


# The Scottish Burden of Disease Study, 2016

## Deprivation report



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# Key findings

- The disease burden in the most deprived areas in Scotland was more than double that found in the least deprived areas (14.1% v. 6.7%), and the burden increased with each level of deprivation.
- Nearly a third (32.9%) of the disease burden in Scotland could be avoided if the whole population had the same rate of burden as those in the least deprived areas of Scotland.
- In deprived areas, early death contributed more burden than living with ill health (57.9% of burden due to early death). Whereas, in the least deprived areas people were more likely to live with ill health (45.4% of burden due to early death). However, there were still fewer people living with, or dying early from, ill health in the least deprived areas than there were in the most deprived areas.
- The fatal burden rate was three times higher in the most deprived areas in Scotland compared with the least deprived areas, with men aged 15 years and over experiencing a higher proportion of this burden than women.
- For most of the leading causes of disease burden in Scotland, the overall burden was greater in the most deprived areas compared with the least deprived areas, e.g. drug use disorders (17.0 times higher), alcohol dependence (8.4 times higher), chronic liver disease (7.2 times higher), chronic obstructive pulmonary disease (COPD) (6.2 times higher) and lung cancer (4.3 times higher).
- There was little or no difference in burden across areas of deprivation for some diseases, such as musculoskeletal conditions, migraine and sense organ diseases (such as impaired hearing or vision).
- The leading causes of disease burden across areas of deprivation also varied by age group. For example, in the most deprived areas drug use disorders were the leading cause of disease burden in people aged 15–44, however, they were not one of the leading causes in the least deprived areas.

# Introduction

Overall health has improved across Scotland over the last 50 years; however, health inequalities remain a significant and longstanding problem. Deprivation is a major factor in health inequalities, with people in less deprived areas living longer and having significantly better health (**Audit Scotland 2012**). Tackling the underlying causes of health inequalities would reduce both the direct costs to the NHS and the wider costs to society.

Last year, the Scottish Burden of Disease (SBoD) study team published the first results from the study (**SBoD overview report**). These showed the extent to which different diseases and injuries affected Scotland's health and life expectancy. In this report we focus on the health inequalities associated with the burden of disease in Scotland.

## Background

Burden of disease studies use a single measure which combines estimates of fatal and non-fatal burden: years of life lost (YLL) due to premature mortality and years lived with disability (YLD) due to time spent living in less than ideal health. The measure used to describe the overall burden of disease is called the disability-adjusted life year (DALY). This allows a fairer picture of the contribution of diseases which are unlikely to cause death but may cause substantial poor health.

By combining information on fatal burden and non-fatal burden, burden of disease studies allow planners and policy-makers to have a better understanding of the contribution that different diseases and injuries make to the total burden of disease and how this burden varies by levels of deprivation. This, in turn, supports decisions about where prevention and service activity should be focused to address health inequalities in Scotland.

## Methods

We calculated the burden of disease by age, gender and deprivation decile for 132 diseases and injury categories as defined by the international **Global Burden of Disease** (GBD) study. The total burden (DALY) for each category was calculated by adding together the fatal burden (YLL) and non-fatal burden (YLD) for each disease or injury. The methods are explained more fully in our **overview report**. In SBoD 2016, all data are presented as 3-year averages for the period 2014–2016 to increase the statistical stability of results across the SBoD disease classification.

We used the Scottish Index of Multiple Deprivation (**SIMD 2016**), which is a validated and widely used area-based measure of multiple deprivation derived from postcodes of residence. SIMD is calculated using 31 indicators across seven domains: income, employment, housing, health, education, skills and training, and area-based access to services.

We categorised individuals into SIMD deciles – from 1 (those living in the 10% most deprived areas) to 10 (those living in the 10% least deprived areas). We present both crude and age-standardised rates (per 100,000 population). Crude rates were calculated from disease total burden (DALYs) and mid-year population estimates from the National Records of Scotland. Where the data were age standardised, this was done directly using European age-standardised rates (EASR) from the **2013 European Standard Population** (EASR) to account for differences in age structure between SIMD deciles.

In this report we detail both the absolute inequalities which reflect the magnitude of difference in burden between two subgroups and relative inequalities which show the proportional differences in health among subgroups.

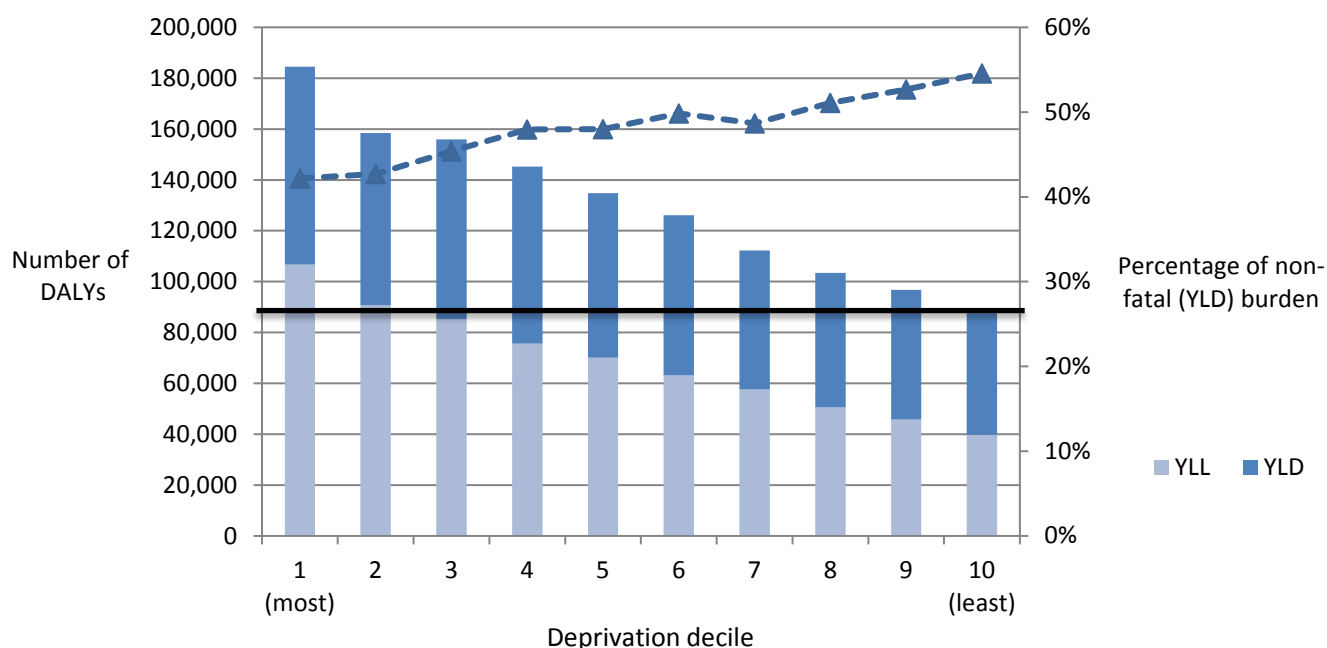
# Results

## Total burden by deprivation

Overall, 1,305,000 DALYs were lost due to ill health or early death in Scotland (SBoD 2016). This ranged from around 184,000 (14.1%) in the most deprived areas to 88,000 (6.7%) in the least deprived areas of Scotland. Total burden increased with increasing levels of deprivation (Figure 1).

Overall, 52.5% of burden was fatal, ranging from 57.9% of the overall burden in the most deprived areas to 45.4% of the overall burden in the least deprived areas. The non-fatal contribution to the overall burden in each decile increased with decreasing levels of deprivation (see broken line in Figure 1).

**Figure 1:** Number of DALYs by deprivation decile, Scotland – SBoD 2016



The least deprived areas in Scotland experienced only half of the burden experienced by the most deprived areas, and the combined fatal (YLL) and non-fatal burden (YLD) in the least deprived areas was lower than just the fatal burden in the most deprived areas (as shown by the solid black line in Figure 1). The marked deprivation gradient results in 32.9% of DALY being considered 'excess' – that is,

the total burden that would have been avoided if all deprivation deciles had the same rate as those in the least deprived areas of Scotland (**Table 1**). This can also be expressed as the percentage of the total burden which is excess within each deprivation decile. This shows that over 50% of the total burden experienced by the most deprived deciles is excess when compared with individuals in the least deprived decile (the corresponding figures are 45% in decile 2 and 44% in decile 3).

**Table 1:** Distribution of total burden (DALY) by deprivation decile, Scotland SBoD 2016

Deprivation decile	DALY	DALY (% of total)	Excess <sup>(a)</sup>	Excess DALY <sup>(b)</sup>
1 (most)	184,454	14.1%	96,928	52.5%
2	158,429	12.1%	71,143	44.9%
3	155,971	12.0%	68,875	44.2%
4	145,275	11.1%	57,929	39.9%
5	134,832	10.3%	47,824	35.5%
6	126,042	9.7%	38,486	30.5%
7	112,284	8.6%	24,055	21.4%
8	103,443	7.9%	15,550	15.0%
9	96,719	7.4%	8,706	9.0%
10 (least)	87,554	6.7%	Reference	Reference
<b>Scotland<sup>(c)</sup></b>	<b>1,305,004</b>	<b>100.0%</b>	<b>429,495</b>	<b>32.9%</b>

(a) Observed burden for each deprivation decile was compared with the expected burden if age-specific rates of burden were the same as for the least deprived decile (decile 10).

