Trends in life expectancy, age and cause-specific mortality in the UK, 1970–2022, in comparison with a set of high-income countries: An analysis of vital statistics data

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Abstract

In 2019 the authors of this report published a paper in Lancet Public Health (https://pubmed.ncbi.nlm.nih.gov/31677776/) comparing life expectancy and mortality trends in England and Wales from 1970 to 2016 to a group of other high-income countries. In 2023 our group started a new project commissioned and funded by UK The Health Foundation that aimed to extend our analyses from our Lancet Public Health paper to consider mortality up to 2022 for the UK and all its constituent parts compared to a set of 21 peer countries. Moreover it aimed tp look at the contribution of specific causes of death to these overall trends. This report, written at the end of 2024, is the final output of this project for The Health Foundation.

In summary, we found that over the past 50 years up to 2022, judged against the central tendency of our set of other high-income peer countries, the UK's mortality record has been average for males and very poor for females. Of even more concern is the fact that over the past 30 years the relative international standing of the UK has deteriorated. This deterioration is seen in nearly all age groups and across a diverse range of causes of death. A key long-term influence is that for both sexes the UK was in the international vanguard of the smoking epidemic, which continues to affect the UK mortality disadvantage among women. At younger adult ages (25-49 years) a historical advantage in external cause mortality, with the UK having lower rates than many other peer countries, has progressively eroded since 2001 and was reversed by 2013. UK drug-related death rates stand out as having shown very steep increases in the period after 2010. However, this has not gone along with the same pattern of increases in alcohol-related deaths and suicide, casting some doubt on the relevance of the "deaths of despair" narrative. What is striking however is that despite the wide range of changes in mortality rates seen since 1990, a persistent north south geographic gradient persists, with only southern areas of the UK having a persistent mortality advantage compared to the peer country median, although even this has diminished over time.

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Preamble

Making comparisons between the mortality of countries at similar levels of national wealth is a valuable way to benchmark progress as well as to provide warning signals about negative trends in any particular country relative to its peers. This report summarises key respects in which mortality in the UK differs from that of a group of 21 comparator countries captured in terms of the median life expectancy and mortality rates of these countries.

Comparing trends in life expectancies at birth is an informative starting point that is widely used.[1-4] However, adding further dimensions is important for deepening understanding. Looking at whether differences between countries vary by sex and are driven by particular age-groups and causes of death is essential. Moreover, breaking down the country of interest into several geographic regions provides further insights. In this report, we consider these various dimensions. An exhaustive account of differences in mortality in the UK with the equivalent median value of 21 peer countries across sex, age, time, cause of death and geography goes beyond the scope of this summary report. Instead, we have picked out what we regard as key elements of our analyses that are informative and potentially relevant to helping drive forward improvements in public health in the UK.

We start by considering life expectancy at birth in the UK relative to the 21 comparator median. This is followed by an account of age-specific mortality, and geographic patterns within the UK in relation to the comparator levels. We then look at cause-specific mortality relative to the median of the comparator countries, for major categories of cause (malignant neoplasms, respiratory and cardiovascular diseases and external causes) as well as suicide, alcohol and drug-related deaths that have been linked together as “deaths of despair”.[5] Finally, we consider what factors may explain the differences in mortality trends and levels in the UK compared to the peer countries.

Data and Methods

Data on all-cause mortality (by age, sex and year) for the UK as a whole and for the 21 comparator countries and the corresponding population exposure were taken from the Human Mortality Database[6] for analyses covering the period 1970 to 2023. For the most recent years (predominantly 2022-23), the missing annual rates were estimated using the weekly mortality data from the Short Term Mortality Fluctuations data series of the HMD (STMF@HMD) as described elsewhere.[7] Mortality and population data used in analyses of all-cause mortality for 1990-2021 for England, Wales, and the 9 standard regions were provided by the Office for National Statistics (ONS).[8] Data for Scotland and Northern Ireland and the corresponding population exposure was taken from the Human Mortality Database.

Data on cause-specific mortality (by 5-year age group, sex, year and cause) for England, Wales and the 9 standard regions of England for the period 2001-2021 were provided by ONS.[8] Equivalent cause-specific death rates for Northern Ireland and Scotland were calculated using HMD population exposures while cause-specific death counts provided by the Northern Ireland Statistics Agency and National Records of Scotland. We restricted our analyses to deaths from 2001 as this was when the 10th revision of the International Classification of Deaths (ICD10) was first used in all parts of the UK and comparator countries. We did not use deaths from earlier years because of the problematic comparability of many cause-of-death items between ICD10 and ICD9, particularly when comparing across countries.[9] Further discussion of the validity of cause of death data, with a focus on potential inconsistencies induced by ICD10 updates are provided in the Annex at the end of this report.

The WHO Mortality Database[10] was used as the source of data for the 21 comparator countries on cause-specific mortality coded to ICD10 from 2001 to 2019. Cause-specific data for 2020 and later years were available for only a limited subset of countries and were thus excluded. We combined deaths across a range of ICD10 chapters to define two aggregated causes: alcohol- and drug-related deaths. The ICD10 codes used to define each cause of death are described in the Annex at the end of this report. Death counts by cause were missing from some countries and specific years as summarised in the Annex. The data series for Finland (2001-2019) and Iceland (2010-19) consisted of 3-digit items (instead of the more detailed 4-digit items), resulting in an inability to construct the aggregate of alcohol-related deaths.

We compared mortality in the UK with the median[a] life expectancy at birth and mortality rates across the 21 comparator high-income countries taking age into account. Further details about the calculation of the comparator medians are provided in the Annex at the end of this report. We computed sex-specific age-standardized deaths rates (ASDRs) in the age group 25-49 years for selected causes of death and all causes combined using the European standard population from 2013. The confidence intervals for cause-specific ASDRs were computed using Keyfitz' formula.[11] Life tables were constructed using the HMD methodology without smoothing at old ages.[12]

To examine geographic patterns of the mortality excess within the UK, we built geographic maps of the ratio of UK ASDRs to the median value for the years 1990, 2000, 2010, and 2019. Data handling, statistical analyses and mapping used a mixture of Microsoft Excel and R studio.[13]

Life expectancy at birth

Over the past 50 years life expectancy the UK has lagged behind the median value for the 21 comparator countries with females doing particularly poorly compared to other countries (Figure 1). For females, there has been a divergence from the comparator median since 1970 as improvements in UK life expectancy increased at a slower rate. By 2000, UK female life expectancy was among the lowest of its peers, and from 2013 onwards was the lowest with the exception of the USA. For males, the UK remained just below the median value over the period 1970-2012. However, from 2013 it diverged from the median and also became among the lowest of the comparator countries after the onset of the COVID-19 pandemic. In 2023, life expectancy at birth among females in the UK stood at 82.9 years in comparison with the comparator median level of 84.5, a difference of 1.6 years. For males, UK life expectancy was at 78.9 years and the median 80.3, resulting in a difference of 1.4 years.

