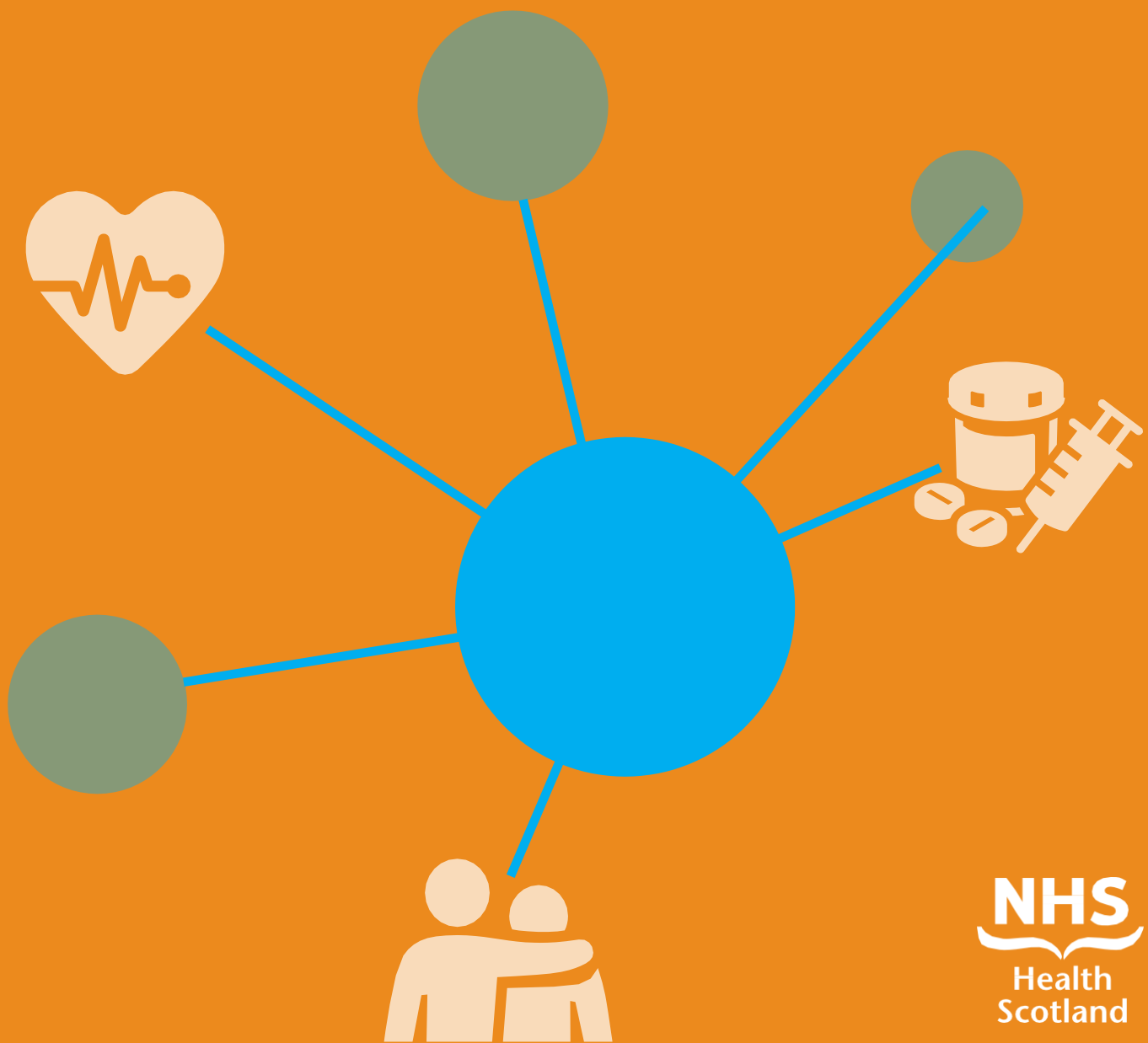



The Scottish Burden of Disease Study, 2016

Asthma 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 asthma in SBoD.