(b) The excess burden is expressed as a percentage of excess to total observed burden for each deprivation decile.

(c) Excess burden in Scotland reflects all excess burden attributed to deprivation deciles outside of the least deprived decile (decile 10).

More conservatively, if the people living in the 20% most deprived areas in Scotland had the same rate of burden as people living in the rest of Scotland, their burden would be reduced from 342,883 to 240,033 DALYs (30% excess within the 20% most deprived areas, or 7.9% of the total burden for Scotland).



Absolute DALY is important for service planning purposes. Equally, the age-standardised DALY is important to understand to what extent differences across deprivation deciles are due to different age and gender profiles and to differences in underlying risk factors.

Almost none of the differences in DALYs across deprivation deciles in Scotland are explained by age and gender. The overall rate of burden still increased with increasing levels of deprivation, and there is still a more than two-fold difference between the most and least deprived deciles, with a higher proportion of burden due to early deaths in the most deprived areas. Furthermore, compared with the least deprived areas in Scotland, the fatal burden rate was three times higher in the most deprived areas whereas the non-fatal burden rate was only 1.7 times higher in the most deprived areas (**Table 2**).

**Table 2:** Total burden (DALY), non-fatal burden (YLD), fatal burden (YLL), counts (*N*), European age-standardised rates (EASR) and rate ratios, by deprivation decile, Scotland – SBoD 2016

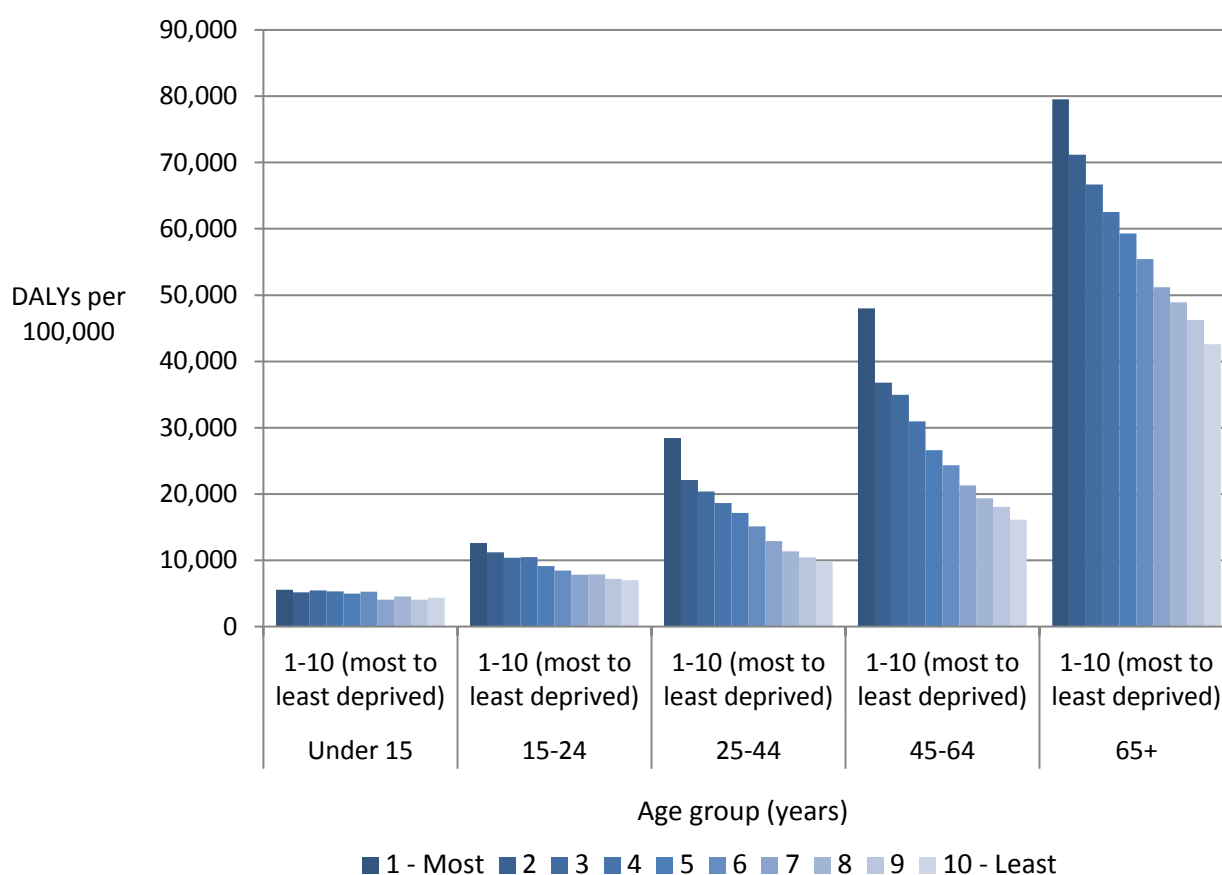
Level of deprivation	Total burden			Non-fatal burden			Fatal burden		
	<i>N</i>	EASR	Rate ratio <sup>(a)</sup>	<i>N</i>	EASR	Rate ratio <sup>(a)</sup>	<i>N</i>	EASR	Rate ratio <sup>(a)</sup>
1 (most)	184,454	38,104	2.3	77,797	15,380	1.7	106,657	22,723	3.0
2	158,429	31,592	1.9	67,661	13,163	1.5	90,768	18,429	2.4
3	155,971	29,738	1.8	70,801	13,400	1.5	85,170	16,338	2.1
4	145,275	27,394	1.6	69,648	13,025	1.4	75,628	14,369	1.9
5	134,832	24,999	1.5	64,688	11,989	1.3	70,144	13,010	1.7
6	126,042	23,064	1.4	62,823	11,526	1.3	63,219	11,538	1.5
7	112,284	20,592	1.2	54,658	9,986	1.1	57,626	10,606	1.4
8	103,443	19,305	1.2	52,829	9,764	1.1	50,614	9,541	1.2
9	96,719	18,049	1.1	50,949	9,442	1.1	45,770	8,607	1.1
10 (least)	87,554	16,691	Reference	47,774	8,992	Reference	39,780	7,698	Reference
<b>Scotland</b>	<b>1,305,004</b>			<b>619,627</b>			<b>685,377</b>		

(a) Rate ratios compare the observed deprivation decile rate of burden with the rate of burden in the least deprived decile.

## Burden by age group and gender

The rate of burden increased with age (**Figure 2**), coinciding with the onset of many chronic and age-related conditions, and the gap between deciles varied across the life course. The largest (three-fold) inequalities in burden across deprivation deciles were in people aged between 25 and 64 years.

**Figure 2:** Age-specific rates of burden (DALY), by age group and deprivation decile, Scotland – SBoD 2016

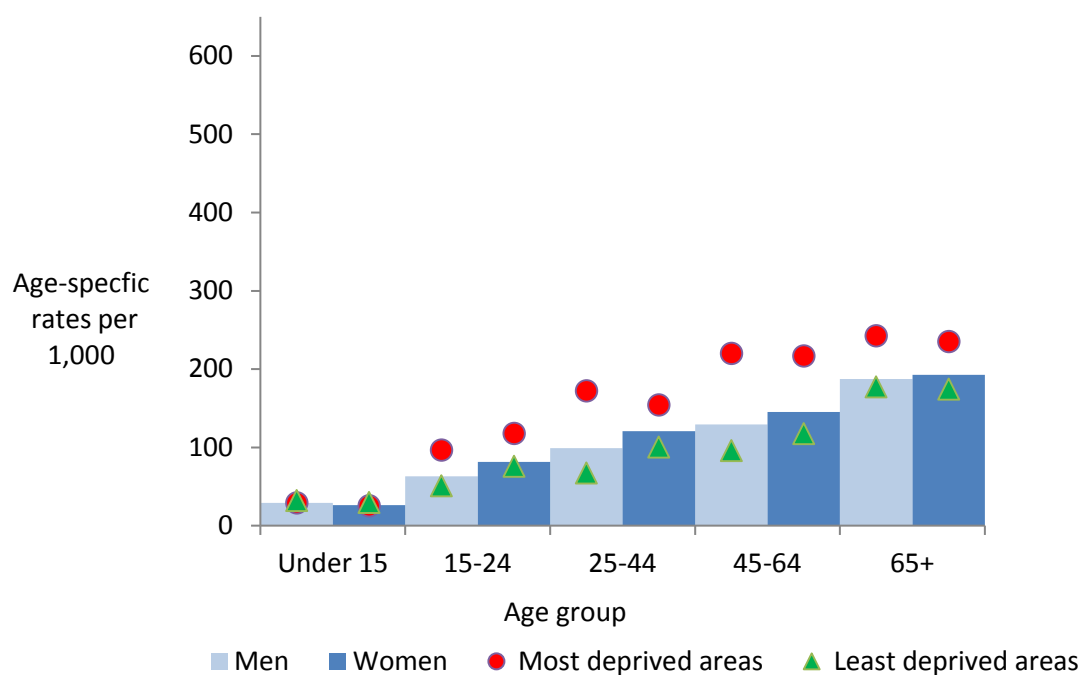


Note: the bars in each age group are ordered left to right, from 1 (most deprived) to 10 (least deprived).