The UK shows very substantial and persistent geographic differences in life expectancy at birth (Figure 2). What is particularly striking is that for females throughout the period 1990-2021, the best performing areas were only at the level of the comparator median, with most being appreciably below. By 2021, all UK areas were below the median. For males, several areas in the south of England were above the median for most of the period, although by 2021 only the South West region remained above.

The ranking of areas in absolute terms as well as relative to the comparator median remained broadly stable throughout 1990-2021. This is evident in the maps in Figure 3, where the magnitude of the life expectancy differences between each UK area and the comparator median are shown for four selected years. The colours assigned to each area reflect the magnitude of the absolute difference, with the same key being used for females and males. This clearly shows for both sexes a north-south gradient, with life expectancy in Scotland, the North-East and the North-West regions of England being persistently lower than the comparator median. For both sexes, Wales became further adrift from the median in 2019 compared to previous years. It is also notable that the male advantage shown in the

[a] The central tendency of the group of 21 peer countries is best represented by the median life expectancy and mortality rates. The alternative measure, the mean, would have the disadvantage of being unduly influenced by outliers.

south of England in the earlier years, with life expectancies lower than the median comparator level, had dissipated by 2019.

Life expectancy at birth for any one year is a summary measure of mortality at different ages. The contributions of different age groups to differences in life expectancy in each area and the comparator median was computed using standard methods[14] and are shown for 2019 in Table 1. This year was selected rather than 2021 because age patterns were strongly disrupted in 2020 and 2021 by the COVID-19 pandemic. Areas are ranked in the table according to the magnitude of the difference with the comparator median, with the same ranking being used females and males. For females, the 65-79 year age group accounts for the largest fraction of the total difference (0.43/1.20). In contrast for males, it is the 25-49 year age group that makes the largest single contribution (0.33/0.85).

Age and geographical variation in all-cause mortality rates

Further insights into the way in which the UK's position relative to the 21 peer countries varies by age are provided in Figure 4. For the youngest (0-24) and oldest (85+) age groups mortality rates in the UK have been at similar levels to the comparator median over the entire period (1990-2021) in both sexes. At ages 50-64 and 65-79 years, UK mortality has been consistently above the comparator median, with the older age group (65-79) showing evidence of convergence in the period up to 2010 in men and women, as was the case among women aged 50-64 years. However, the 25-49 age group shows strong evidence of a divergence, with mortality rates in the UK declining appreciably less steeply than those of the comparator median. Even more dramatically, unlike the comparator median, there is a notable increase in rates in the UK from 2013 onwards. The differences in trends in the 25-49 year age group are particularly striking for men with a cross-over in the mid-2000s reversing the initial advantage of the UK relative to the comparator median level.

Geographic differences in mortality within the UK relative to the comparator median vary according to age at death. This is shown in the maps in Figure 5 which display the ratio of mortality rates in each area to that of the comparator median by age group in 2019. While every age group shows evidence of a north-south gradient, with the mortality rate ratios being highest in Scotland and northern England and Wales, this pattern is most pronounced at ages 25-49 years, and least pronounced at age 80+ years.

Cause-specific mortality rates – all ages combined

The direction and size of differences in UK mortality rates with the comparator median varies by cause of death as shown in Figure 6. However, interpretation of any such differences needs to consider the possibility that medical certification of cause and rules for cause coding do vary between countries as well as across time within countries, which can give rise to artefactual differences.

Of the four major categories of cause of death shown in Panel A of Figure 6, respiratory disease shows the largest relative difference between the UK and the comparator median. Consistent with the findings of other international studies,[15] respiratory disease death rates in the UK are very much above the comparator median over the entire period from 1990, typically being 50%-70% higher.

Mortality rates from malignant neoplasms show steady declines in the UK as well as in the comparator median, although rates are consistently higher in the UK. For males there is a slight widening of the absolute difference between the UK and the comparator median from 2014.

Cardiovascular disease mortality rates have declined steeply in the UK as has the comparator median, with the declines in both having been roughly in parallel. However, in 2011 there is a step downward change in UK levels in both sexes. This resulted in UK rates becoming lower than the comparator median, having previously been higher. This is likely to be due to changes in coding rules used by the Office for National Statistics in England,[b] whereby deaths that were previously assigned to "unspecified cerebrovascular disease" being coded to "vascular dementia or unspecified dementia". This resulted in these deaths being transferred out from the category of cardiovascular disease to dementia.

Mortality rates from external causes of injury, poisonings and violence in the UK are lower than the comparator median. However, the UK rates have been increasing since 2013, unlike the comparator median levels which have been reducing in males and (to a smaller extent) in females. This has led to the UK advantage being almost entirely eliminated by 2019 in both sexes.

The equivalent trends for suicide, alcohol- and drug-related deaths are shown in Panel B of Figure 6. In all years, UK suicide rates were below the median comparator level. However, suicide rates in both females and males increased in the UK from 2010. In contrast the comparator median suicide rates showed a shallow decline.

Alcohol-related deaths in the UK showed a varying pattern over time, increasing until around 2006, followed by a fall with a small subsequent increase to 2019. During the COVID-19 years (2020 and 2021), UK rates increased sharply. In contrast alcohol-related mortality rates for the comparator median declined for most of the period from 2001, although there was an uptick for males after 2015.

The most striking contrast in trends between the UK and its peer countries median rate was for drug-related deaths. For females and males rates increased from a low in 2003 (males) and 2007 (females). In contrast the comparator median rates for both sexes did not show any consistent trend of increase or decrease.