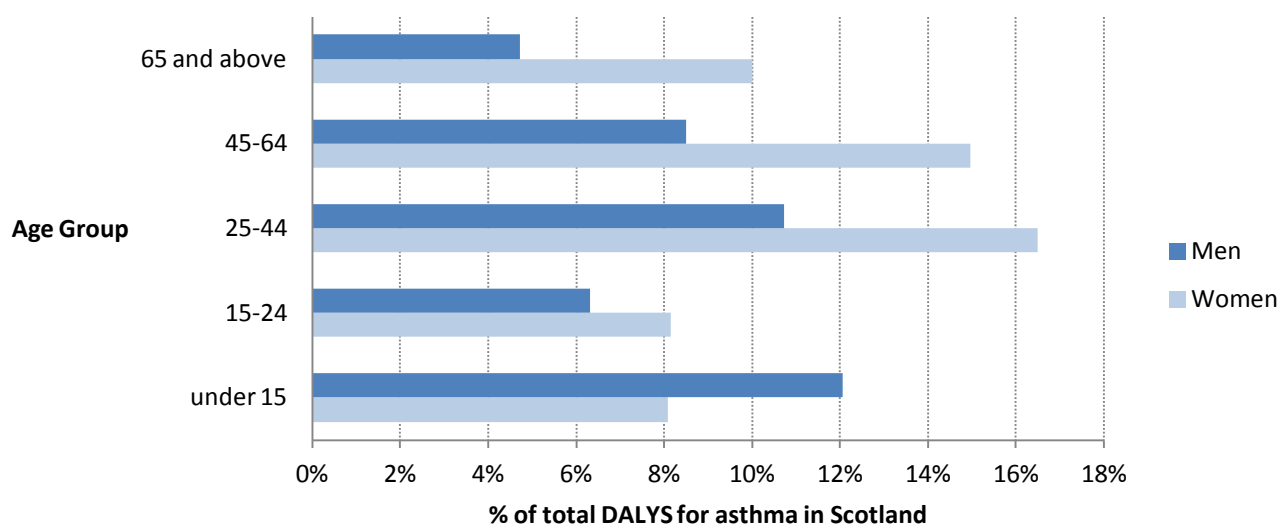
Burden of disease studies aim to estimate the difference between ideal and actual health in a country or region at a specific point in time. Individuals can suffer non-fatal health loss due to suffering disability attributable to a disease or injury, or suffer fatal health loss which is early death due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

Asthma was the 23rd most common cause of disease burden in Scotland in 2016, resulting in a total of approximately 15,800 DALYs. Of this total burden, 13% was due to premature mortality attributed to asthma and 87% was attributed to the health loss suffered due to living with asthma.

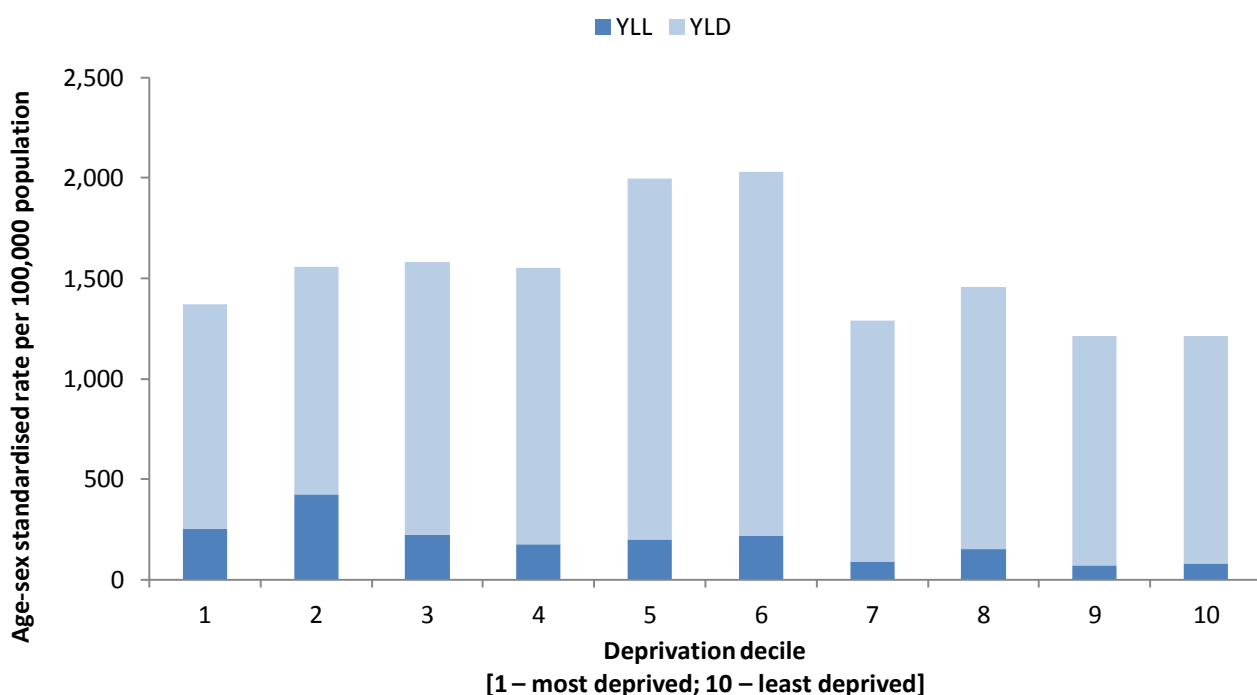
Figure 1 Percentage of total DALYs by gender and age group for asthma



The percentage of the total asthma DALY was greater for women (58%) than men (42%). Overall, people aged 25-44 years accounted for over quarter of the burden (27%) followed by those aged 45-64 years (23%). In both these age groups, women contributed a higher proportion (16% and 15% respectively) to the total burden, than men (11% and 8% respectively) (Figure 1). In contrast, in children aged under 15, boys (12%) accounted for more of the overall asthma burden than girls (8%). Note that the burden we are describing above is the absolute burden and has not been adjusted for the age/gender case-mix.

