

Scottish Burden of Disease study

**Forecasting the future burden of disease:
Incorporating the impact of demographic
transition over the next 20 years**

November 2022



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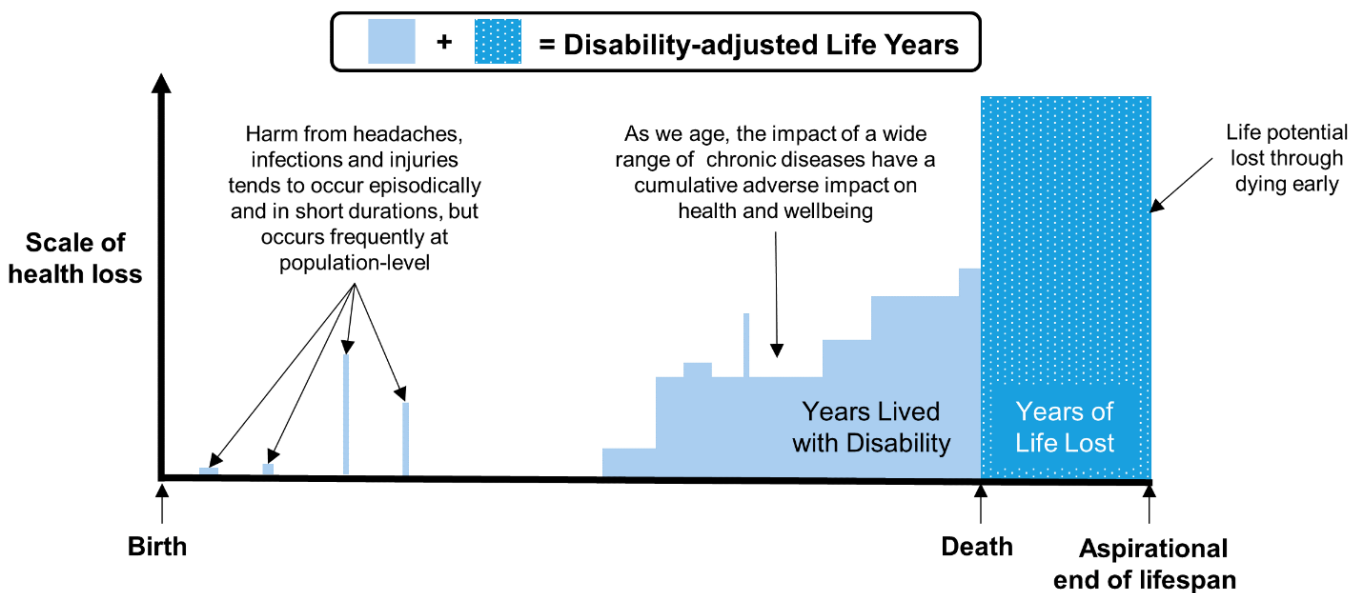
Key points

- Estimates of annual disease burdens characterise the proportionate impact of causes of morbidity, and mortality, on population health and can help inform discussions over priorities for workforce and care service planning and redesign, and disease prevention.
- Despite an overall decline in the projected population in 20 years' time, the annual disease burden is forecast to increase 21% over a similar period.
- To achieve a similar level of crude disease burden as 2019, the forecasted annual disease burden in 2043 would need to reduce by 17% which is equivalent to eradicating the entire disease burden of cancer in 2019.
- In terms of overall health needs, the sub-group with the largest forecasted annual crude disease burden is those aged 65 to 84 years. This is due to the interaction between the extent of health needs and increasing size of this population sub-group.
- Cause-specific forecasts indicate that the five leading grouped causes in 2019 are the same as those forecast to be the leading causes in 2043.
- Absolute increases in annual disease burdens are forecast to be largest for cardiovascular diseases, cancers, and neurological diseases. These three disease groups account for 68% of the total increase in forecasted disease burden.
- Forecasted relative increases in annual disease burdens highlight increases for: common infectious diseases; unintentional injuries; diabetes and kidney diseases; and chronic respiratory diseases.
- These estimates only account for projected demographic changes (i.e. the expected changes in the number of people and their ages) and assume that disease prevalence rates remain the same in 2043 as in 2019. They do not take into account changes in disease prevalence and mortality that could occur due to changing risk factor profiles, access to services or advances in prevention and treatment.

