevalence of individuals suffering long term outcomes of an injury caused by a fall.

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<sup>3</sup> For instance the health state for long term outcomes of fracture of neck of femur states "...had a broken hip in the past, which was fixed with treatment. The person can only walk short distances, has discomfort when moving around, and has some difficulty in daily activities.".

Years lived with disability (YLD) for falls are estimated using:

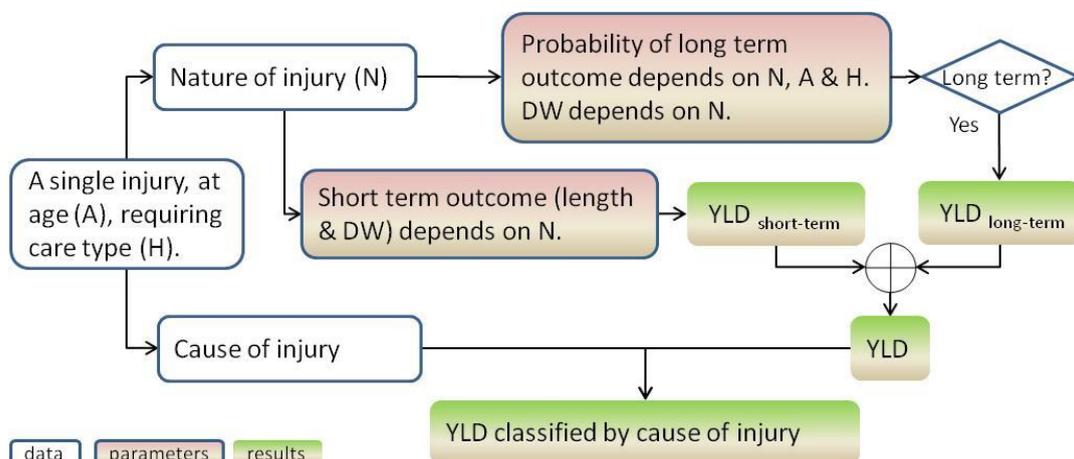
- the number of individuals with a fall in each year
- the probability of having life-long consequences
- the average duration for recovering from an injury caused by the fall
- the severity of the disability associated with the nature of the injury

### Estimating the number of individuals suffering short and long term outcomes, probability of long term outcomes, average duration and disability weights

To estimate the number of fall-related injuries, we linked data from Emergency Departments and hospitalisations using the Community Health Index (CHI) number. Once we identified the age of the individual, the nature and the type of care required (outpatient or inpatient) for the injury, we estimated the likelihood of long term outcomes for it. This method is based on the specifications of the Global Burden of Disease (GBD) study [9]. For short term outcomes, the average duration depended on the nature of the injury and the type of care required for recovery (

Figure 3). The GBD study [9] estimates more than 80 different durations depending on the nature of the injury and the type of care required. The disability weight for both the short and long term outcomes only depended on the nature of the injury.

Figure 3 Diagram summarising the method to calculate YLD based on the injury: nature and cause of injury, age and type of care required (outpatient or inpatient)



In 2016, we counted approximately 55,700 individuals suffering a fall-related injury that year, who were still alive at the end of the year<sup>4</sup>. All of them contributed to the 2016 YLD based on the short term outcome of the injury, but not all of them suffered long term outcomes. This same exercise was done for all years since 1996. For each year before 2016, we counted how many individuals suffered a fall-related injury, calculated the burden of the long term outcome of their injury and carried it over into subsequent years for as long as the individual was still alive. We estimated that in 2016 there were approximately 121,800 individuals living with the physical consequences of a previous fall-related injury. Once we took into account the contribution of all the injuries individuals were estimated to be suffering approximately 7,500 YLDs due to fall-related injuries in Scotland in 2016.

## Data quality

In order to provide a measure of the degree of accuracy<sup>5</sup> and relevance<sup>6</sup> of the estimated disease DALYs to users, a measure of data quality has been developed for the SBoD study. This measure assigns a RAG (Red; Amber; Green) status to each disease or injury indicative of the accuracy and relevance of the estimates. Interpretation of the RAG status can be defined as follows:

### **Highly accurate and relevant**

Estimates have been derived using relevant and robust data sources with only a small degree of adjustments performed to the input data.

### **Moderately accurate and relevant**

Estimates have been derived using reasonably relevant and robust data sources with only a moderate degree of adjustments performed to the input data.

### **Uncertainties over accuracy and relevance**

Estimates have been derived using less comprehensive or relevant data sources with a high degree of adjustments performed to the input data.

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<sup>4</sup> The same individual may have suffered two or more fall-related injuries. All of the injuries were taken into consideration to work out the short term burden of the injury, as long as the time between injuries was longer than the average duration for recovering from the short term outcomes of the injury. If the individual died in 2016, s/he did not contribute to the falls burden for 2016. This life lost is accounted for in the YLL calculation and contributes to the burden of his/her cause of death.

<sup>5</sup> How precise, unbiased or certain the estimate is.

<sup>6</sup> Do we measure the thing we want to measure?

The data quality has been assessed using three main criteria:

- Relevance and accuracy of the data source used to measuring the population of interest
- Likelihood that the implemented disease model captured the overall burden of disease or injury
- The relative contribution of ill-defined deaths to YLL, and YLL to DALY.

These criteria are subjectively assessed and each criterion is scored on a scale of 1 to 5. Further details on these data quality measures are available on the ScotPHO website [1].

Based on these criteria, the estimates of burden of falls in Scotland are  **moderately accurate and relevant.**

The components used for the calculation are almost certainly an under-estimate – particularly of fall-related injuries. While individuals suffering fall-related injuries may attend Emergency Departments, the reporting of the cause and nature of injury is of low quality [10]. Therefore, we cannot confidently say that we have captured most of the long and short term outcomes of fall-related injuries.

Finally, the methodology to translate the burden of injuries to YLD relies heavily on an estimate of the probability of developing long term physical outcomes from the fall. This parameter comes from a single study used by GBD, which covered a broad range of injuries [9] and more research may be required to assess the accuracy of those results.

## What next to improve estimates for falls?

Future iterations of the SBoD will review the process of assigning ill-defined deaths to make use of the contributory causes of death that are recorded in NRS mortality data.

The parameters that determine the non-fatal burden, namely the probability of a long term outcome and the average duration of recovery from injury, will also be reviewed and adapted to the Scottish population if possible.

The quality of data for Emergency Department records has improved in recent years [9] so this data source is becoming increasingly valuable to assess the burden of injuries in general.

These improvements are partly dependant on exploring other data sources and reviewing evidence from high quality research that it is relevant to Scotland. Please contact the SBoD project team ([nhs.healthscotland-sbod-team@nhs.net](mailto:nhs.healthscotland-sbod-team@nhs.net)) for enquiries and suggestions on how to improve our estimates.

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