The burden of asthma varied by deprivation¹ decile as outlined in Figure 2. The highest DALY rates were found in decile five and six (2,037 and 2,072 per 100,000 respectively). There was little difference in the total asthma burden between the most and least deprived decile however the contribution of the fatal burden to the asthma DALY was higher in the most deprived decile (18%), compared to the least deprived decile (7%).

Figure 2 Asthma DALY (rates per 100,000²) by deprivation decile



¹ 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.

² 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 Asthma

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 asthma 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 136 deaths per year caused by asthma. 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 asthma 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. 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 individuals clinical history was evaluated to inform the target cause for redistribution. For asthma, approximately 8% of the mortality count comes from these ill-defined deaths. For this reason, the number of deaths due to asthma 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 2,000 YLL due to Asthma in Scotland in 2016. Dividing the total YLL for asthma by the total mortality count indicates that, on average, individuals who die due to asthma die 15 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 asthma

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 were as follows:

Estimating the number of individuals suffering disability

To estimate prevalent cases of asthma in 2016, data from the Quality & Outcomes Framework (QOF) was used [7]. The QOF measures a General Practices achievement against a set of evidence based indicators. Payments are made to each general practice based on the achievements against these indicators. QOF was a major part of the new General Medical Services (GMS) contract, which was introduced on 1st April 2004 and decommissioned on the 31st March 2016. QOF contains information on General Practices with a registered population in Scotland. The QOF measures achievement against a range 74 indicators and includes quality indicators for asthma. Prevalence data within the QOF are collected in the form of practice 'registers'. A QOF register may count patients with one specific disease or condition, or it may include multiple conditions. There may also be other criteria for inclusion on a QOF register, such as age or time of diagnosis.

We used QOF asthma prevalence rates (6.3 per 100) as at 1st April 2016 to estimate our total prevalence count for asthma (7). The total prevalent estimate was later redistributed to different deprivation decile, age groups and gender based on the proportions we obtained from the Practice Team Information dataset (PTI) [8]. 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 [9]. The number of individuals that had a Read code specific to asthma between 1 April 2003 and 31 September 2013 were used to estimate the age groups and gender proportions. The list of Read codes we used to identify asthma consultations can be found on the ScotPHO website [1]. We used the average number of individuals consulting for asthma per year, for the time period covered by PTI (2003-2013) to estimate the number of prevalent cases in 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 prevalent cases of asthma, we estimated that there were approximately 348,500 individuals in the Scottish population living with asthma in 2016.

Severity distribution and disability weights

The levels of severity and disability due to asthma in Scotland were based on the specifications of the GBD 2016 study [10]. This allowed prevalent cases to be disaggregated by levels of severity and the associated disability at each level of severity. 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 [11]. The severity distributions and disability weights for asthma are outlined in

Once the severity of asthma and associated disability were taken into account, individuals were estimated to be suffering approximately 14,000 YLDs due to asthma in Scotland in 2016.

Table 1.

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

Cause	Description	Disability Weight	Distribution
Asthma, no symptoms	has no symptoms within the past 4 weeks	0	36%
Asthma, controlled	has wheezing and cough once a month, which does not cause difficulty with daily activities.	0.015	20%
Asthma, partially controlled	has wheezing and cough once a week, which causes some difficulty with daily activities.	0.036	21%
Asthma, uncontrolled	has wheezing, cough and shortness of breath more than twice a week, which causes difficulty with daily activities and sometimes wakes the person at night.	0.133	23%

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.

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.

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 asthma in Scotland are  **moderately accurate and relevant.**

³ How precise, unbiased or certain the estimate is.

⁴ Do we measure the thing we want to measure?

Our asthma DALY of approximately 15,800 is lower than the DALY (22,660) estimated in GBD2016 (12). Although YLL contributes a larger proportion to the SBoD asthma DALY than it does in the GBD (13% and 9% respectively), our YLD contributes a smaller proportion of the DALY compared to GBD2016, primarily because GBD estimate a higher prevalence of asthma: we estimated that there were approximately 348,500 individuals living with asthma in Scotland in 2016 compared to 534,358 individuals estimated in GBD2016 [12]. Asthma UK estimates that 368,000 people are currently receiving treatment for asthma [13]. The prevalence of asthma however can depend on the definition and data source used: Mukherjee et al (2016) reported that the annual prevalence (in 2010-11) of patient reported clinician-diagnosed symptomatic asthma in Scotland was 9.9% (equivalent to approximately 535,100 people in Scotland with asthma in 2016) 5.6 % (approximately 303,000 people) for a clinician diagnosed asthma and of 6.0% for clinician- diagnosed-and-treated asthma (approximately 325,300 people) [14].

What next to improve estimates for asthma?

Future work on the SBoD study will attempt to refine the estimates of prevalence. This work will include reviewing the coding and recording of asthma in alternative national datasets and exploring local area datasets for information. The development of the Scottish Primary Care Information Resource (SPIRE) will help us to improve our estimates of the burden of disease in Scotland [17]. 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) for enquiries and suggestions on how to improve our estimates.

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