1. Background and aim

The Scottish Burden of Disease (SBOD) study is a population health surveillance system which monitors how diseases, injuries and risk factors prevent the Scottish population from living longer lives in better health. The SBOD study measures the burden of disease using disability-adjusted life years (DALYs). DALYs are a summary measure of population health that combine the impact of morbidity and mortality in a comparable manner, as illustrated in Figure 1.

Figure 1. An illustration of how DALYs accumulate through the life course



This comparability is achieved through framing health loss due to living with, and dying from, causes of diseases and injury as a function of time (years of life lost). Through standardising health loss in a single metric, the impact can be considered cumulatively across the life course, meaning comparisons within and across diseases can be made on a like-for-like basis. Therefore, DALYs can be used to inform the proportionate impact that causes of disease and injury are having in preventing Scottish residents from achieving aspirational longevity and minimising the time they live in less-than-ideal health states.

The aim of this briefing paper was to forecast the burden of disease over the next two decades. As these forecasts indicate how the changing demographic situation in Scotland will impact the causes of disease burden, these forecasts are useful to contribute to discussions over informing priorities for workforce and care service planning and redesign, and for prioritising areas for disease and injury prevention. This work does not look at the additional impact of changing prevalence or treatment of diseases, although the SBOD study is working to produce scenarios to assess this. There is also substantial uncertainty about the future demographic profile of Scotland given the recent stalled trends in life expectancy, the COVID-19 pandemic, and changes in migration patterns.

2. Methodology

DALY rates were sourced from the SBOD study for 2019.¹ Data were sourced for each five-year age group, separately for males and females. In this briefing paper, age-sex specific disease burden rates were assumed to be constant over the forecasting period, which means that there will be no future changes – either positive or negative – to the underlying epidemiological rates. This means that although the underlying epidemiological trends incorporate the 2019 epidemiological situation at an age-sex specific level (rates are defined for 20 demographic sub-groups), they do not incorporate any changes over time. The implications of this are that forecasts might under/overestimate the future disease burden if the age-standardised disease burden had been de/increasing in the years prior to 2019, or if any changes happen post-2019. However, it has been well evidenced that there has been a lack of epidemiological improvements in both life expectancy and healthy life expectancy over the last ten years, meaning this is likely a plausible scenario, particularly at an all-cause level.^{2,3} As sourced SBOD estimates are from the year prior to the COVID-19

pandemic, the impact of the COVID-19 pandemic has not been included in these forecasts, and negative health impacts of the cost-of-living crisis will not be captured.