Within each age (15 years and above) and deprivation group, non-fatal burden (YLD) was higher in women than men (**Figure 3a**). The largest within-age inequalities for non-fatal burden were in men aged 25–44 years, and men and women aged 45–64 years. Non-fatal burden was higher at 45–64 years in the most deprived areas than at 65 and above in the least deprived areas, reflecting

the earlier onset of disease and injury in deprived areas. Absolute inequalities in non-fatal burden seem to narrow in older ages, but this is due to the compression of morbidity in less deprived areas at older ages.<sup>1</sup>

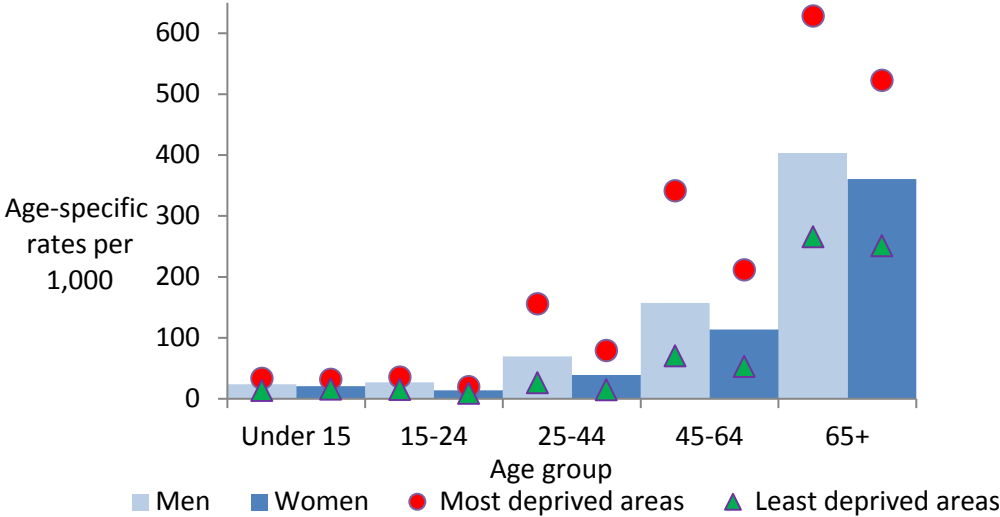
**Figure 3a:** Non-fatal burden (YLD) by gender and age group, overall (bars) and extremes (circles and triangles denote most and least deprived areas), Scotland SBoD 2016



Within each age (15 and over) and deprivation group, fatal burden (YLL) is higher in men than women. The largest within-age inequalities for fatal burden are in men and women aged 25–44 and 45–64 (**Figure 3b**), with up to a six-fold difference between the most and least deprived deciles in men aged 25–44.

<sup>1</sup> The compression of morbidity is that the burden of lifetime illness can be compressed into shorter periods before the time of death, if the onset of chronic disease can be postponed. The link below explains how organ function declines by age, so it is natural that even those who have managed to avoid high levels of multimorbidity, will eventually pick up chronic conditions. Source: Fries (2005) [www.ncbi.nlm.nih.gov/pmc/articles/PMC2690269](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2690269).

**Figure 3b:** Fatal burden (YLL) by gender and age group, overall (bars) and extremes (circles and triangles denote most and least deprived areas), Scotland SBoD 2016



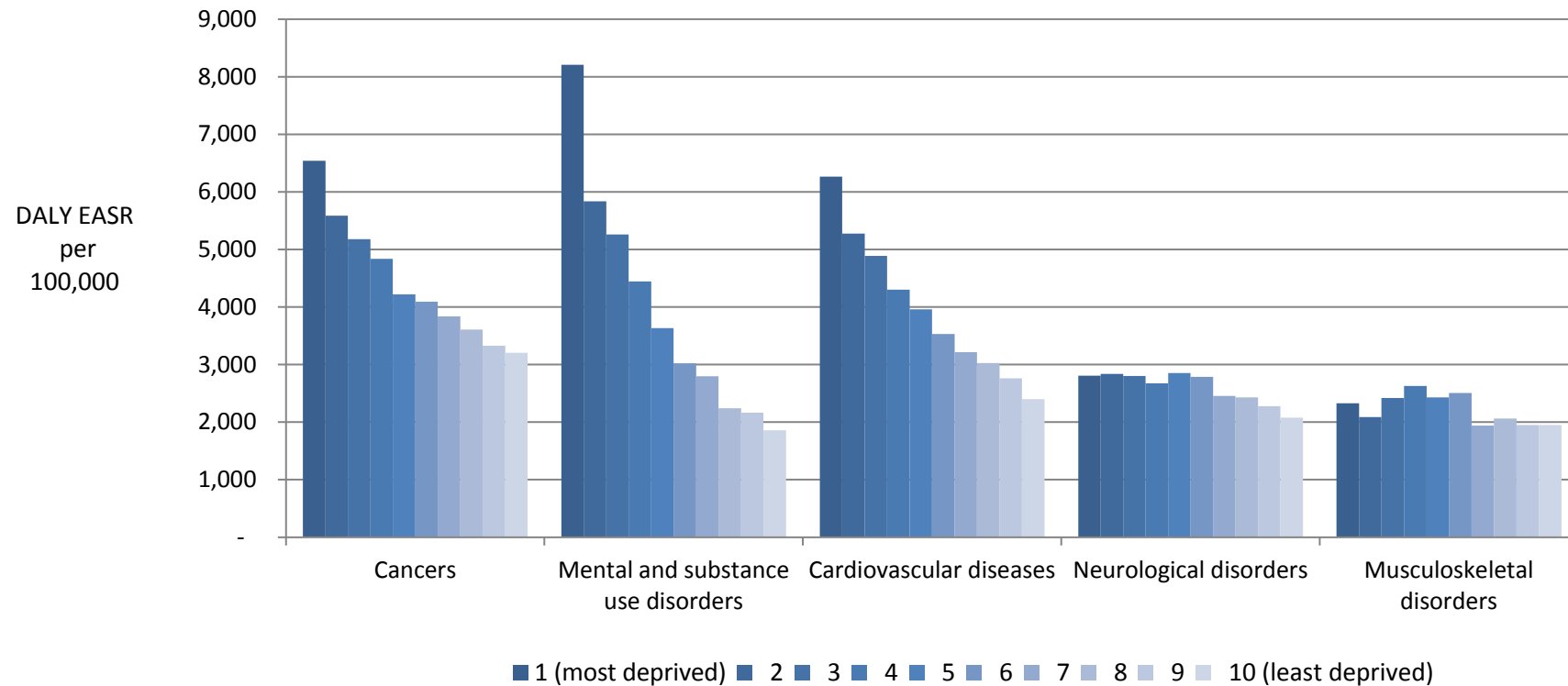
# Which diseases drive inequalities in total burden?