In summary these three specific grouped causes of death showed a variety of trends in how UK mortality differed from the peer median level, although overall rates for each increased in the UK between 2001 and 2021, while the comparator median decreased or remained constant.

Cause-specific mortality rates by age group

Figures 7 show time trends in mortality by major cause categories for individual age groups.

All malignant neoplasms. Throughout the period 2001-2019, in each adult age group from 25-49 to 80+ years, women in the UK have higher mortality rates than the comparator median. For men, the UK has consistently higher rates only in the two older age groups. At younger adult ages, UK men either track the comparator median level (ages 50-64) or show a cross-over (ages 25-49) having initially had lower rates which then surpassed the comparator median from 2013. Both men and women at this youngest adult age (25-49) show a reduced rate of decline from around 2010. In the youngest age group (0-24), there is no systematic difference between the UK and the comparator median over the period from 2001.

Respiratory diseases. The picture of the UK having markedly higher respiratory disease mortality rates than seen in for the comparator median, is seen in every age group for both females and males. It is notable that in the 25-49 age group there was an increase in UK rates in 2013 for both sexes.

[b] See Annex on Data and Methods at the end of this document for further details

Cardiovascular diseases. In adults under the age of 80+ years, mortality rates from cardiovascular diseases are consistently higher than the comparator median. In the 80+ age group the reverse is true. Between 2001 and 2012, there is a suggestion that rates in the UK fell faster than the comparator median level leading to a degree of convergence in the 50-64 and 65-79 year age groups. Subsequently a mixed pattern by age was seen, with some suggestion of a divergence in the 50-64 year age group for women and men. The step down in UK rates in 2011 already noted for the all-ages rates in Figure 6 is most noticeable at ages 80+, but is not apparent at all below the age of 65 years. This is what would be expected given the previously described changes in coding practice whereby deaths from undefined stroke were moved to dementia, which will mainly affect deaths in old age.

External causes. In 2001, the UK had notably lower external cause mortality rates than the comparator median in every age group. However, this distinct advantage was reduced or reversed in the subsequent years. In both sexes rates in the youngest age group (0-24) rates converged as the declines in the UK were shallower than the declines for the median comparator, and from 2015 plateaued. In each of the older age groups there was an increase in external cause mortality rates that began after 2010. At age 25-49 years, the pronounced increase seen in the UK occurred alongside a decline in comparator median rate, resulting in a cross-over in 2013. Similar differences in trends in the UK and the comparator median in the 50-64 year age-group resulted in the two being at very similar levels by 2019.

Figure 8 focuses on three causes of death that have been suggested to be linked together as "deaths of despair".[5] We have focused on adult age groups below 80 years of age where deaths from these conditions are most common.

Suicide and deaths of undetermined intent. Rates of suicide in the UK were lower than the comparator median level for men regardless of age, the gap being largest in the oldest age group (65-79 years). This was also the case for women except in the youngest age group (25-49) at the end of the period, when in 2019 rates in the UK and comparator median converged. The UK stood out as showing some evidence of increasing rates most notably among men at ages 50-64 years, although more modest increases were also seen after 2016 in women and men at age 25-49 years. In contrast, there was no indication of increases in the median comparator rates in any age group.

Alcohol-related deaths. The patterns of mortality from alcohol-related death rates are heterogeneous depending upon age and sex. The relative size of the gap between the UK and the comparator median changed substantially from the youngest to the oldest age groups. At age 25-49 years the gap remained roughly similar for both sexes, with UK rates being consistently higher than the comparator median. At age 50-64 years there was a divergence between the two over time, with comparator median rates declining slightly over time. In the oldest age group (65-79) rates were lower in the UK than the comparator median among men, and at similar levels for women. For men at this age there was a convergence with UK rates rising and comparator median rates falling over time. It should be noted that in the UK there was a consistent increase in rates between 2020-21 driven by the COVID-19 pandemic.

Drug-related deaths. At ages 25-49 and 50-64 years, the UK showed clear and substantial increases in mortality rates from drug-related causes among both women and men in contrast to the comparator median which showed little systematic variation over time. This resulted in a steep divergence in rates with the UK having appreciably higher rates by 2019 compared to the situation in 2001. In the oldest age group (65-79) there was a different picture, with UK rates being slightly below those of the comparator median in most years.

Cause-specific mortality rates by geographic area

The pattern of geographic variation across the UK in the proportional size of the gap between rates in the UK and the comparator median shows considerable variation by cause of death in 2019 (Figures 9 and 10).

Among females in the UK all malignant neoplasms and respiratory diseases showed higher rates than those of the comparator median in every geographic area (Figure 9). A similar pattern was evident for males, although for all malignant neoplasms the South East area of England showed rates that were at the same level as the comparator median. Respiratory disease mortality rates were notable in both sexes in that, unlike most other causes of death, Scotland did not have the highest rates. Instead the highest rates were found in Wales and the North West of England. Cardiovascular disease mortality showed the more typical north-south gradient in mortality within the UK in 2019, although most areas had lower rates than the comparator median. This is also the case with external cause mortality rates, although in this case Scotland stood out as being the one area with higher rates than the comparator median.

The ratio of suicide rates in the UK to the comparator median showed relatively little geographic variation for either sex (Figure 10). Rates were marginally higher in Scotland than the comparator median, while in other areas the reverse was the case. Alcohol-related mortality showed the typical north-south pattern, although this was only pronounced for females. Drug-related deaths were proportionally higher throughout the UK for both sexes. The geographic pattern showed a strong north-south pattern, with the highest relative excess in Scotland and the North East region of England, and the lowest in the south-east.

The steep rise in drug-related mortality over time in the 25-49 year age group in the UK compared to the comparator median (see discussion of Figure 8 above) is evident in the Figure 11 map. This shows the ratio of UK mortality from this group of causes at ages 25-49 to rates of the comparator for three years (2001, 2010, 2019). In each area of the UK there was a marked and progressive deterioration in UK's position relative to the comparator median. Even those areas in the south of England which had lower mortality in 2001, had higher rates than the comparator median by 2019.

The bigger picture: bringing it all together

The objective of this project is to identify and throw new light on the way in which mortality rates in the UK have evolved overtime in relation to other high-income countries, paying particular attention to sex, age, geography and causes of death.