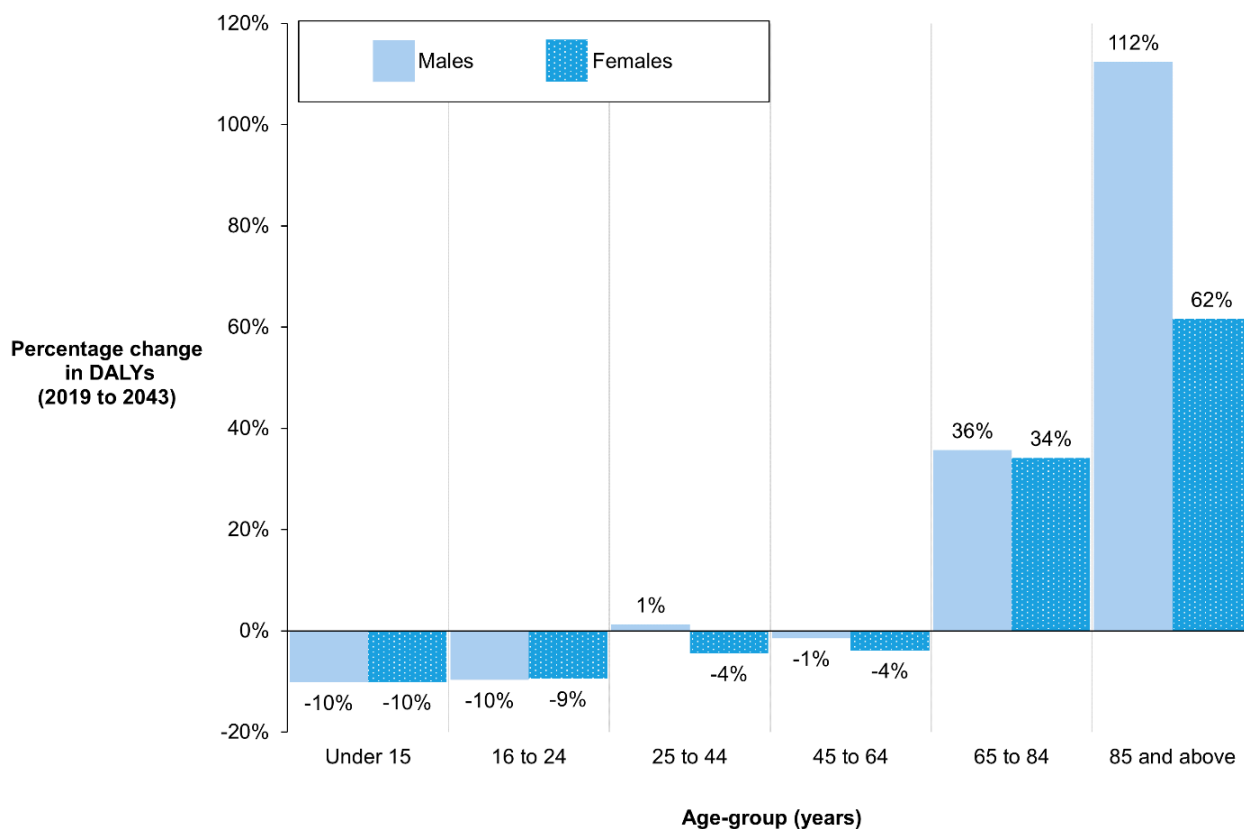
Population projections at five-year age group, separately for males and females, were sourced from National Records Scotland up until the year 2043.⁴ The scenario used was based upon the most recent publication of principal projections. This work will be updated when new population projections are published based on the recent census.

The estimates presented in this briefing paper relate to crude numbers. Estimates are not presented as rates (crude, or age-standardised) as the aim is to present how demographic change is forecast to intersect with population health needs at the overall level, to provide insights into how absolute changes in population health are forecasted.

