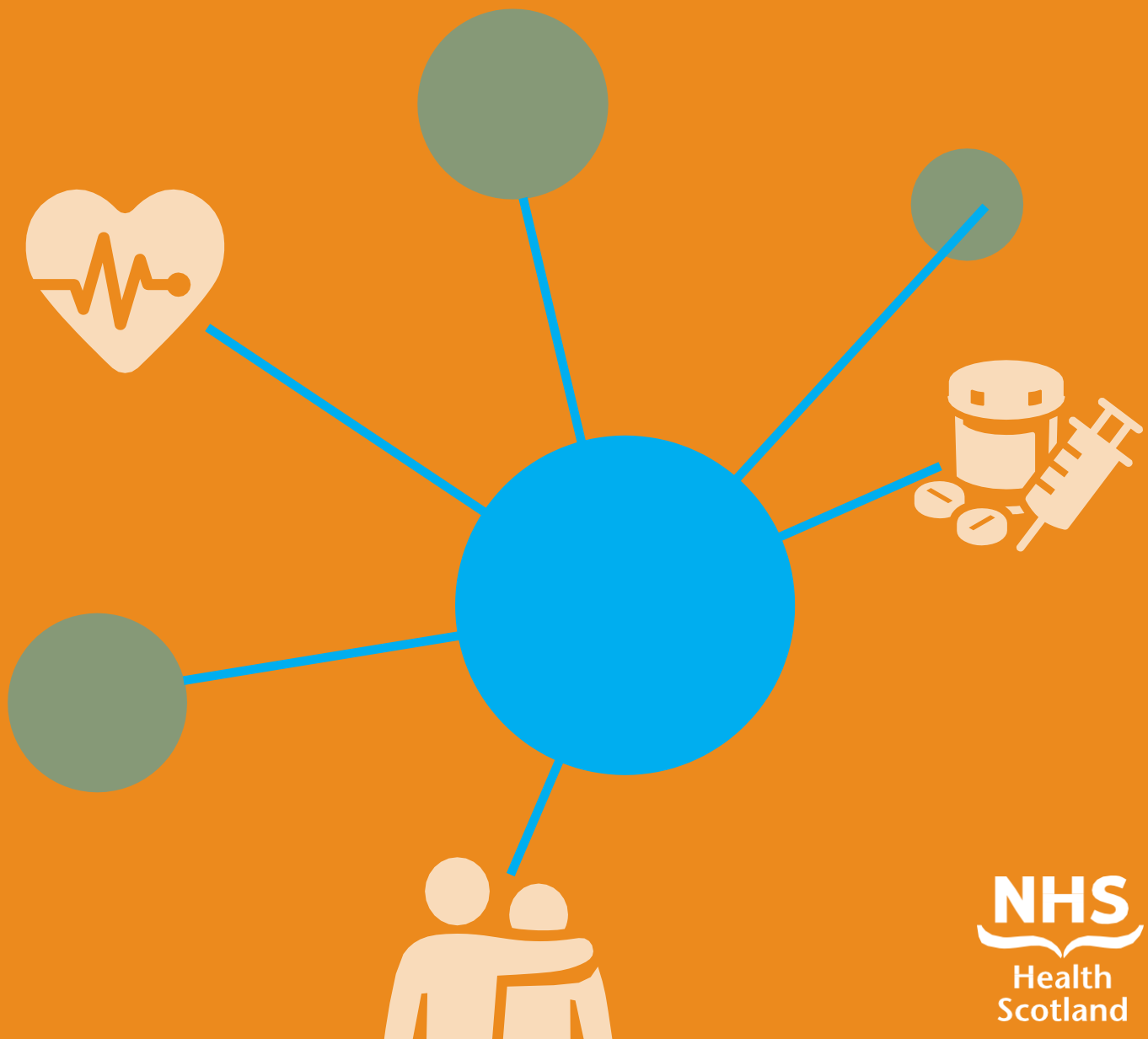



# The Scottish Burden of Disease Study, 2016

## Lower respiratory infections technical overview



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1 South Gyle Crescent  
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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 lower respiratory infections (LRIs) in SBoD.