The overriding feature of trends since 1950 in life expectancy at birth in the UK and other high-income countries has been one of steady improvement.[1,3] In the decade preceding the COVID-19 pandemic there was increasing evidence that rates of improvement had started to falter, and in the case of the USA, even fall. The UK is one of several European countries where improvements in life expectancy at birth slowed down in the middle years of the 2010s.[16]

The first thing that stands out from our analysis is that UK life expectancy at birth has been at or just below the median level of the 21 peer comparator countries for the entire time since 1970 in both sexes. For most of the past 50 years, UK female life expectancy has been further below the median level of its peers than male life expectancy. From 2000 female life expectancy was one of the lowest of all comparator countries. This poor performance of UK female life expectancy as a whole is echoed in the fact that since 1990 only a few of the 12 UK areas we have looked at have had female life expectancy levels above the median. The generally negative position of the UK relative to its peers preceded the COVID-19 pandemic, which further exacerbated the UK's poor international standing. In 2023, UK life expectancy at birth among females was lower than any of our comparator countries other than the USA, with male life expectancy being the third lowest. The long-term and pronounced deficit in female life expectancy in the UK relative to many other peer countries has not received the attention it deserves.

Looking in more detail within the UK over the past 20-30 years, while the overall picture is not impressive, there are a few geographic areas and causes of death where the UK's mortality experience has been consistently better than median of the comparator countries. The southern regions of England have had a mortality advantage compared to the median, with higher life expectancy. Turning to cause of death, of the ones we have examined deaths from external causes, and within this suicide rates, have had consistently lower age-standardised rates than the comparator median. As we discuss further below, however, these unusual advantages shown by southern regions of England and external causes are unfortunately being eroded over time.

A number of geographic areas and causes of death have done consistently worse compared to the comparator median. Scotland stands out as having done particularly poorly compared to the median of comparator countries,[17] with consistently the lowest values of any of the 12 geographic areas we have examined. Northern regions of England, Wales and Northern Ireland have also done poorly compared to the median level.

What is remarkable about the north-south pattern of geographic variation in life expectancy and all-cause mortality in the UK relative to the comparator median is that it has remained broadly fixed over the period we have focussed on from 1990 onwards. The north does consistently worse than the south. However, it should be noted that the advantage of southern regions of England relative to the comparator median diminishes over time particularly for males.

As explained earlier, our analyses of time trends by cause of death only extend from 2001 to 2021 for the UK and up to 2019 for the comparator median. In the period 2001-2019, it is respiratory disease mortality in the UK has been particularly elevated compared to the median, with rates being typically 50%-70% higher. This is the case irrespective of age or sex and is consistent with what has been found previously.[15] Malignant neoplasms have also shown consistently higher age-standardised rates compared to the median comparator among adults over the period from 2001, females doing worse than men in both absolute and relative terms. Cardiovascular diseases (CVD) constitute by far the largest cause of death. Under the age of 80+ years, CVD mortality rates have been consistently higher in the UK than the comparator median level. It should be once more emphasised, that the apparent fall in the UK's total age-standardised CVD mortality rates 2010-11, to become lower than the comparator median, is likely to be an artefact of change in coding practices in the UK.

In summary, the four major grouped causes of death we have examined (malignant neoplasms, respiratory diseases, cardiovascular diseases and external causes of injury, poisoning and violence) together account for the vast majority of all deaths in the UK. Respiratory diseases have rates consistently above the median in every age group and both sexes. The same applies to CVD mortality under the age of 80+ years. For women mortality rates for malignant neoplasms are also higher than the comparator median in all age groups, while for men the UK has higher rates above the age of 65+. It is only external cause mortality rates which have been consistently below the median level, with the exception of the 25-49 age group since 2010.

This broad overall pattern of consistent mortality differences between the UK and its peers has not been static. Over the past 20-30 years there have been changes in their magnitude and direction for some population sub-groups, and for a group of less common but nevertheless important causes of preventable death (deaths from suicide and undetermined intent, alcohol-related causes and drug-related causes).

The most dramatic change over time in the relative of standing of mortality in the UK compared to the median of the 21 peer countries is in the 25-49 year age group. The worsening relative position of all-cause mortality rates in the UK among these younger working-age adults was apparent in the 1990s for both women and men. This was the result of mortality rates for the comparator median declining at a steeper rate than in the UK. For males this had the effect of reversing the initial UK advantage of lower mortality in the 1990s with rates exceeding those of the comparator median from 2004 onwards. However, from 2013 this longer-term divergence at ages 25-49 years became even more pronounced with rates in the UK in working-age women and men starting to increase while those of the comparator median continued to decline.[c]

This startling cross-over in all-cause mortality rates in the 25-49 year age group has a number of cause-specific elements. The most obvious is external cause mortality, which showed a cross-over around 2013, moving from initially lower mortality than the comparator median to having rates that went above it. This was in part driven by external cause rates in the UK in both sexes increasing from 2013 onwards. Further dissection of what other factors may have driven the increase in the UK all-cause mortality rate at ages 25-49 years revealed that from 2013 mortality from drug-related causes also show increases from 2013 in both sexes, which were particularly sharp for men. However, added to this was a deacceleration in the declines in mortality rates from malignant neoplasms and cardiovascular disease in the UK at age 25-49 from 2013 that contrasted with the continuing downward trend for the comparator median.

The 25-49 age group is not the only one where the difference in mortality between the UK and the median of the 21 comparator countries has changed over time. The 0-24 year age group also shows similar features. In 1990 UK rates were either below those of the comparator median (males) or at the same level (females) but by the mid-2000s the UK crossed over to end with higher rates. At older ages, from age 50 years upwards, there is no evidence of such negative crossovers. Indeed, between 1990 and 2010, there was a positive convergence in rates, with female rates at 50-64 years in the UK falling more steeply than the comparator median, the same being evident for both women and men at age 65-79. However, for both these older age groups convergence was replaced in 2013 with a degree of divergence as UK rates plateaued. Mortality from cardiovascular disease and external causes both played a role in driving this. In addition, among those aged 50-64 years, drug-related deaths show a steep increase in both sexes in the UK from 2013, also adding to the divergence in all-cause mortality from this point at these older ages.