## Variation by broad disease groups

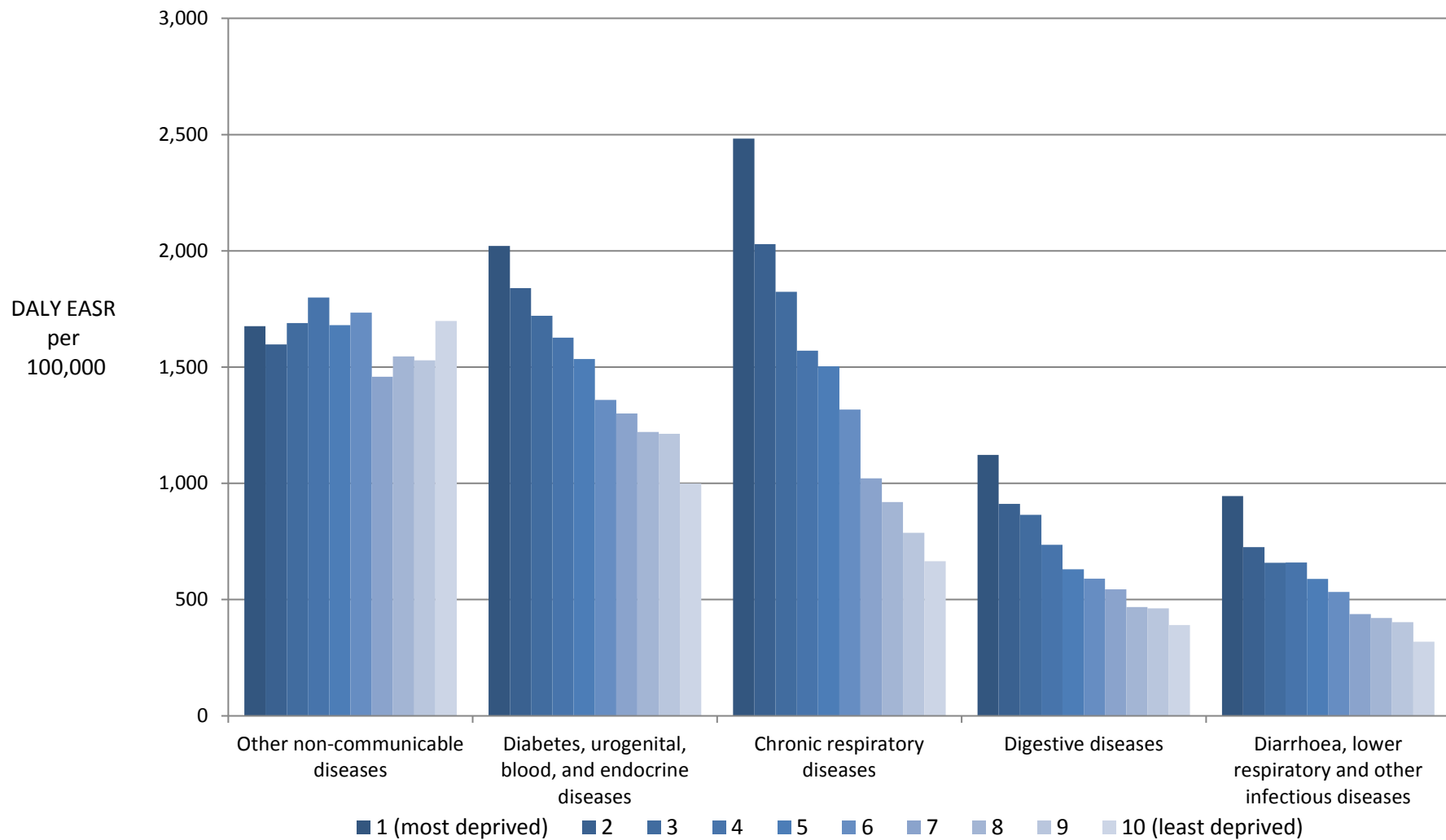
For most broad disease groups, the greatest burden was experienced in the most deprived areas in Scotland; however, the difference in rates varied by disease group (**Figure 4**). The biggest difference was for the rate of chronic liver disease, where the rate in the most deprived areas was 7.3 times higher than in the least deprived areas.

The rate of burden due to mental and substance use disorders in the most deprived areas was 4.4 times the rate observed in the least deprived areas. Similarly, chronic respiratory diseases; suicide and self-harm-related injuries; and diarrhoea, lower respiratory and other infectious diseases had around three times the rate of burden in the most deprived areas compared with least deprived areas (rate ratios 3.7, 3.2 and 3.0, respectively). Conversely, the burden for other non-communicable diseases (including skin and sense organ diseases, such as impaired hearing and vision) was similar in the most deprived areas compared with least deprived areas (rate ratio 1.0).

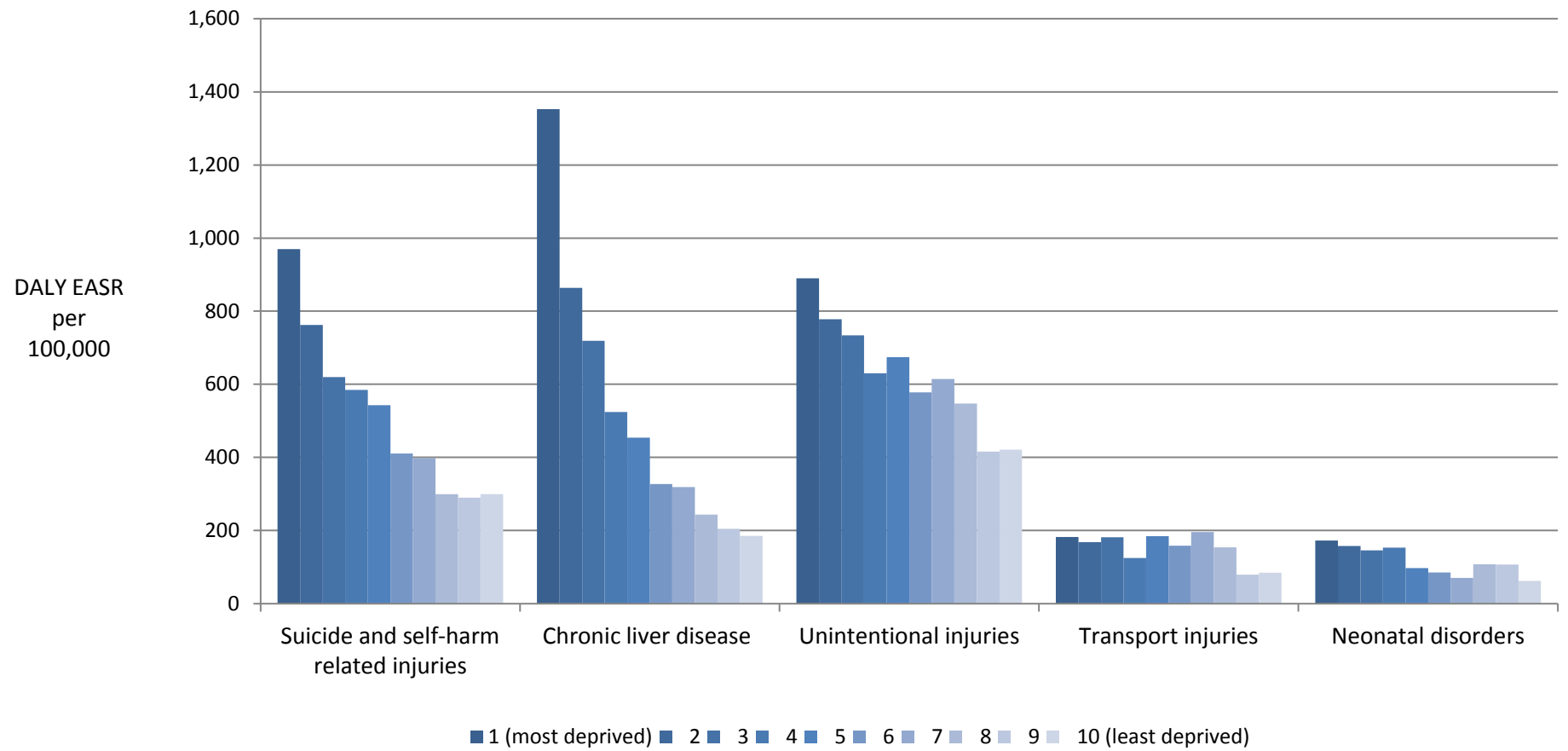
**Figure 4:** DALY EASR per 100,000 population, by disease group and deprivation, Scotland – SBoD 2016. Notes: the y-axis scale changes with each set of graphs



Note: the bars for each disease group are ordered left to right, from most deprived (1) to least deprived (10).