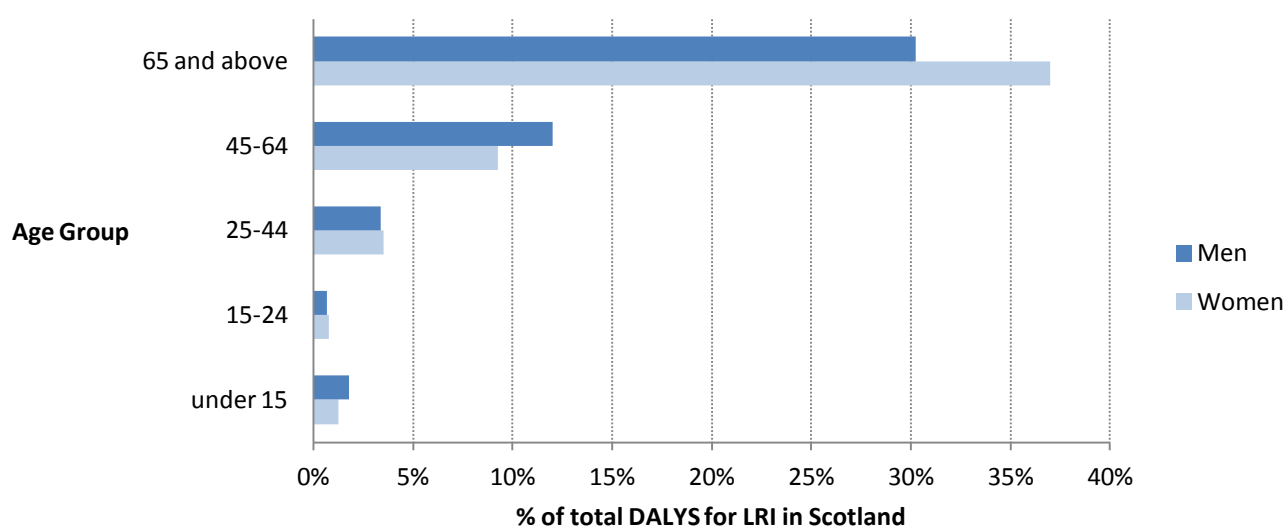
Burden of disease studies aim to estimate the difference between ideal and actual health in a country or region at a specific point in time. Individuals can suffer non-fatal health loss due to suffering disability attributable to a disease, condition or injury, or suffer fatal health loss which is early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

LRIs were the 18<sup>th</sup> most common cause of disease burden, in Scotland in 2016, resulting in a total of approximately 22,000 DALYs. Of this total burden, 94% was due to premature mortality attributed to LRI and 6% was attributed to health loss suffered due to living with LRI.

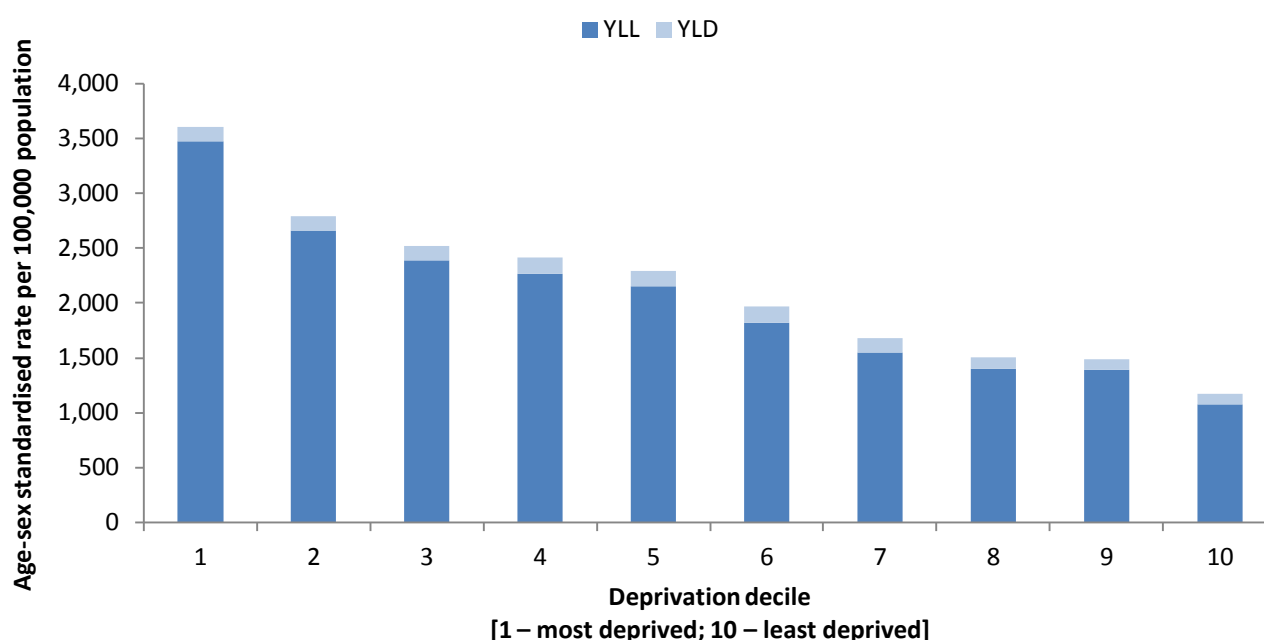
**Figure 1 Percentage of total DALYs by gender and age-group for LRIs**



Men and women contributed a similar share of the burden (48% vs. 52%). Overall, 67% of the total LRIs burden was contributed by individuals aged 65 years and over, as outlined in Figure 1. Note that the burden we are describing above is the absolute burden and has not been adjusted for the age/gender case-mix.

