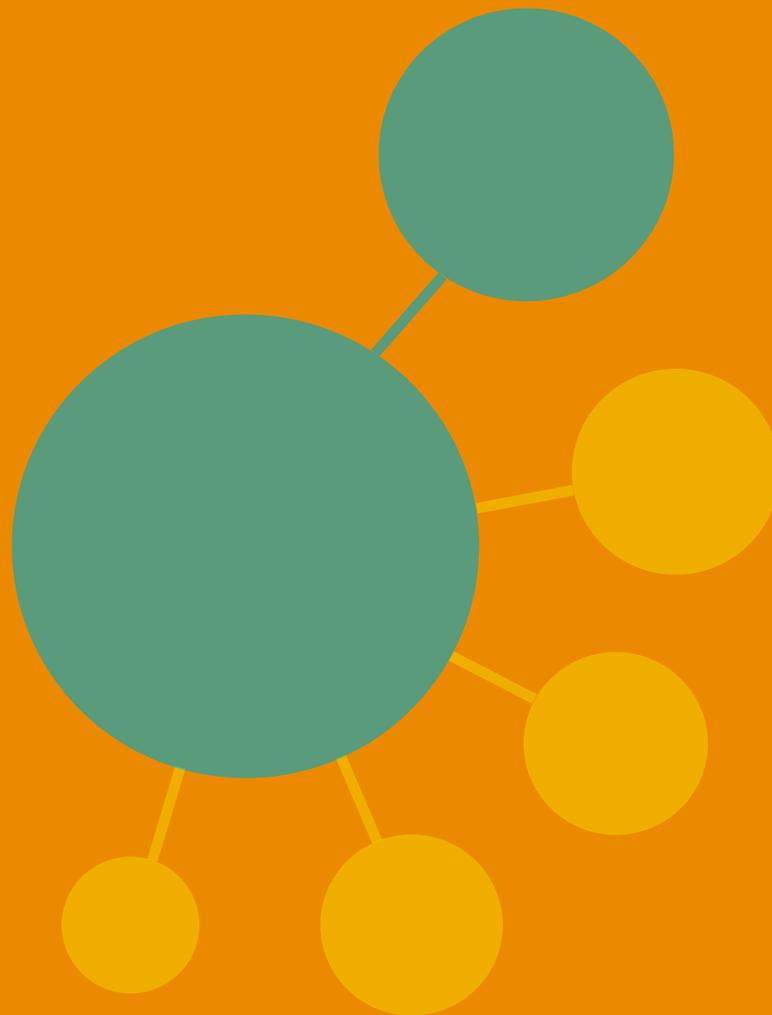


Scottish Burden of Disease Study, 2015

Diabetes mellitus technical overview



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Published by NHS Health Scotland

1 South Gyle Crescent
Edinburgh EH12 9EB

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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 diabetes in SBoD.

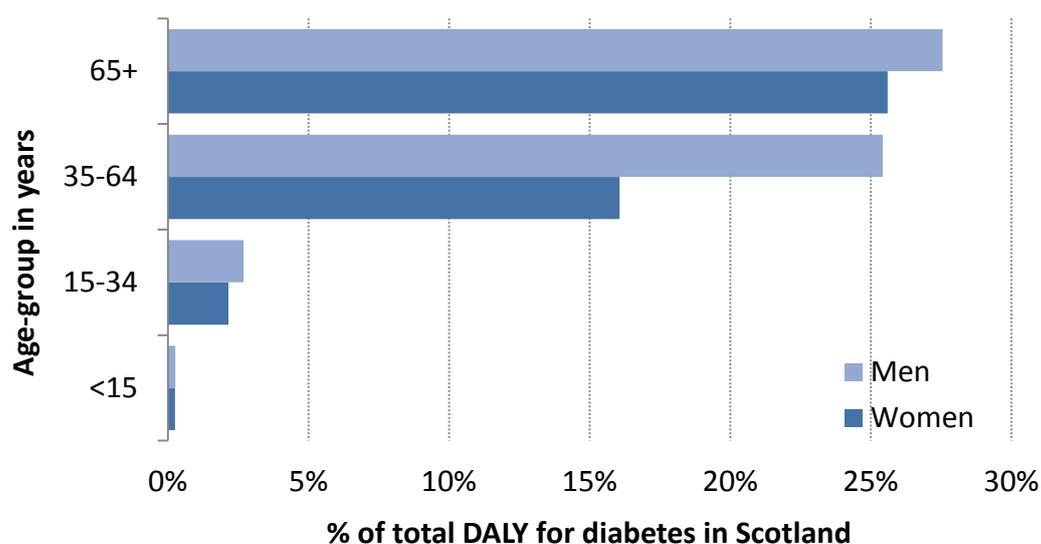
Burden of disease studies aim to estimate the difference between ideal and actual health in a country or region at a specific point in time. Individuals can suffer non-fatal health loss due to suffering disability attributable to a disease, condition or injury, or suffer fatal health loss which is early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

Diabetes was the 14th most common cause of disease burden in Scotland in 2015, resulting in approximately 25,700 DALYs. Of this burden, 30% was due to premature mortality attributed to diabetes and 70% was attributed to health loss suffered due to living with diabetes.