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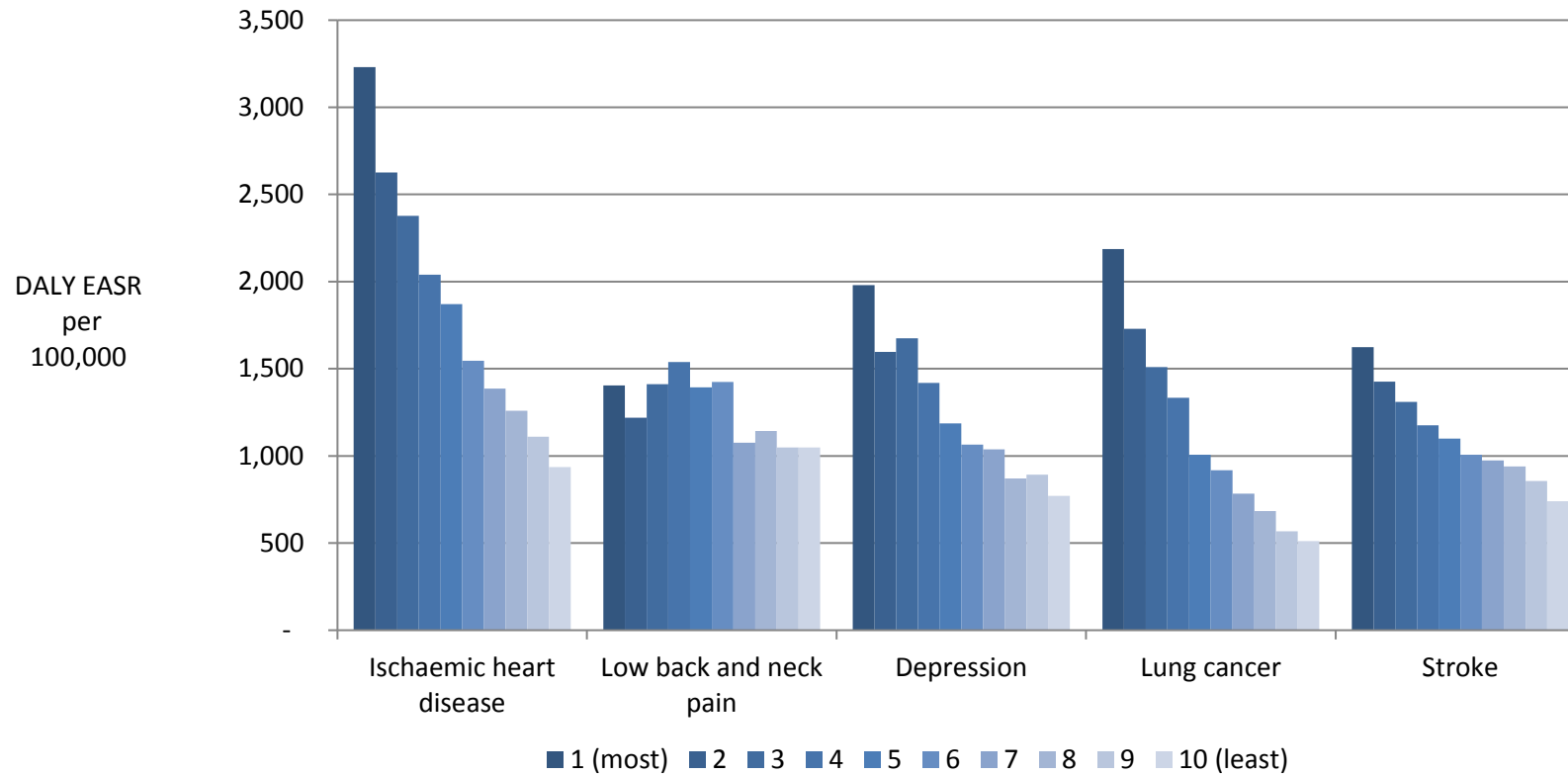
## Variation by specific disease or injury

Focusing on the diseases and injuries that are the leading contributors to the disease burden in Scotland, in general, a strong gradient in the age- and gender-standardised rates was seen across areas of deprivation, with higher rates of burden in the most deprived areas of Scotland (**Figure 5**). There were marked inequalities in rate of burden for ischaemic heart disease, lung cancer, stroke, drug use disorders, self-harm and suicide, COPD, alcohol dependence, chronic liver disease and lower respiratory infections. The largest relative inequalities in burden between the most and least deprived areas were observed for drug use disorders (17.0 times higher), alcohol dependence (8.4 times higher), chronic liver disease (7.2 times higher), COPD (6.2 times higher) and lung cancer (4.3 times higher). Conversely, the burden for migraine, other musculoskeletal disorders and sense organ diseases was fairly similar or lower in the least deprived areas (rate ratio 1.0, 0.9 and 0.8, respectively).

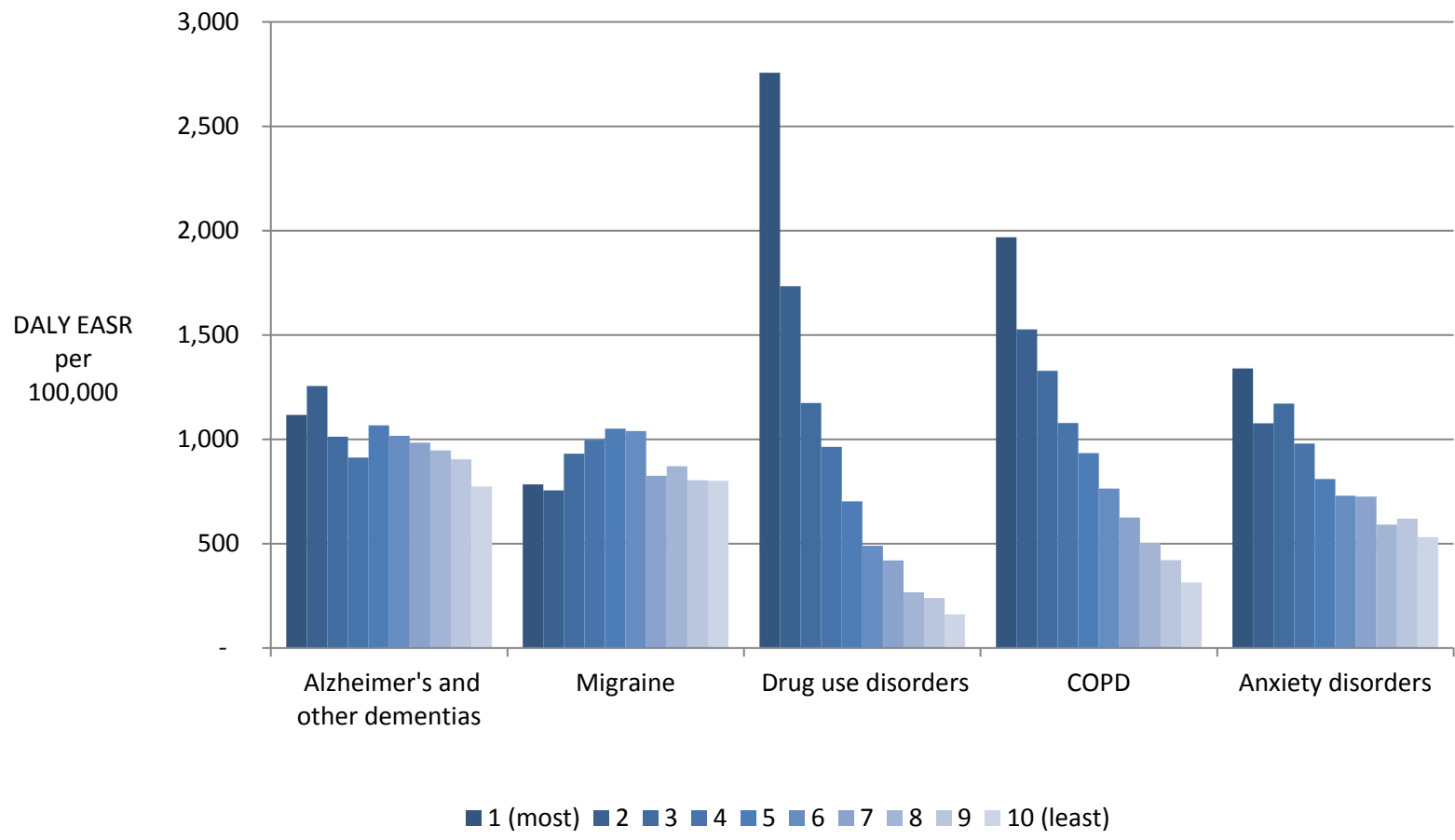
Drug use disorders, alcohol dependence, chronic liver disease, COPD and lung cancer were also major contributors to absolute inequalities in the disease burden. In contrast, low back and neck pain, and migraine, also major contributors to overall DALY, had relatively low relative inequalities. This indicates that burden does not vary across deprivation groups for these specific conditions.

**Figure 5:** DALY EASR per 100,000 population for the leading causes of burden by deprivation decile, Scotland – SBoD 2016.