Potential explanations

The explanations for the long-term differences in life expectancy and mortality in the UK compared to the median of the 21 comparator countries are almost certainly different to those for the most recent negative trends that have occurred since 2010.

Longer-term influences. Smoking is a key factor that has driven adult mortality dynamics in high-income countries over the past 50 or more years. It's impact on mortality and life expectancy is profound for two reasons: 1) It is causally related to a large number of common causes of death from cancers and non-malignant conditions including respiratory disease and cardiovascular diseases; 2) Most high income countries in the 20th century had substantial tobacco epidemics, in

[c] The full extent of this reversal among working age adults in the UKs initial advantage is shown graphically in the heat map in Figure 12. This shows the emergence of a hot spot of excess relative mortality in the UK under the age of 50 years that becomes particularly evident from 2000 onwards.

which large proportions of the population have smoked regularly even if today smoking prevalence has fallen.

The UK is recognised as having been in the international vanguard of the cigarette epidemic.[18,19] In the 1960s when its mortality impact on men was at its height it is estimated that almost half of all deaths aged 35-69 years in the UK were attributable to smoking.[19] For women the maximum impact of smoking on mortality in the UK came later in the late 1980s when a quarter of all deaths at ages 35-69 years have been attributed to smoking.[19] Reflecting the lagged effect of smoking on cancer incidence and mortality, despite declines in smoking among women in the UK in recent decades, in 2018 they still had one of the highest mortality rates from lung cancer in Europe.[20] The impact on smoking of the intensity and timing of the smoking epidemic in the UK compared to other countries will also have contributed to the high rates of respiratory disease mortality in the UK compared to the comparator median, although as noted elsewhere air pollution and other factors may also be important.[15]

An important part of the explanation of why female life expectancy in the UK since 1970 has been lower than most of the 21 peer countries is the timing and intensity of the smoking epidemic in the UK relative to that of other countries. The impact of smoking on adult mortality in the UK and many other countries follows a birth cohort pattern, with the likelihood of smoking going up and then down in successive generations (birth cohorts).[21-23] Women in the UK were leaders of the global smoking epidemic : taking up smoking in large numbers earlier in the 20th century and smoking more heavily than women in other most other countries. Within the UK, Scotland stands out as having being particularly badly affected by smoking.[24]

The effect of differences in generational timing of the smoking epidemic across countries on total mortality can be seen in the heat map in Figure 12. This shows that for women older than 50 years in the UK, it is among those born around the 1925 (indicated by the diagonal dashed yellow line in the figure) who have the highest mortality relative to the comparator median. A similar but slightly more diffuse effect is seen for men around the 1900 birth cohort. As time passes these cohort effects driven by smoking recede. This is clearly seen in the convergence of all-cause mortality rates in the UK with the comparator median between 1990 and 2010 at ages 65-79 years (Figure 4).

The other major long-term influence on the mortality differences between the UK and peer countries that we have observed is the gradual elimination of the relative mortality advantage held by the UK relative to the comparator median for peer countries among adults under the age of 45 years in the 1970s and 1980s. This can be observed in the heat map in Figure 12, where particularly for men, it is evident that mortality was particularly low compared to the peer comparator median in between 1970 and the early 1990s in those aged under 35 years. A similar but weaker effect is also evident for women. This is largely explained by the UK having had particularly low mortality rates from external causes of injury poisonings and violence (the dominant cause of death at young adult ages in high-income countries) compared to other countries.[25] According to the Health for All Database between the 1970s and the 1990s the age-standardized death rates for external causes of injury, poisoning and violence under the age of 65 years were 30%-35% lower than the average of the 14 (Western) European Union (EU) member states. However, between 2001 to 2009 this advantage gradually disappeared with rates in the UK going from being 28% to 18% lower. In the 2010s this advantage was almost entirely eliminated, being only 1% lower than the EU comparator countries by 2015.[26] A detailed analysis of international variation in external cause mortality in the 1980s and 1990s[27] found that England and Wales had notably low mortality compared to other countries for most components of this aggregate of causes including road traffic injuries and suicide. Scotland however had rates that were appreciably higher.

The elimination of the comparative advantage at young adult ages appears to be mainly due to other countries reducing their mortality from external and other causes of death while the UK failed to make equivalent progress. Younger adult external cause mortality rates in the UK flatlined between 2001 and 2010 while the comparator median continued to fall. The reasons for this are unclear, and require further investigation at the level of individual components of external cause mortality.

Recent negative trends. In the period from 2010 onwards, differences between mortality in the UK and the peer country median moved in a negative direction for a range of causes and in most age groups. For some causes this was due to an increase in the UK following a period of decline or stability, and for others a slowing down or plateauing of a previous downward trend. Once again this can be observed for all causes of death in the heat map in Figure 12. Under the age of 50 years a new hot spot starts to emerge after 2000, with time becoming stronger and affecting an increasingly wide range of ages as mortality rates in the UK became higher than those for the comparator median. This phenomenon is completely separate to the long-term cohort affect described above and represents a new phenomenon.

The change in UK rates in this recent period were most clearly seen for external causes, and occurred simultaneously in all age groups. However, it was also evident for malignant neoplasms in younger adults (25-49) and cardiovascular disease particularly in the age groups 25-49 and 50-64. Suicide rates in the younger working age adults (25-49) also stepped up in males around this time. The most dramatic increases in UK rates were for drug-related deaths in both the 25-49 age group and in the 50-64 age group.

Since 2018 much attention has been given to the decline in the rate of improvement of life expectancy in the UK since 2010,[28-30] with some authors pointing out that this is not a uniquely British phenomenon.[16,31] Government policies introduced around 2010 in the aftermath of the 2008 financial crisis, have been put forward as an important ultimate cause.[32] What is evident is that in the UK these policies led to erosion of safety nets for the most vulnerable groups, making many people's lives harder.[33] Moreover, in some parts of the UK, such as the North East region, deindustrialisation that has been occurring over a period of many decades has also had a serious impact on people's life chances, well-being and health.[34]

One attempt to explain some of these broader negative social and economic effects on mortality has involved the development of the concept of "deaths of despair". This arose from a 2015 paper by Case and Deaton that described increases in the white non-Hispanic mortality rates in middle aged adults in the USA,[35] They suggested that much of this was attributable to drug and alcohol poisonings, suicide, and deaths from chronic liver diseases and cirrhosis: causes which were subsequently bundled together as "deaths of despair".[5] This concept encapsulates a wide range of potential causal mechanisms including absolute and relative deprivation and associated states of hopelessness which drive people to behaviours that are self-harming and potentially fatal.

