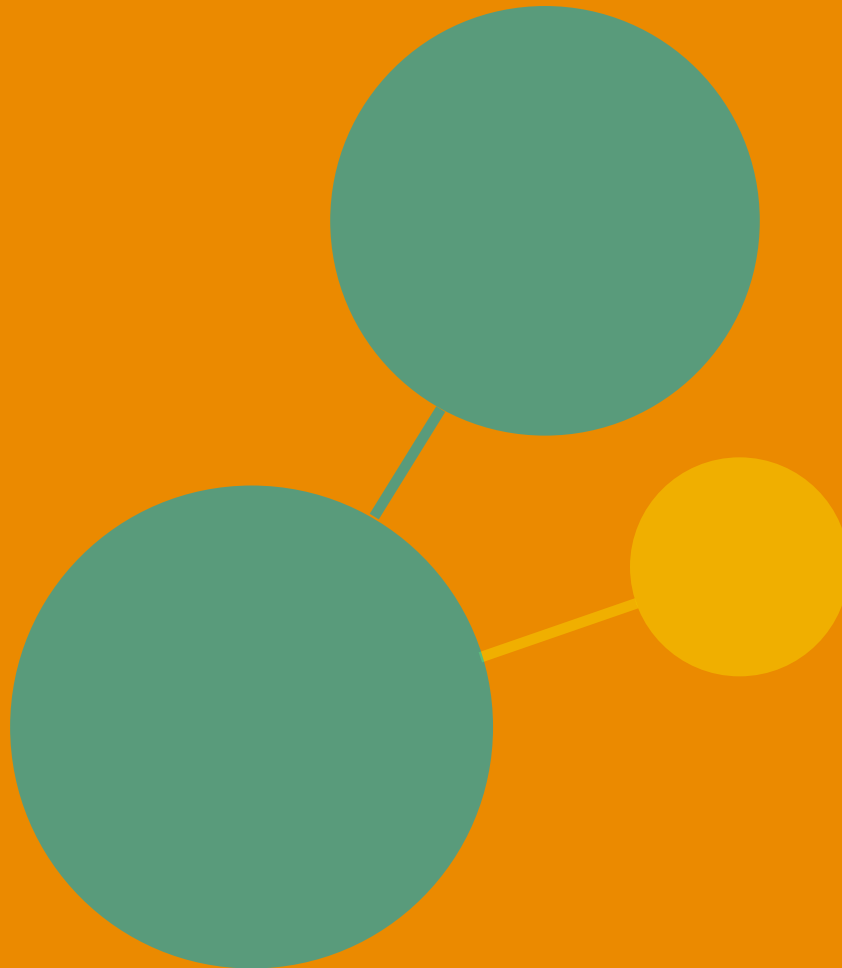



Scottish Burden of Disease Study, 2015

Suicide and self-harm 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 2015 [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 suicide and self-harm related injuries (S&SHRI) in SBoD.

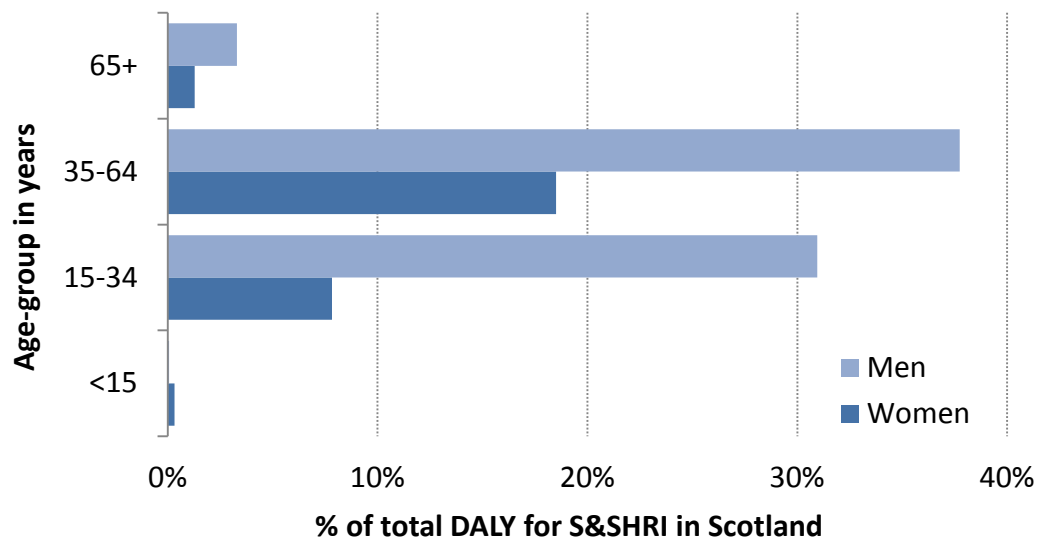
Burden of disease studies aim to estimate the difference between ideal and actual health in a country or region at a specific point in time. Individuals can suffer non-fatal health loss due to suffering disability attributable to a disease, condition or injury, or suffer fatal health loss which is early 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).