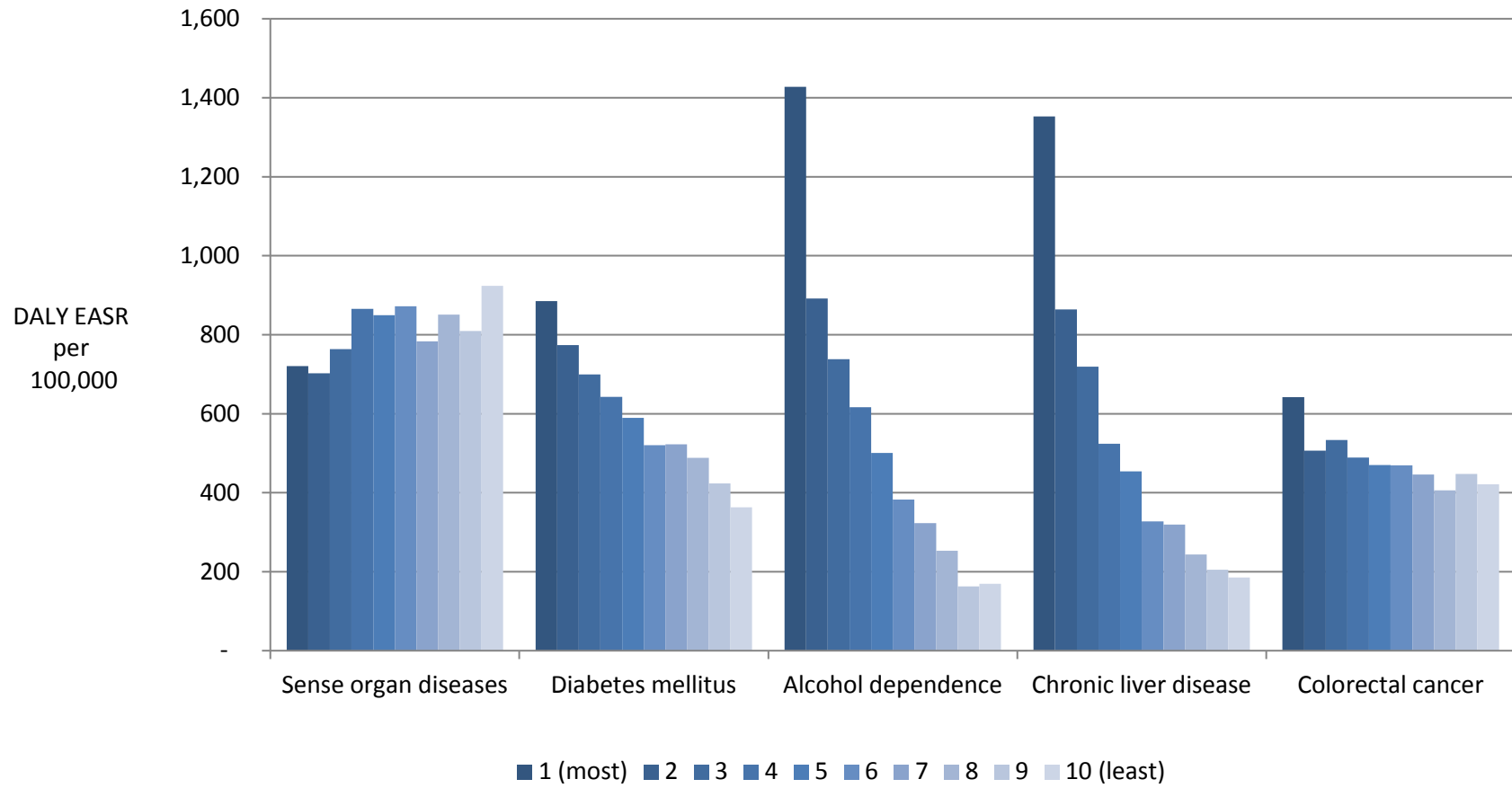
Note: the y-axis scale changes with each set of graphs



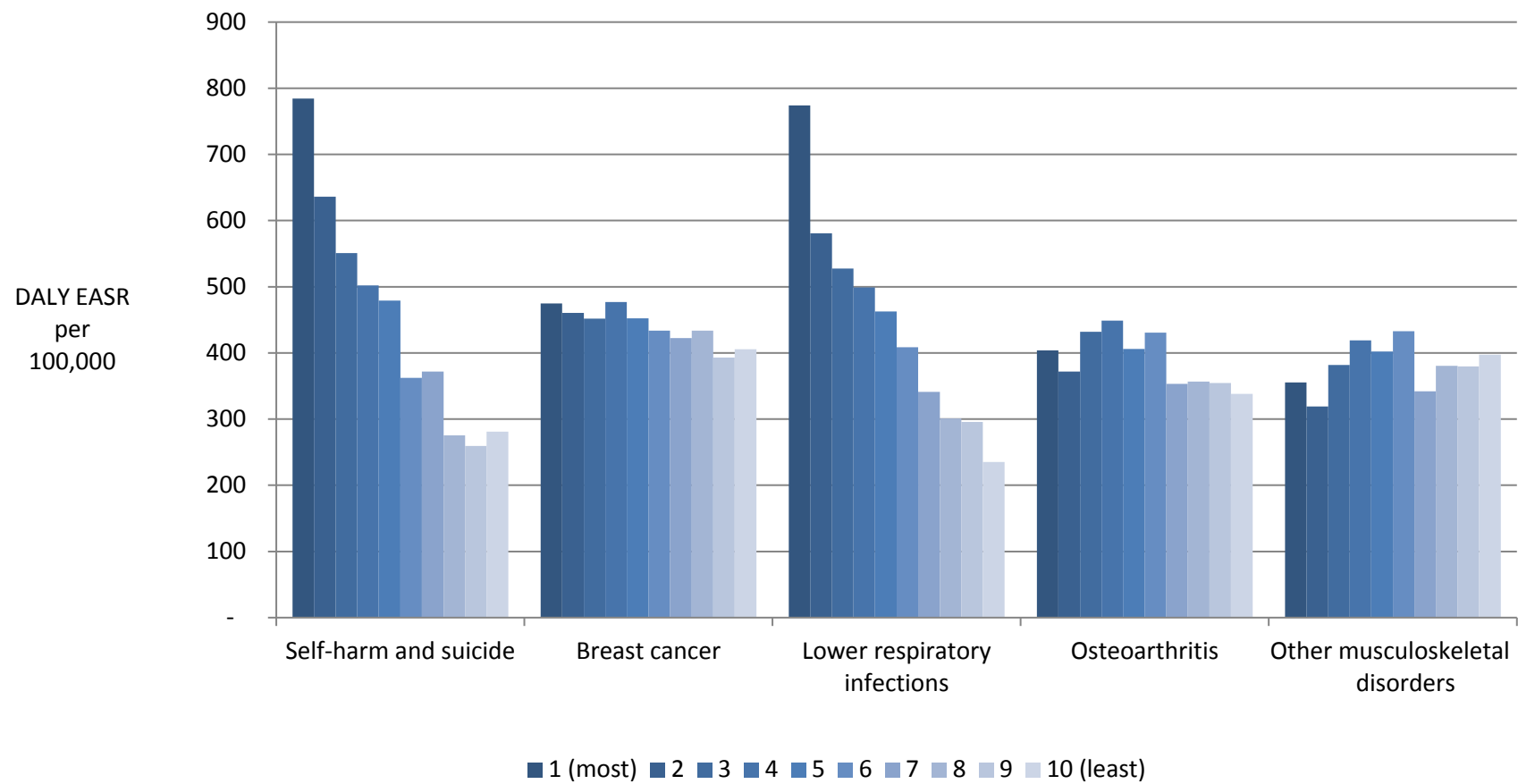
Note: the bars for each disease group are ordered from left to right, from most deprived (1) to least deprived (10).



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A summary of the 10 leading causes of the absolute burden in the most and least deprived areas of Scotland is shown in **Table 3**, illustrating the very different pattern of burden in different areas of deprivation.

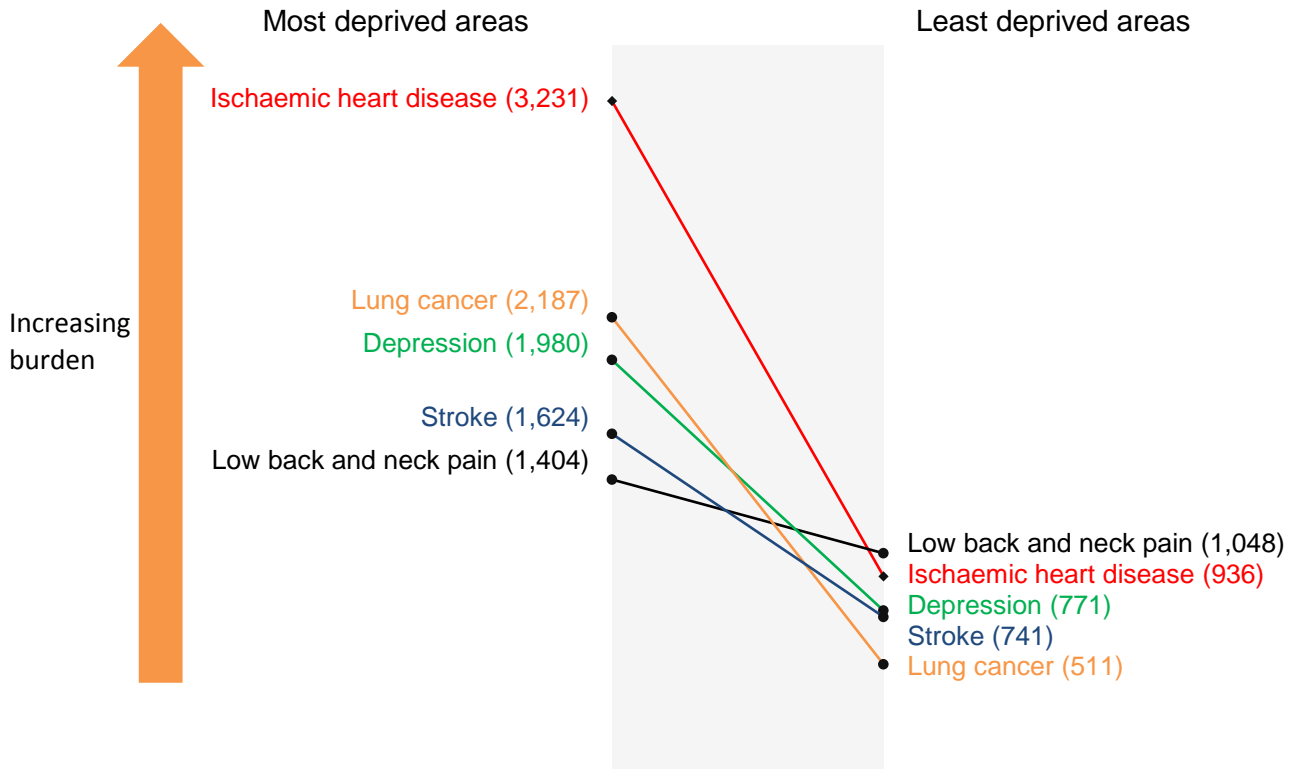
**Table 3:** Leading causes of burden in the least and most deprived areas, Scotland – SBoD 2016