How far do our findings support the idea that this combination of causes jointly acted together as important drivers of the divergence in working age mortality rates in the UK from those of the median of 21 peer countries that has occurred since 2010? We have already described the sharp increases in drug-related deaths in working age adults in the UK that has led to a marked divergence with the comparator median. Suicide rates have generally been lower in the UK than the comparator median, although in the 50-64 age group men have shown an increase that started in the early 2000s resulting in a partial convergence with the higher median level. A similar effect was seen for women aged 25-49 years. However, alcohol-related mortality rates at working ages in the UK have not shown negative trends relative to the comparator median. It is only in men in the older age group (65-79) that a divergence has occurred with rates increasing in the UK as those of the comparator median have fallen. Taken as a whole, therefore, the negative trends in drug-related mortality rates at work-ages have not been consistently mirrored by either of the two other proposed components of "deaths of despair": alcohol-related deaths and suicides.

Other work has recently brought into question the coherence of how this concept of deaths is assumed to be driven by a common set of psychosocial factors.[36,37] Consistent with our findings, Dowd et al.[38] found that in the period 2001-19 mortality trends from suicide, alcohol-related, and drug-related causes did not increase in parallel in the UK or Canada, despite an overall recent increase in total mortality at working ages. While drug-related mortality rates in younger adults increased, suicide rates in the UK increased only slightly and alcohol-related causes declined, most notably in Scotland. Our results and those of Dowd et al. challenge the view that there is a causal commonality shared by deaths from suicide, alcohol- and drug-related causes linked to a common "deaths of despair" driver. However, this is not to dispute that deaths from these preventable causes can be related to deprivation and poverty. Instead, we should formulate more specific hypotheses to explain the distinct dynamics of the mortality trends of each of these causes.

The very dramatic and exceptional rise in drug-related deaths in the UK needs to be considered not only in terms of what drives people to take drugs, but also in terms of availability of specific drugs. There is evidence that access to heroin and synthetic opioids has been rising in Europe.[39] The specific drug-types involved in the UK increases cannot be reliably determined based on information on death certificates in the UK alone other than in Scotland.[40] However, it has been estimated that in 2022, almost half of drug-poisoning deaths in England and Wales involved an opiate.[41] This is consistent with estimates suggesting that the UK has particularly high levels of opioid consumption, with prescription opioids playing some role, but most recently fentanyl and other illicit opioids becoming more important.[42]

It should be noted that after 2010 there was plateauing of mortality from cardiovascular diseases in adults under the age of 80+ years and a slowing down of the decline in deaths from malignant neoplasms at ages 25-49. The former will be of particular importance given how common cardiovascular disease deaths are over the age of 50 years. The reasons for these changes in rates are unclear. However, there is evidence that there have been slowdowns in cardiovascular disease mortality in many high-income countries.[43] If the slowing down in the rate of decline in cardiovascular mortality is happening more quickly in the UK than in other countries this would explain the observed divergence with the comparator median levels from around 2010. Further work to understand this is required, such as examining international differences in obesity levels as well as access to and use of effective primary and secondary preventive treatments.

A final comment about the comparability of cause-specific death rates is essential. As we describe in the Annex of this report there are very clear instances where changes in coding practice in the UK have resulted in substantive changes in mortality rates from various causes. For some of the cause-groups we have analysed (alcohol- and drug-related) we have been able to use aggregates of causes that will have reduced or eliminated the impact of these UK coding changes on trends. However, this is not the case for cardiovascular disease as discussed above and in the Annex. There must however be a further and more general concern about the validity of some of our comparisons of cause-specific rates in the UK with comparator median levels. It is highly likely that the behaviour of doctors certifying causes of death are likely to vary between countries, and different national statistical offices will have introduced changes in coding practices which are not necessarily the same or did not occur at the same time as in the UK. Being able to assess their impact on our findings goes far beyond the scope of this project.

Having highlighted these potential challenges, however, it is important to note that these issues about the international comparability of cause of death rates do not affect the comparability of comparisons of all-cause mortality rates and life expectancy. As we have described in detail, there are very clear and important contrasts in how UK all cause mortality rates at different ages vary from the peer comparator median levels. These are very unlikely to be explicable by any form of statistical artefact.

In summary, over the past 50 years, judged against the central tendency of set of peer countries the UK's mortality record has been for males average and for females poor. Of even more concern is the fact that over the past 30 years the relative international standing of the UK has deteriorated. This deterioration is seen in nearly all age groups and across a diverse range of causes of death. A key long term influence is that for both sexes the UK was in the international vanguard of the smoking epidemic, which continues to affect the UK mortality disadvantage among women. At younger adult ages a historical advantage in external cause mortality, with the UK having lower rates than many other peer countries, has progressively eroded since 2001 and was reversed by 2013. UK drug-related death rates stand out as having shown very steep increases in the period after 2010. However, this has not gone along with the same pattern of increases in alcohol-related deaths and suicide, casting some doubt on the relevance of the "deaths of despair" narrative at least in the form originally proposed by Case and Deaton.[5] What is striking however is that despite the wide range of changes in mortality rates seen since 1990, a persistent north south geographic gradient persists, with only southern areas of the UK having a persistent mortality advantage compared to the peer country median, although even this has diminished over time.

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Figures and Tables

Figure 1. Life expectancy at birth by year (1970 – 2023) in the UK and comparator countries, plus the median life expectancy for the group of 21 comparator countries.