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 suicide and self-harm related injuries

S&SHRI was the 16th most common cause of disease burden in Scotland in 2015, resulting in a total of approximately 22,300 DALYs. Of this total burden, 98% was due to premature mortality attributed to suicide and 2% was attributed to the short and long term physical impact of self-harm related injuries (SHRI). The estimate does not take into consideration the potential mental health issues associated with self-harm, such as depression, anxiety, alcohol dependency, drug use disorders or personality disorders which would instead be reported within those categories.

Figure 1 Percentage of total DALYs by gender and age-group for S&SHRI



The majority of Scotland’s S&SHRI burden was contributed by men (72%) rather than women (28%). Overall, 38% of the total S&SHRI burden was contributed by men aged 35 to 64 years, closely follow by men aged 15 to 34 years (31%), as outlined in Figure 1. Note that the burden we are describing is the absolute burden and has not been adjusted for the age/gender case-mix.

How did we produce these estimates?

DALYs attributed to a disease, condition 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 suicide

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 suicide death from the expected remaining life expectancy for a person at that age.

Estimating the number of deaths

There were a total of 630 deaths caused by suicide in 2015. 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 suicide 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. These ill-defined deaths are therefore redistributed amongst specific causes of death across the burden of disease cause list based on the redistribution of deaths method used in the GBD study [3]. For suicide, approximately 13% of the mortality count comes from ill-defined death categories such as ICD-10 codes Y10-Y34 'events of undetermined intent' and other ICD-10 codes. Further explanation of this method is available in the SBoD technical paper [1]. For this reason, the number of deaths due to suicide which have been reported are different from that of officially reported sources.

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 2013 gender-specific National Life Tables for Scotland [5]. There were approximately 21,800 YLL due to suicide in Scotland in 2015. Dividing the total YLL for suicide by the total mortality count indicates that, on average, individuals who die by suicide die approximately 35 years earlier than would otherwise be expected on the basis of the life expectancy of the general population.

Years Lived with Disability (YLD) due to self-harm related injuries

To estimate the YLD due to SHRI in 2015, both the long and short term outcomes of self-harm were considered:

- The burden of long term outcomes present in 2015 is based on estimates of the number of individuals suffering life-long physical consequences of SHRI recorded in the year 2015 or before (the amount of burden an individual endures in 2015 is counted for all individuals still suffering physical consequences of past SHRI)
- The burden of short term outcomes in 2015 is based on the number of SHRI recorded in the year 2015. 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 state¹ is assigned to each nature of injury and each health state carries a disability weight [6]. 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 [7]. This allows the burden of different health conditions to be compared.

For instance, a self-harm incident may result in someone cutting a tendon or nerve. 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 self-harm, the nature of injury is injured nerves, the short term consequence is the impairment suffered for a few weeks and the potential long term consequence could be the impact on mobility caused by the nerve damage. Over 99% of the SHRI YLD comes from the prevalence of individuals suffering long term outcomes of self-harm.

¹ For instance the health state for injured nerves which states "...had a nerve injury in the past, which continues to cause some difficulty moving. The person often injures the affected part because it is numb".

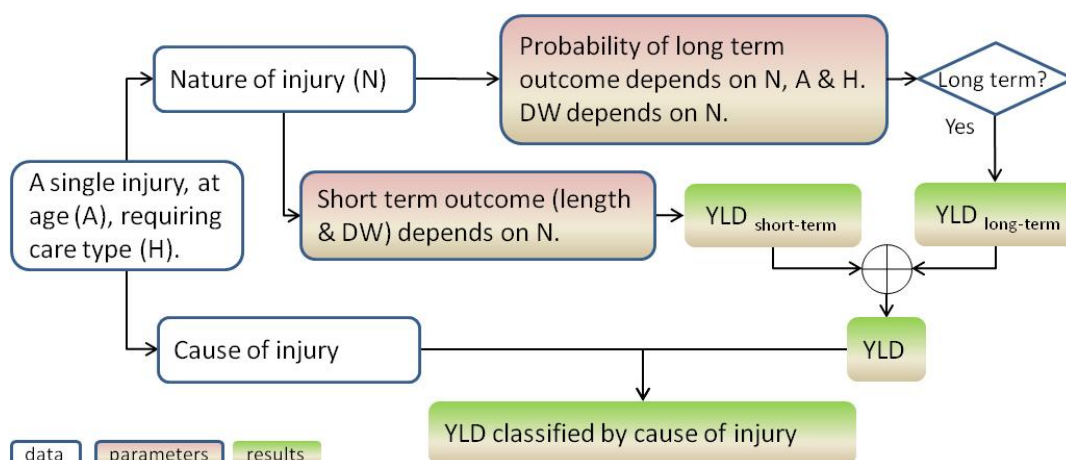
YLD for SHRI are estimated using:

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

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 SHRI, 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 SHRI, we estimated the likelihood of long term outcomes for it. This method is based on the specifications of the Global Burden of Disease (GBD) 2015 study [8]. For short term outcomes, the average duration depends on the nature of the SHRI and the type of care required for recovery, (Figure 2). The GBD 2015 study [8] 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 depends on the nature of the SHRI.

Figure 2 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 2015, we counted approximately 13,300 individuals suffering a SHRI, who were still alive at the end of the year². All of them contributed to the 2015 YLD based on the short term outcome of the SHRI, but not all of them suffered long term outcomes. This same exercise was done for all years since 1981. For each year before 2015, we counted how many individuals suffered SHRI, calculated the burden of the long term outcome of their SHRI and carried it over for as long as they were still alive. We estimated that in 2015, there were approximately 9,000 individuals living with the health consequences of a previous SHRI. Once we took into account the contribution of all the injuries, individuals were estimated to be suffering approximately 500 YLDs due to SHRI in Scotland in 2015. Most of the individuals we counted suffered a SHRI with a long term outcome that contributed a very small amount to the total YLD, such as cuts and poisoning, hence the relatively small YLD. The method does not capture long term mental ill-health consequences within this category.

Data quality

In order to provide a measure of the degree of accuracy³ and relevance⁴ 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. These estimates can be considered a highly accurate depiction of the burden incurred from the disease, condition or injury.

² The same individual may have suffered two or more SHRI. All incidents 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 2015 this life lost is accounted for in the YLL calculation.

³ How precise, unbiased or certain the estimate is.

⁴ Do we measure the thing we want to measure?

 **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. These estimates can be considered a moderately accurate depiction of the burden incurred from the disease, condition or injury.

 **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. These estimates contain substantial uncertainties and should be used with some caution.

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 S&SHRI in Scotland are amber,

 **moderately accurate and relevant.**

The components used for the calculation are almost certainly an under-estimate – particularly of SHRI, but the impact on the DALY is likely to be relatively small because most unrecorded cases are likely to be related to injuries that carry a relatively small disability weight.

Although 98% of the burden of S&SHRI comes from mortality, there are some issues with how suicide deaths are estimated. This study identified suicide deaths using a

restricted list of ICD-10 codes, in particular X60-X84, which refer to 'intentional self-harm'. NRS also includes in its statistics self-harm deaths for which the underlying cause was classified as an 'event of undetermined intent' (ICD-10 codes Y10-Y34 plus Y87.2) [9]. In line with the GBD study, we treated these deaths as ill-defined deaths and redistributed them to suicide and other causes, in particular drug use disorders and various types of injuries: falls, drowning, road injuries, assaults, poisoning and adverse effect of medical treatment.

NRS reported a total of 672 probable suicides (i.e. deaths which are the result of intentional Self-harm or Events of Undetermined Intent in 2015 [9]), which is 6.5% higher than our estimate. If these additional deaths had been included in our calculations, using 34.6 years as the average years of life lost per death caused by suicide, our estimate of the burden would have increased by 6.5%. However, S&SHRI would still have been the 16th largest contributor to Scotland's overall burden.

In addition, while individuals suffering SHRI may attend Emergency Departments, the reporting of the cause and nature of injury is of low quality [10]. Coding and likelihood of hospital inpatient admittance for SHRI is also suspected of being of variable quality. Therefore, we cannot confidently say that we have captured most of the long and short term consequences of self-harm related injury that happened. There will also be cases of individuals not disclosing their cause of injury. However the YLD would have to increase seven fold to move S&SHRI from being the 16th to the 15th largest contributor to Scotland's overall burden. As the estimated short and long term physical consequences of SHRI are low, we would need to see a very large increase in prevalence of SHRI to change its rank. Note that the long term mental health burden for these individuals should be captured elsewhere (in our calculations of burden due to depression, anxiety, etc).

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 a self-harm incident. This parameter comes from a single study used by GBD, which

covered a broad range of injuries [8] and more research may be required to assess the accuracy of those results.

What next to improve SBoD estimates for S&SHRI?

Future iterations of the SBoD will work to align the definition of suicide with that of the NRS. In addition to this, the process of assigning ill-defined deaths will be reviewed, 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 consequence 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 [10] 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) for enquiries and suggestions on how to improve our estimates.

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