Rank	10 diseases contributing most to burden in the most deprived areas of Scotland	% of overall DALYS in most deprived areas	10 diseases contributing most to burden in the least deprived areas of Scotland	% of overall DALYS in least deprived areas
1	Drug use disorders	8.1%	Low back and neck pain	6.4%
2	Ischaemic heart disease	7.9%	Sense organ diseases	5.6%
3	Depression	5.6%	Ischaemic heart disease	5.5%
4	Lung cancer	5.3%	Migraine	5.0%
5	COPD	4.7%	Depression	4.7%
6	Alcohol dependence	3.9%	Alzheimer's and other dementias	4.4%
7	Low back and neck pain	3.9%	Stroke	4.3%
8	Stroke	3.8%	Anxiety disorders	3.2%
9	Anxiety disorders	3.8%	Lung cancer	3.0%
10	Chronic liver disease	3.7%	Colorectal cancer	2.5%

Note: Shaded cells represent the diseases that appear in only one list.

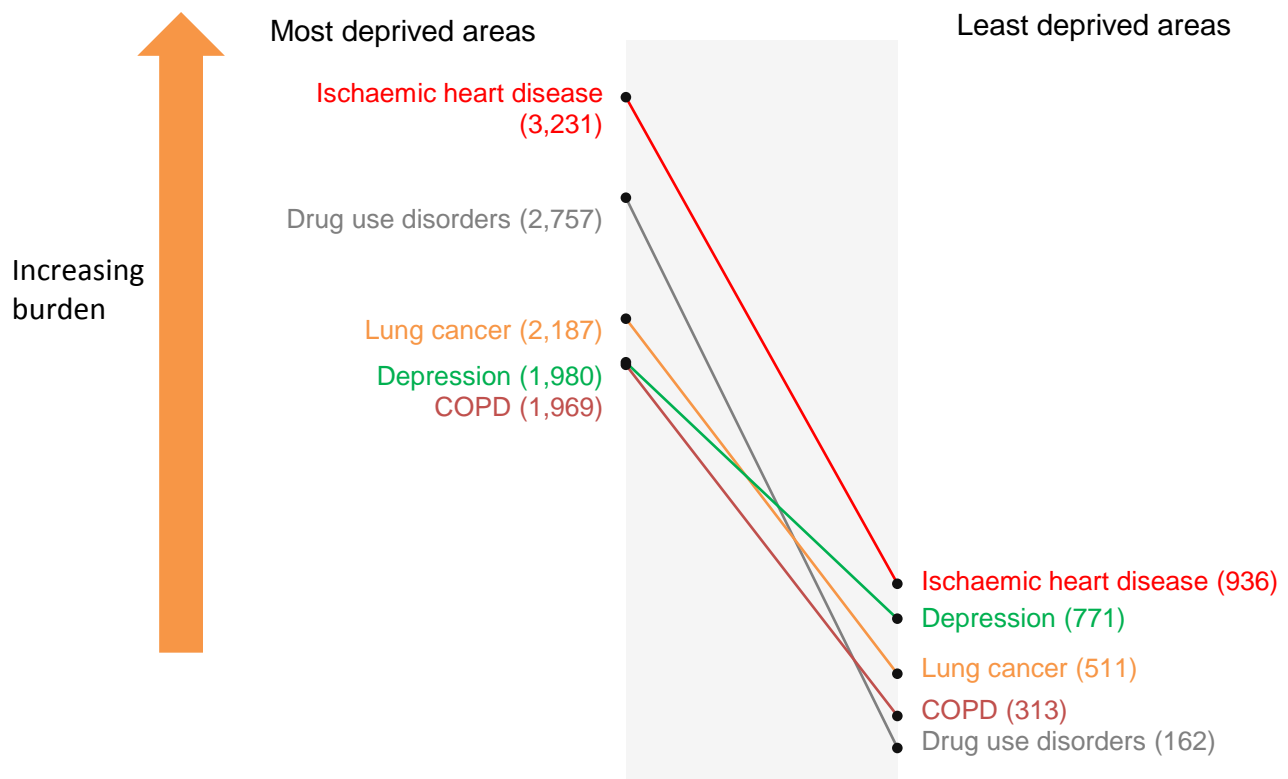
**Figure 6** focuses on the diseases which cause the largest age-standardised overall burden in Scotland. These have substantially higher rates in the most deprived areas, though the differences are less marked for low back and neck pain.

**Figure 6:** DALY EASR per 100,000 population, for the five leading causes of DALYs in Scotland: comparison of burden in the most and least deprived areas – SBoD 2016



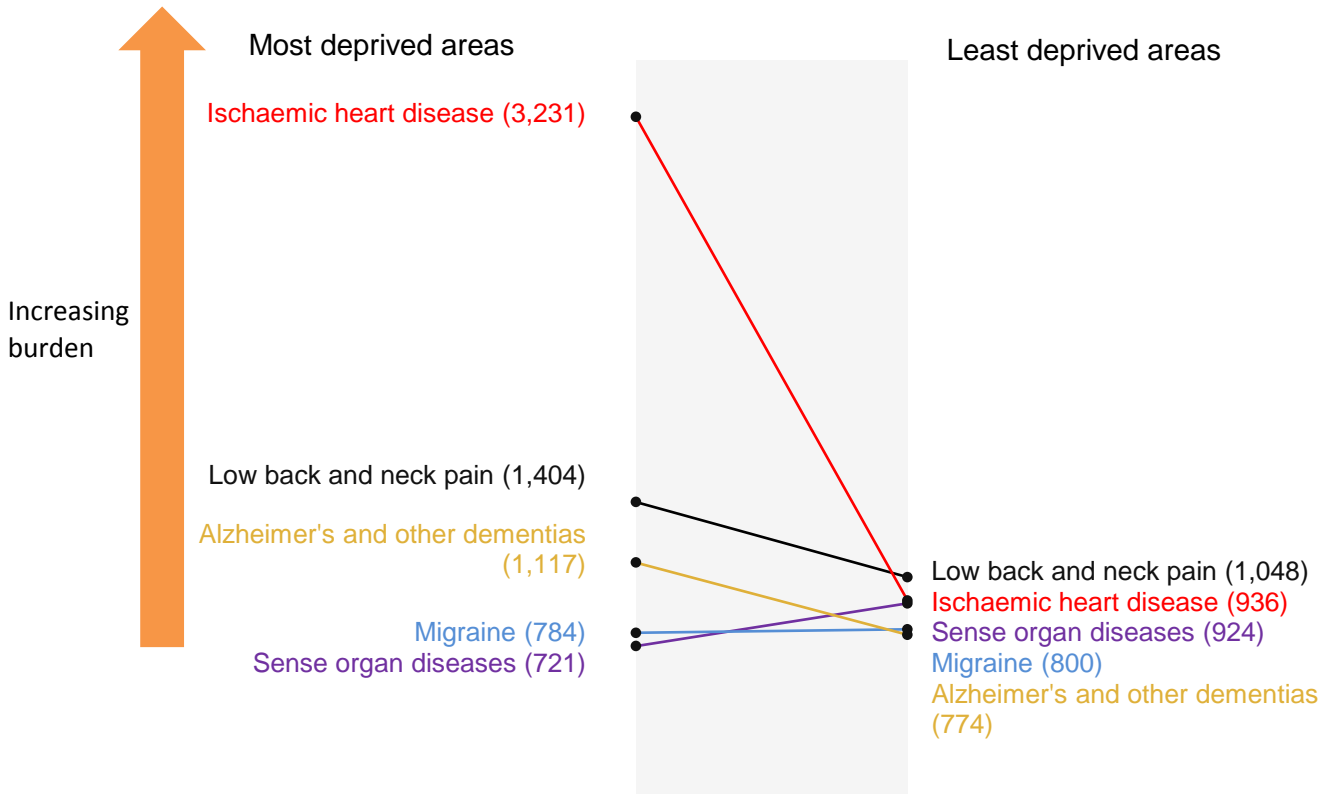
**Figure 7** shows diseases and injuries which have the largest burden in the most deprived areas. These drive the pattern of overall disease burden in Scotland. **Figure 8** shows diseases and injuries which cause the largest burden in the least deprived areas. Even these conditions have lower burden than the same diseases in more deprived areas. For example, low back and neck pain is responsible for the largest burden the least deprived areas, but still results in lower DALYs than low back and neck pain in the most deprived areas (where it only ranks 7th in terms of burden).