Figure 1 Percentage of total DALY by gender and age-group for diabetes



The percentage of the total diabetes DALY was greater for men (56%) than women (44%). Overall, people aged 65 years and over accounted for over half (53%) of the total diabetes burden in Scotland in 2015: men in this age group contributed a slightly higher proportion (28%) to the total burden than women (26%). Men aged 35-64 years accounted for 25% of the total diabetes burden, compared to 16% of women aged 35-64 years. At younger ages, there were no differences between men and women (Figure 1). Note that the burden which 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 due to diabetes

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 skin and subcutaneous disease death from the expected remaining life expectancy for a person at that age.

Estimating the number of deaths

There were approximately 640 deaths caused by diabetes 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 diabetes mortality count are deaths that have come from what are termed ill-defined cause of deaths in burden of disease studies. These ill-defined deaths are causes of death that have been coded with ICD10 codes in vital registers but for the purposes of burden of disease studies, are not regarded as sufficiently specific causes of death [3]. 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 diabetes, 8% of the total death count comes from ill-defined death categories (such as 'acute and unspecified renal failure', 'intracranial and intraspinal phlebitis', and 'thrombophlebitis'). Further explanation of this method is available in the SBoD technical paper [1]. For this reason, the number of deaths due to diabetes 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 7,700 years lost to premature mortality caused by diabetes in Scotland in 2015. Dividing the total YLL for diabetes by the total mortality count for diabetes indicates that, on average, individuals with diabetes die approximately 12 years earlier than one would

otherwise be expected on the basis of the life expectancy of the general population.

Years lived with disability due to diabetes

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 prevalence

To estimate prevalent cases of diabetes in 2015, the Scottish Diabetes survey (2015) was used [6]. The Scottish Diabetes Survey is the most complete routine data source for diabetes in Scotland. Based on data provided by all 14 Scottish health boards, it combines information from primary and secondary care. The survey provides data on the number of people with diabetes, the effects on their health, and the progress being made to improve the delivery and outcomes of care for diabetes. Data for this survey is extracted from the Scottish Care Information – Diabetes Collaboration (SCI-DC), NHS Scotland's diabetes patient management system, which is used in every health board and holds data on all people with diabetes living in Scotland. The SCI-DC database was rolled out across Scotland from 2000 and the estimated coverage of the total diabetic population is around 99% [7].

Using this method of identifying prevalent cases of diabetes, the 2015 Scottish Diabetes Survey estimated that there were approximately 284,000 individuals in the Scottish population living with diabetes in 2015.

Severity distribution and disability weights

The levels of severity and disability due to diabetes in Scotland were based on the specifications of the GBD 2015 study [8]. This allowed us to disaggregate the prevalent cases into 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 [9]. The severity distributions and disability weights for diabetes are outlined in Table 1.

These severity distributions and disability weights were applied to the estimated number of people living with diabetes (n= 284,000), resulting in a total of 18,000 YLD due to diabetes in Scotland in 2015.

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

Severity level	Description	% of individuals	Disability weight
Uncomplicated diabetes	Has a chronic disease that requires medication every day and causes some worry but minimal interference with daily activities.	76	0.049
Neuropathy and other complications of diabetes	Has pain, tingling and numbness in the arms, legs, hands and feet. The person sometimes gets cramps and muscle weakness.	22	0.299
Vision loss due to diabetes mellitus	See below for levels of severity	2	See below
Total		100	
Moderate vision loss	Has vision problems that make it difficult to recognize faces or objects across a room.	(73)	0.008
Severe vision loss	Has severe vision loss, which causes difficulty in daily activities, some emotional impact (for example worry), and some difficulty going outside the home without assistance.	(10)	0.001
Blindness	Is completely blind, which causes great difficulty in some daily activities, worry and anxiety, and great difficulty going outside the home without assistance.	(17)	0.002

Data quality

In order to provide a measure of the degree of accuracy¹ and relevance² 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.

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

¹ How precise, unbiased or certain the estimate is.

² Do we measure the thing we want to measure?

- 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 diabetes in Scotland are

 **highly accurate and relevant.**

We have used a national diabetes survey based on data from a national diabetes register with near complete population coverage. The Scottish Care Information-Diabetes Collaboration (SCI-DC) database, registers data on all individuals assigned a diagnosis of diabetes by their clinicians for 99.5% of general practices nationally. Diagnostic coding levels are very high for adults because they are required to receive payments under the general practice United Kingdom pay-for-performance program [10]. A validation study among the subset of people with diabetes mentioned on a hospital record in 2007 found that 99% were included in the diabetes register [7].

However, our estimate of diabetes prevalence does not take into account people with type 2 diabetes who have few symptoms and who are not diagnosed as diabetic. It has been estimated that there were approximately 30,500 individuals, aged 16 years and over, with undiagnosed diabetes in Scotland in 2015, just under 10% of all people with diabetes (diagnosed and undiagnosed combined [11]). If we are to assume that this undiagnosed population all had uncomplicated diabetes, the additional YLD contributed by this undiagnosed population would increase YLD by 1500 and diabetes would move from 14th to 13th in the DALY ranking for Scotland in 2015.

What next to improve estimates for diabetes?

Future iterations of the SBOD will work to refine our estimates of prevalence to take into account the estimated undiagnosed diabetic population in

Scotland. Further to this, work will be carried out to attempt to derive estimates of severity levels for diabetes using data from the Scottish Care Information – Diabetes Collaboration 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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