3. Results

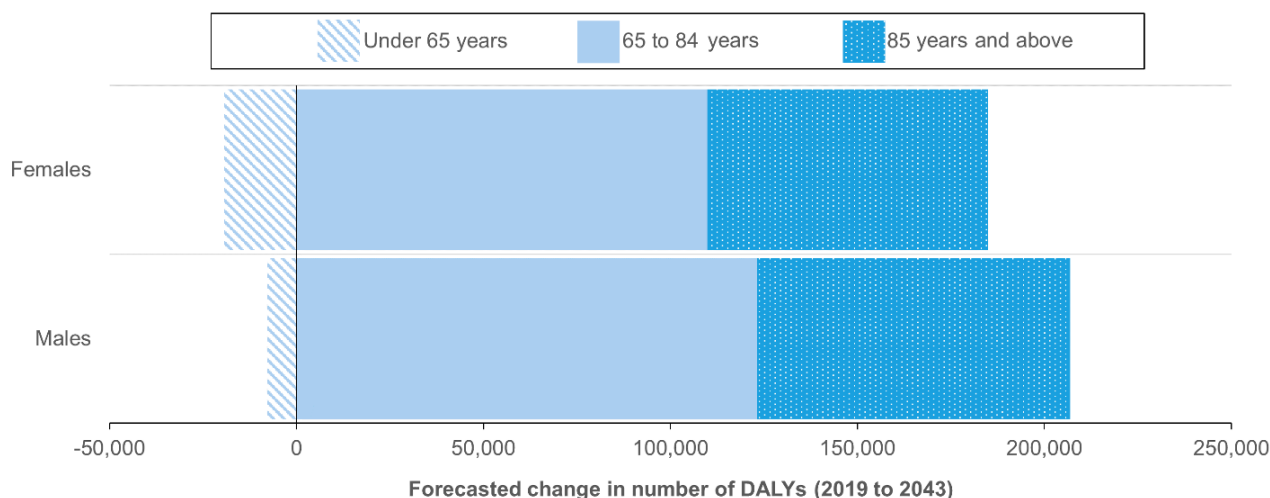
Despite projections indicating that Scotland's population is set to decline over the next 20 years, the corresponding annual disease burden is forecast to increase 21% between 2019 and 2043. Although the disease burden is forecast to increase for both females and males, 55% of the increase is forecast for males (Figure 2). On the absolute scale the disease burden is forecast to increase substantially for those aged 65 years and above, with the largest increases for the 65 to 84 years age group.

Figure 2. Change in the number of all-cause DALYs by age and sex, 2019 to 2043



Forecasted increases in DALYs are substantially driven by age. In terms of percentage change within each age group, reductions are forecasted in the region of 10% for children and young people (under 15 years) and for late teens and people of younger working ages (16 to 24 years) for both males and females (Figure 3). Age groups in the mid-to-late working ages (25 to 64 years) are forecasted to have smaller changes, with females forecasted slightly larger reductions (4%). Males and females aged 65 to 84 years have a forecasted disease burden around 35% higher in 2043 compared to 2019. The largest percentage increases are in the 85 years and above age group: 112% for males, and 62% for females.

Figure 3. Percentage change in the number of all-cause DALYs within age group, 2019 to 2043



Forecasted estimates of annual disease burdens for each cause of disease and injury group indicate that 19 out of 21 cause groups are forecasted to have higher annual disease burdens in 2043 compared to 2019 (see Supplementary Tables). In terms of ranking the leading causes, the leading five cause groups are forecast to be the same in 2043 (Table 2). Chronic respiratory diseases are forecast to cause a relatively higher annual disease burden in 2043 than in 2019.

Table 1. Ranking the leading six causes of disease and injury groups in 2019 and 2043

Rank	2019	2043
1	Cancers	Cancers
2	Cardiovascular diseases	Cardiovascular diseases
3	Neurological disorders	Neurological disorders
4	Mental health disorders	Mental health disorders
5	Musculoskeletal disorders	Musculoskeletal disorders
6	Substance use disorders	Chronic respiratory diseases

The largest absolute annual disease burden increases in 2043 are forecast (in order) from: cardiovascular diseases; cancers; neurological disorders; chronic respiratory diseases; diabetes and kidney diseases; and common infectious diseases (see Table 2 and Supplementary Tables). Forecasts in annual disease burdens from cancers, cardiovascular diseases, and neurological disorders account for 68% of the total increase. In terms of increasing relative needs within a cause group, the largest annual disease burden percentage increases in 2043 are forecast (in order) from: common infectious diseases; cardiovascular diseases; neurological disorders; unintentional injuries; diabetes and kidney diseases; and chronic respiratory diseases.

Table 2. Ranking the six largest changes in annual disease burden between 2019 and 2043

Rank	Absolute change	Percentage change
1	Cardiovascular diseases	Common infectious diseases*
2	Cancers	Cardiovascular diseases
3	Neurological disorders	Neurological disorders
4	Chronic respiratory diseases	Unintentional injuries
5	Diabetes and kidney diseases	Diabetes and kidney diseases
6	Common infectious diseases*	Chronic respiratory diseases

* Common infectious diseases are defined as: diarrhoea, upper/lower respiratory, and other common, infectious diseases. As these estimates are based on the pre-pandemic epidemiological situation, COVID-19 is not included in this category.