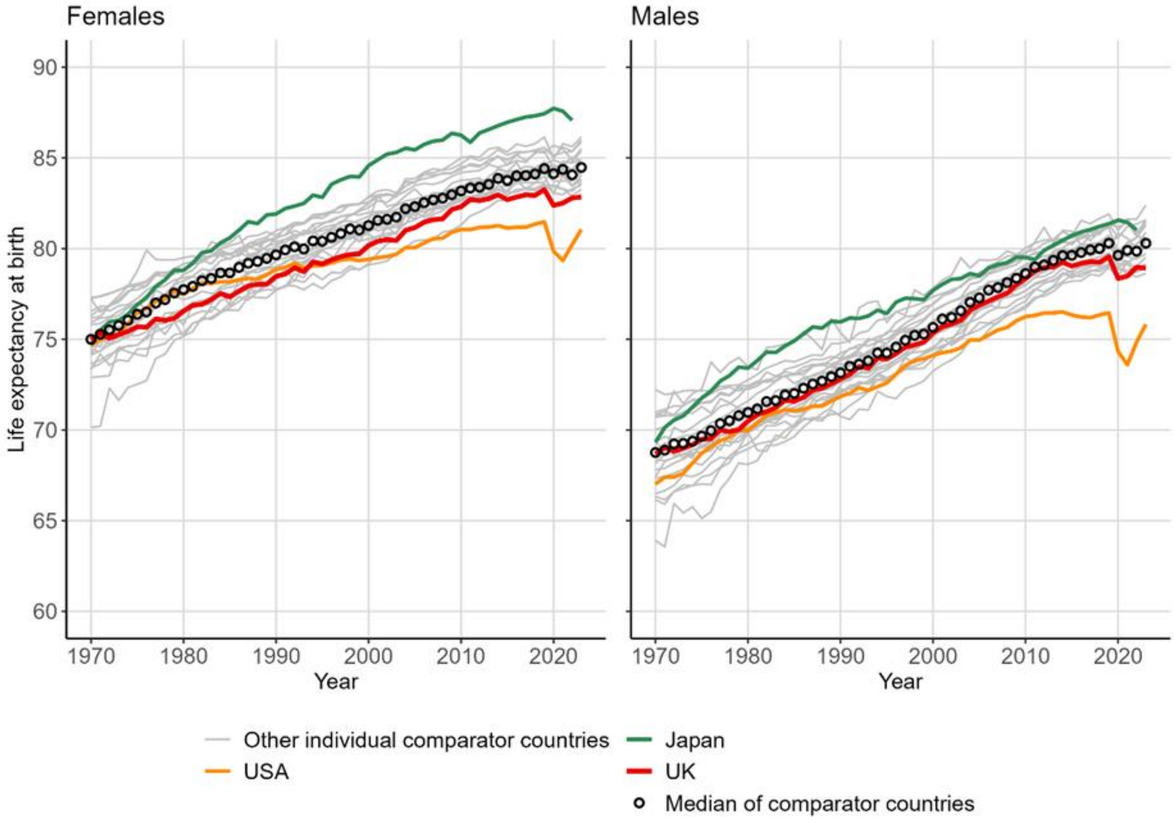


Figure 2. Life expectancy at birth by year (1990 – 2021) by sex in the 9 regions of England, Wales, Scotland, and Northern Ireland plus the median for the 21 comparator countries.

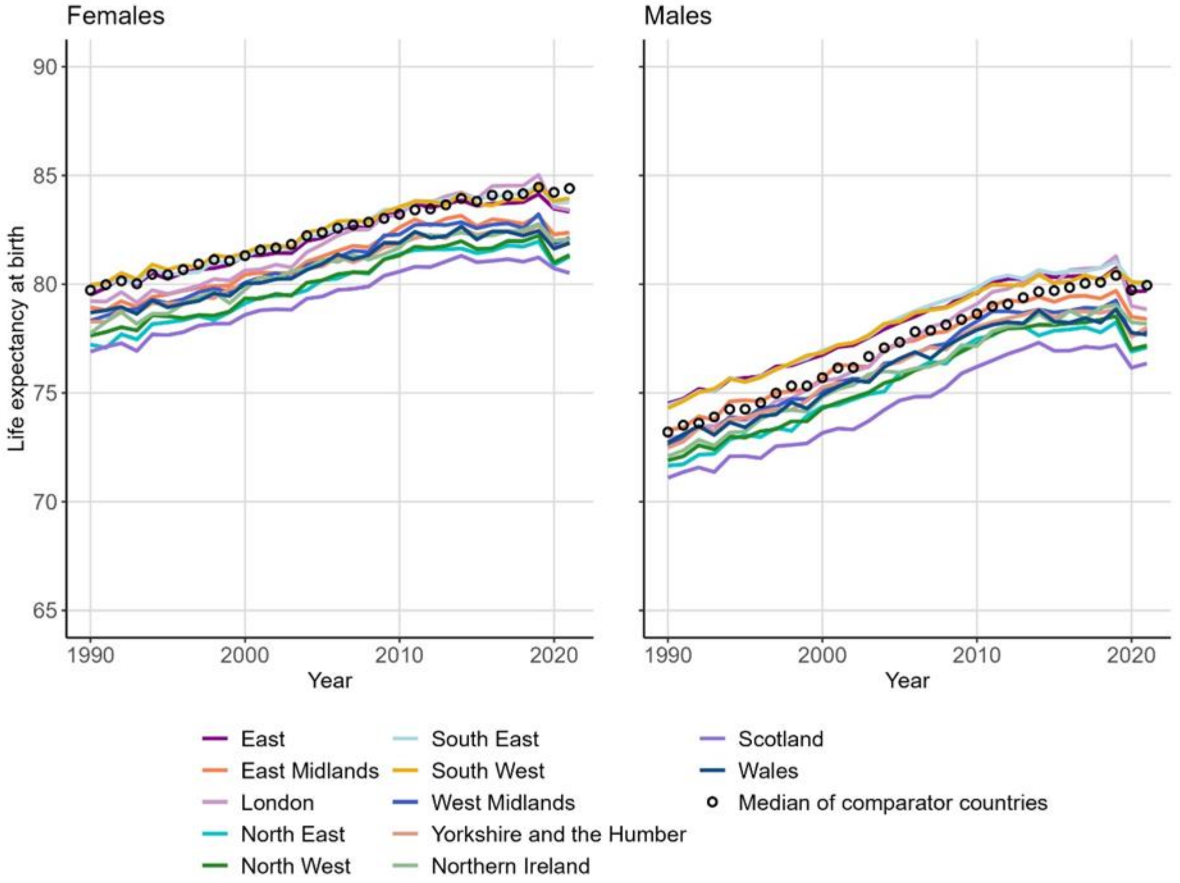


Figure 3. Difference in life expectancy at birth in each area of the UK relative to the median value for 21 comparator countries by sex for selected years.