**Figure 7:** DALY EASR per 1,000 population, for the five leading causes of DALYs in the most deprived areas of Scotland and comparison with rates for the same conditions in the least deprived areas, SBoD 2016





**Figure 8:** DALY EASR per 1,000 population, for the five leading causes of DALYs in the least deprived areas of Scotland and comparison with rates for the same conditions in the most deprived areas – SBoD 2016



The leading causes of disease burden across deprivation deciles also vary by age group (**Table 4**).

**Table 4:** Leading causes of total burden (% DALY rate per 100,000 people) by age group and deprivation decile, Scotland – SBoD 2016

	Rank				
Age (years)	1	2	3	4	5
<b>0–14</b>					
<b>Most deprived</b>	Anomalies present at birth (16%; 881)	Neonatal preterm birth complications (11%; 603)	Sense organ diseases (6%; 352)	Sudden infant death syndrome (6%; 335)	Skin disorders (6%; 334)
<b>Least deprived</b>	Anomalies present at birth (22%; 944)	Sense organ diseases (12%; 541)	Skin disorders (11%; 482)	Asthma (7%; 320)	Migraine (5%; 231)
<b>15–24</b>					
<b>Most deprived</b>	Drug use disorders (16%; 1,980)	Depression (10%; 1,208)	Low back and neck pain (9%; 1,123)	Migraine (8%; 981)	Self-harm and suicide (6.6%; 837)
<b>Least deprived</b>	Migraine (13%; 884)	Low back and neck pain (10%; 718)	Depression (9%; 600)	Skin disorders (8%; 537)	Sense organ diseases (7%; 478)
<b>25–44</b>					
<b>Most deprived</b>	Drug use disorders (24%; 6,742)	Depression (9%; 2,575)	Low back and neck pain (6%; 1,650)	Anxiety disorders (6%; 1,618)	Alcohol dependence (5%; 1,543)
<b>Least deprived</b>	Migraine (12%; 1,180)	Low back and neck pain (12%; 1,144)	Depression (10%; 1,014)	Anxiety disorders (7%; 680)	Sense organ diseases (7%; 645)
<b>45–64</b>					
<b>Most deprived</b>	Ischaemic heart disease (9%; 4,210)	Depression (7%; 3,278)	Lung cancer (6%; 3,025)	Chronic liver disease (6%; 2,880)	Drug use disorders (6%; 2,712)
<b>Least deprived</b>	Low back and neck pain (8%; 1,343)	Migraine (6%; 1,019)	Depression (6%; 996)	Sense organ diseases (6%; 990)	Ischaemic heart disease (5%; 727)
<b>65+</b>					
<b>Most deprived</b>	Ischaemic heart disease (12%; 9,665)	Lung cancer (9%; 6,846)	COPD (9%; 6,780)	Stroke (7%; 5,752)	Alzheimer's and other dementias (7%; 5,444)
<b>Least deprived</b>	Alzheimer's and other dementias (9%; 3,871)	Ischaemic heart disease (9%; 3,736)	Stroke (7%; 3,140)	Lung cancer (5%; 1,936)	Sense organ diseases (4%; 1,790)

Note: Percentages represent each disease contribution to the overall burden in that age group in the most and least deprived areas of Scotland.

Among infants and children aged 0–14 years, anomalies present at birth (e.g. Down’s syndrome, congenital heart anomalies) were the leading causes of disease burden in the most and least deprived areas. Neonatal pre-term birth complications and sense organ diseases were the second highest contributors to disease burden in the most and least deprived areas in this age group, respectively.

Drug use disorders were the leading cause of disease burden in people aged 15–44 years living in the most deprived areas, while migraine was the leading contributor to the burden in the least deprived areas in this age range. Depression, and low back and neck pain were major contributors to the disease burden in both the most and least deprived areas.

Approximately a third of the burden for those aged 45–64 years living in the most deprived areas was caused by ischaemic heart disease, depression, lung cancer, chronic liver disease and drug use disorders. Of these conditions, only depression and ischaemic heart disease were in the highest ranking for the least deprived areas, with low back and neck pain, migraine and sense organ diseases being the other main contributors to burden in this age group.

In those aged 65 years and over, the main contributors to burden were similar for both the most and least deprived areas, though the rankings within each decile differed. Whereas ischaemic heart disease was the largest contributor to burden in most deprived areas for this age group, Alzheimer’s and other dementias were the largest contributor in the least deprived areas. The major difference between the most and least deprived areas in this age group was for COPD which accounted for 8.5% of the burden in the most deprived compared with 3.1% in the least deprived areas.

Within each age group, for nearly all the diseases and injuries with the significant burden, the rate of burden was higher in the deprived areas – differences in burden across deprivation groups were driven by a wide range of diseases.

# Discussion

The population of Scotland is growing older and living longer. Although we are living longer we are not, on average, experiencing this in perfect health. Health burden is increasingly being defined by what makes us sick rather than what is killing us, and the complexity of experiencing multiple health problems makes the burden worse. This has serious implications for planning services and the care workforce, and places emphasis on the need for effective policy making aimed at preventing (as well as mitigating) poor health. Much of the overall disease burden and the inequality in disease burden is caused by a relatively small number of diseases and injuries (seven diseases and injuries explain over half of the absolute inequality in disease burden, and 25 diseases and injuries explain 70% of the overall disease burden [**SBoD 2016, Grant 2018 – figure 10.4**]).

Most of these diseases also have the highest relative inequalities, indicating significantly higher burden from these conditions in deprived areas as a proportion of that in less deprived areas.

While ischaemic heart disease continues to cause the highest burden, this study highlights the need to pursue the public health priorities of mental health, alcohol, tobacco, drug problems, diet, healthy weight and physical inactivity. Research shows that individual behaviour change initiatives will not generate the step change in health that is needed in Scotland. A combination of bold policies to reduce poverty and adversity, alongside regulatory changes such as those seen for alcohol and tobacco to reduce unacceptable inequalities in burden, with bold public health leadership in local planning and communities, will create the conditions to reduce the overall burden of disease.

## Limitations

The SIMD is a measure widely used in Scotland to monitor and assess social and health inequalities. However, because SIMD is an area-based measure it does not perform well in identifying materially deprived individuals, that is it

wrongly classifies some individuals as 'deprived' when they are not, or 'not deprived' when in fact they are (**Fischbacher 2014**).

A further criticism of SIMD is that because it includes a health domain, its use to study deprivation patterns in health is invalid because SIMD and the health indicator being studied are not independent of each other. However, the health domain is weighted to account for a relatively small part of the overall SIMD (14% of SIMD 2016), and previous analysis of health inequalities using SIMD was found to give similar results whether the health domain was included or excluded, because that domain was so highly correlated with the overall index (**ISD, 2017**). Therefore, it is very unlikely the use of SIMD would impact on the report conclusions.

Benefits of the approach implemented in this report is that the same measure of deprivation has been used consistently across all 132 diseases.

Please see our **overview report** for a more general discussion about the limitations and strengths of the overall methods used in the SBoD study.

The report **Health Inequalities Policy Review** summarises the evidence available on measures likely to be to be effective and ineffective in reducing inequalities in health.

## What's next?

Publishing comprehensive burden of disease estimates for Scotland provides a starting point for informed health-related policy debate.

Alongside this report we are publishing burden estimates by local authority area, to enable local health and social care planners to assess burden against the composition of their workforce and services.

Our next publication will include projections of the disease burden in Scotland up to 2030, to lay the foundation for the next phase of our work programme.

This involves estimating the contribution of a range of exposures in the population (including income, smoking, obesity and alcohol consumption) in explaining the burden of disease in Scotland. This will then be used to estimate the reduction in burden arising from prevention strategies (i.e. their potential effectiveness), quantified in terms of the reduction in length of time people spend in ill health. We will compare this with the cost of these strategies and any reduction in demand for and cost of public services and resources.

Further work is also planned to look at the impact of multi-morbidity on burden for individuals and the health service.

## How can I find out more?

Visit our web pages at [www.scotpho.org.uk/comparative-health/burden-of-disease/overview](http://www.scotpho.org.uk/comparative-health/burden-of-disease/overview) to find other reports in our Scottish burden of disease series, technical information and detailed results for all 132 diseases and injuries.

Contact the Scottish burden of disease team: [nhs.healthscotland-sbod-team@nhs.net](mailto:nhs.healthscotland-sbod-team@nhs.net)

## The team

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