4. Interpretation

4.1. Summary

Despite a projected decrease in the Scottish population, the annual disease burden is forecast to increase 21% in the next 20 years. This means that to retain the 2019 levels of disease burden, the 2043 forecast would need to reduce by 17%, which is similar to averting the entire burden of cancer in 2019.

The largest areas of absolute disease burden are forecast to be in those aged 65 years and above, particularly within those aged 65 to 84 years. Forecasted increases in disease burden from males is higher than that of females, and is likely explained by recent reductions in the gap in life expectancy between sexes resulting in an increase in males living to older ages.

Although the five leading grouped causes in 2019 are forecast to be the same in 2043, there are important changes in both absolute and relative terms. Absolute increases in disease burden are forecast to be largest for cardiovascular diseases, cancers, and neurological disorders. Forecasted relative increases in annual disease burdens highlight increases for: common infectious diseases; unintentional injuries; diabetes and kidney diseases; and chronic respiratory diseases. These relative increases are due to the disproportionately high impact of these causes in elderly age groups.

Forecasted estimates of annual disease burdens give useful insights into the proportionate causes of population health loss affecting the Scottish population. They give insights into the characteristics of people, and their health issues, that will require health and other care services in order to ensure that they can live longer lives in good health. Forecasted changes in disease burden based on demographic change and stable prevalence of disease are helpful to inform how care services and workforces need to adapt to successfully mitigate the future health needs of the Scottish population. Considerations over interventions and efforts to mitigate and prevent the underlying causes of these diseases are required to prevent forecasted disease burdens becoming a reality.

4.2. Uncertainties

Due to the nature of forecasting studies, uncertainty will be inherent within any estimates. It is important to consider these aspects when using the findings presented in this briefing paper.

The presented forecasts do not consider any underlying improvements, or worsening, in the underlying disease trends. This could mean that future disease burdens are misrepresented if vast changes have occurred. For example, the underlying epidemiological trends for drug use disorders have been worsening, which have continued to be observed in recent years. In this case, forecasts on substance use disorders may be underestimated if this worsening continues, as they are based solely on the epidemiological position observed in 2019. On the other hand, the disease burden from chronic liver diseases has been decreasing in the last few years. Through not considering these positive trends, the forecasts for chronic liver diseases may be overestimated. The SBOD study is carrying out cause-specific projections for selected diseases which will incorporate changes in the underlying disease patterns. These should give more detailed insights through incorporating any improvements in preventing and tackling disease in resulting forecasts. However, these additions are not without further uncertainties. As forecasts will be made at the individual cause level, they do not consider the impact of competing risks. This is particularly relevant in elderly populations, whereby improvements in tackling one disease could have an adverse effect on the epidemiology of another disease. Furthermore, these approaches could still under/overestimate as: (1) the underlying disease trends are sensitive to the period over which they are observed; and (2) the factor chosen to extrapolate the worsening/progressing of underlying trends is somewhat arbitrary.

Preventative activity, alongside early intervention and improved treatments would all need to be acted upon for these forecasts not to become a reality. Worsening of causative factors will likely mean that these forecasts underestimate the future disease burden. There is already evidence that the COVID-19 pandemic has exacerbated progress in tackling disease and risk factors, meaning the forecasts in this briefing paper may underestimate the future disease burden. An example of this is that the failure to mitigate the rise in overweight and obesity in primary-school children will lead to a worsening of epidemiology trends, meaning that forecasts of the obesity-attributable disease burden will be

underestimated.⁵ Furthermore, COVID-19 and the public health protective measures put in place have indirectly caused delays, and restrictions, to accessing healthcare services, including individuals becoming reluctant to access essential healthcare services.⁶ Many of these factors are likely to increase health inequalities in the short, medium and long term. These forecasts do not consider these factors, so unless these are mitigated, future forecasts are likely to underestimate the future disease burden, and underlying inequality.⁷