The LRIs DALY increased with increasing levels of deprivation<sup>1</sup>, as outlined in Figure 2. Individuals in the most deprived decile experienced a burden that was 3 times greater than individuals in the least deprived decile.

**Figure 2 LRIs DALY (rates per 100,000<sup>2</sup>) by deprivation decile**



## 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).

<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.

## Years of life lost (YLL) due to lower respiratory infections

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 LRI death 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 2,100 deaths per year caused by LRIs, 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 2016 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 LRIs 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 LRIs, approximately 2% of the mortality count comes from these ill-defined deaths. For this reason, the number of deaths due to LRIs 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 20,800 YLL due to LRI in Scotland in 2016. Dividing the total YLL for LRIs by the total mortality count indicates that, on average, individuals who die due to LRIs die approximately 8.3 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 lower respiratory infections

Years lived with disability (YLD) are estimated using:

- disease and injury prevalence estimates
- levels of severity
- disability weights

Our sources of information for these three components are as follows:

### **Number of incidents**

To estimate the number of LRI incidents in 2016, the Practice Team Information dataset (PTI) was used [7]. This dataset was collected by ISD Scotland from April 2003 to September 2013. It includes information from a nationally representative 5% sample of Scottish General Practices regarding face-to-face consultations between individuals and a member of the practice team (GPs, nurses and clinical assistants). The presence of a unique patient-identifier on the dataset allows for the grouping of consultations for each individual. The reason for each consultation was coded using Read codes [8]. The number of individuals that had a Read code specific to LRI between 1 April 2003 and 31 September 2013 were used to estimate the annual trend. The number of individual's were counted and if they consulted more than once in a given year, assuming that their consultations were more than 56 days apart, additional incidents was recorded. We projected the estimated annual incidence trends of chronic other sense organ diseases for the period covered by PTI (2003-2013) to 2014, 2015 and 2016. There is no information about the death of individuals in PTI, so adjustments to account for deaths were made using average mortality rates for each age, gender and deprivation decile in Scotland.

Using this method of identifying the number of incidents of LRI, we estimated that there were approximately 142,100 incidents of LRIs in the Scottish population in 2016.

### **Severity distribution and disability weights**

The levels of severity and disability due to LRIs in Scotland were based on the specifications of the GBD 2016 study [9]. This allowed the number of incidents to be disaggregated by levels of severity and the associated disability at each level of severity. Each incident of LRIs was assumed to have lasted, on average, for 56 days [9]. The disability weights were developed by the GBD study through surveys of the general public and take into account the consequences of each disease, condition and injury [10]. The severity distribution and disability weights for LRI are outlined in Table 1.

**Table 1 Description and allocation to severity levels for LRIs with corresponding disability weight**

Severity level	Description	% of individuals	Disability weight
Moderate	Has a fever and aches, and feels weak, which causes some difficulty with daily activities.	85	0.051
Severe	Has a high fever and pain, and feels very weak, which causes great difficulty with daily activities.	15	0.133
Guillain-Barré syndrome	Is paralyzed from the waist down, cannot feel or move the legs and has difficulties with urine and bowel control. The person uses a wheelchair to move around.	0	0.296

Once the severity of LRI, duration and associated disability were taken into account, individuals were estimated to be suffering approximately 1400 YLDs in 2016, due to LRI.

## Data quality

In order to provide a measure of the degree of accuracy<sup>3</sup> and relevance<sup>4</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..


<sup>3</sup> How precise, unbiased or certain the estimate is.

<sup>4</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 LRI in Scotland are:  **moderately accurate and relevant.**

When estimating the burden of LRI, we have estimated that 94% of the burden is attributed to premature mortality due to LRI. Scottish mortality data is deemed to be of high-quality, which is the main reason for this assessment [10].

Estimates of the number of incidents of LRI in a population are difficult to obtain, as studies are usually restricted to specific pathogens and relate to confirmed incidents only. In our study, we have chosen to use GP consultations to determine the number of incidents of suspected LRI, as using confirmed incidents only would be likely to produce an underestimate.

The Global Burden of Disease study (GBD) estimated there were 4.3 LRI incidents per 100 individuals in Scotland in 2016 [12]. Our comparable estimate is 2.6 incidents per 100 individuals. In our study, the non-fatal burden (YLD) contributes a higher proportion of DALYs (6.2%) than is estimated in GBD 2016 (0.01%). In SBoD, we use Scottish life expectancy to estimate YLL which means our YLL is always lower than that estimated by GBD (who use an aspirational life expectancy [12]). If we had used the aspirational life table, the share of the non-fatal burden would have reduced.

## **What next to improve estimates for lower respiratory infections?**

Future work on the SBoD study will include reviewing the coding and recording of LRI in alternative national datasets. The development of the Scottish Primary Care Information Resource (SPIRE) will provide a future source of estimates for incidents of LRI [13]. Further to this, work will be carried out to attempt to derive estimates of severity levels that are dependent on age and that are specific to the Scottish population.



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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