These forecasts do not include the impact of COVID-19. In not doing this, the forecast disease burden is likely to be an underestimate to a degree, particularly if variants of concern become a major public health threat. Evidence has indicated that although the disease burden of COVID-19 infection is decreasing, it remains a substantial mortality risk, with wide inequalities.⁸ As the disease burden is concentrated to elderly age groups, the exclusion of COVID-19 in the forecasts likely understates the substantial increases which are already forecast for those elderly age groups, and underlying inequalities in this disease burden. Uncertainties over the long-term impact of long COVID, and how it may contribute to increases in non-communicable disease prevalence, could also impact the trajectory of these forecasts.

The current situation in relation to the cost-of-living crisis is also likely to result in major health inequalities, as those who are most vulnerable will suffer the most. The crisis itself is of a large magnitude, so is also likely to have impacts across the whole population. These factors have been unable to be incorporated, however the continuation of the adverse cost-of-living context will not only increase health inequalities but worsen future disease burdens across the Scottish population. Previous SBOD research has shown that a third of overall pre-pandemic disease burden is attributable to inequalities in multiple deprivation.⁹ Forthcoming research from the SBOD study will update estimates on the extent of inequality in pre-pandemic disease burden for specific causes.¹⁰

References

- ¹ Scottish Burden of Disease study. Public Health Scotland. Available at: www.scotpho.org.uk/comparative-health/burden-of-disease/overview/
- ² Fenton L, Minton J, Ramsay J et al. Recent adverse mortality trends in Scotland: comparison with other high-income countries. *BMJ Open*. 2019;9:e029936. doi: <https://doi.org/10.1136/bmjopen-2019-029936>
- ³ Walsh D, Wyper GMA, McCartney G. Trends in healthy life expectancy in the age of austerity. *J Epidemiol Community Health*. 2022;76:743-745. doi: <https://doi.org/10.1136/jech-2022-219011>
- ⁴ National Records of Scotland. Projected Population of Scotland (2020-based). Available at: www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-projections/population-projections-scotland/2020-based
- ⁵ Public Health Scotland. Primary 1 Body Mass Index (BMI) statistics Scotland. Available at: www.publichealthscotland.scot/publications/primary-1-body-mass-index-bmi-statistics-scotland/primary-1-body-mass-index-bmi-statistics-scotland-school-year-2020-to-2021/
- ⁶ Scottish Government. Coronavirus (COVID-19): Public attitudes and behaviours – April update. Available at: www.gov.scot/publications/public-attitudes-behaviours-around-coronavirus-april-update
- ⁷ Douglas M, Katikireddi S V, Taulbut M et al. Mitigating the wider health effects of COVID-19 pandemic response. *BMJ*. 2020;369:m1557 doi: <https://doi.org/10.1136/bmj.m1557>
- ⁸ Wyper GMA, Fletcher E, Grant I et al. Widening of inequalities in COVID-19 years of life lost from 2020 to 2021: A Scottish Burden of Disease Study. *J Epidemiol Community Health*. 2022;76:746-749. doi: <https://doi.org/10.1136/jech-2022-219090>
- ⁹ Wyper GMA, Fletcher E, Grant I et al. Inequalities in population health loss by multiple deprivation: COVID-19 and pre-pandemic all-cause disability-adjusted life years (DALYs) in Scotland. *Int J for Equity in Health*. 2021;20:214. doi: <https://doi.org/10.1186/s12939-021-01547-7>

¹⁰ Grant I, Mesalles-Naranjo O, Wyper G et al. Burden of disease in Scotland: invited chapter. In: Anne Slater, ed. Scotland's population, the registrar general's annual review of demographic trends 2017. Edinburgh: National Records of Scotland; 2018.