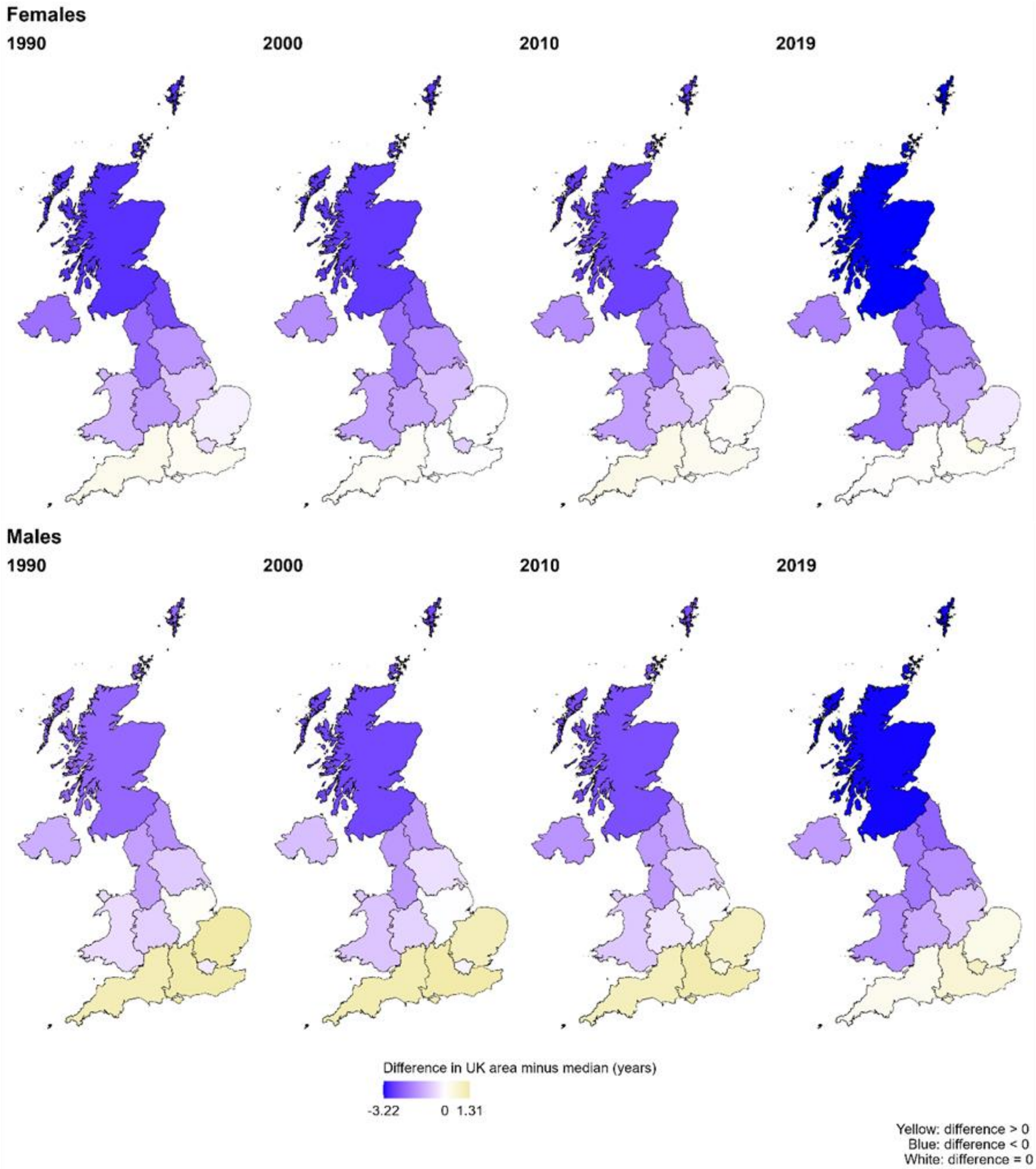


Figure 4. Age-standardised all-cause mortality rates per 100,000 by year (1990 – 2021), age group, and sex in the United Kingdom plus the median for the 21 comparator countries.

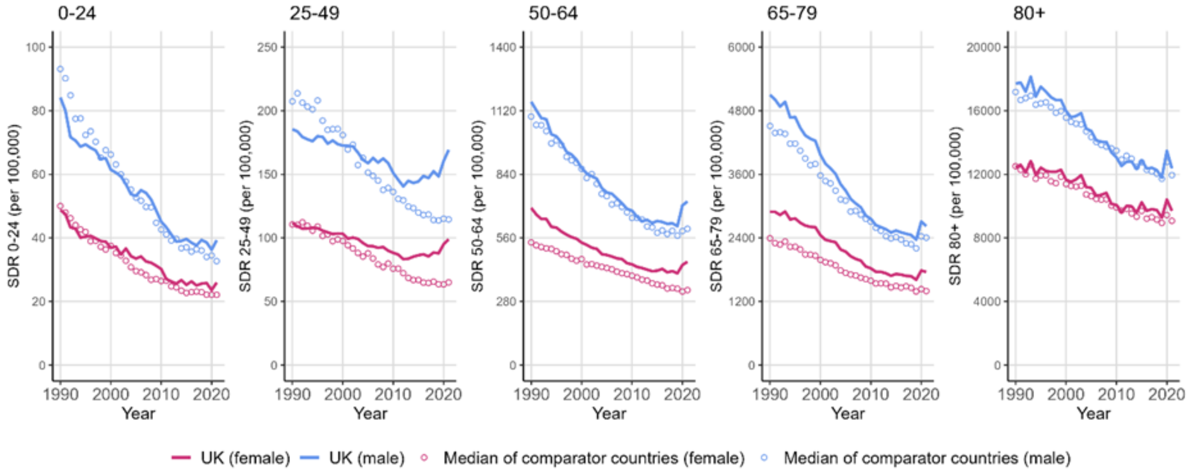


Figure 5. Ratio of all-cause age-standardised mortality rates by age group in each area of the UK relative to the median value for 21 comparator countries by sex, 2019.

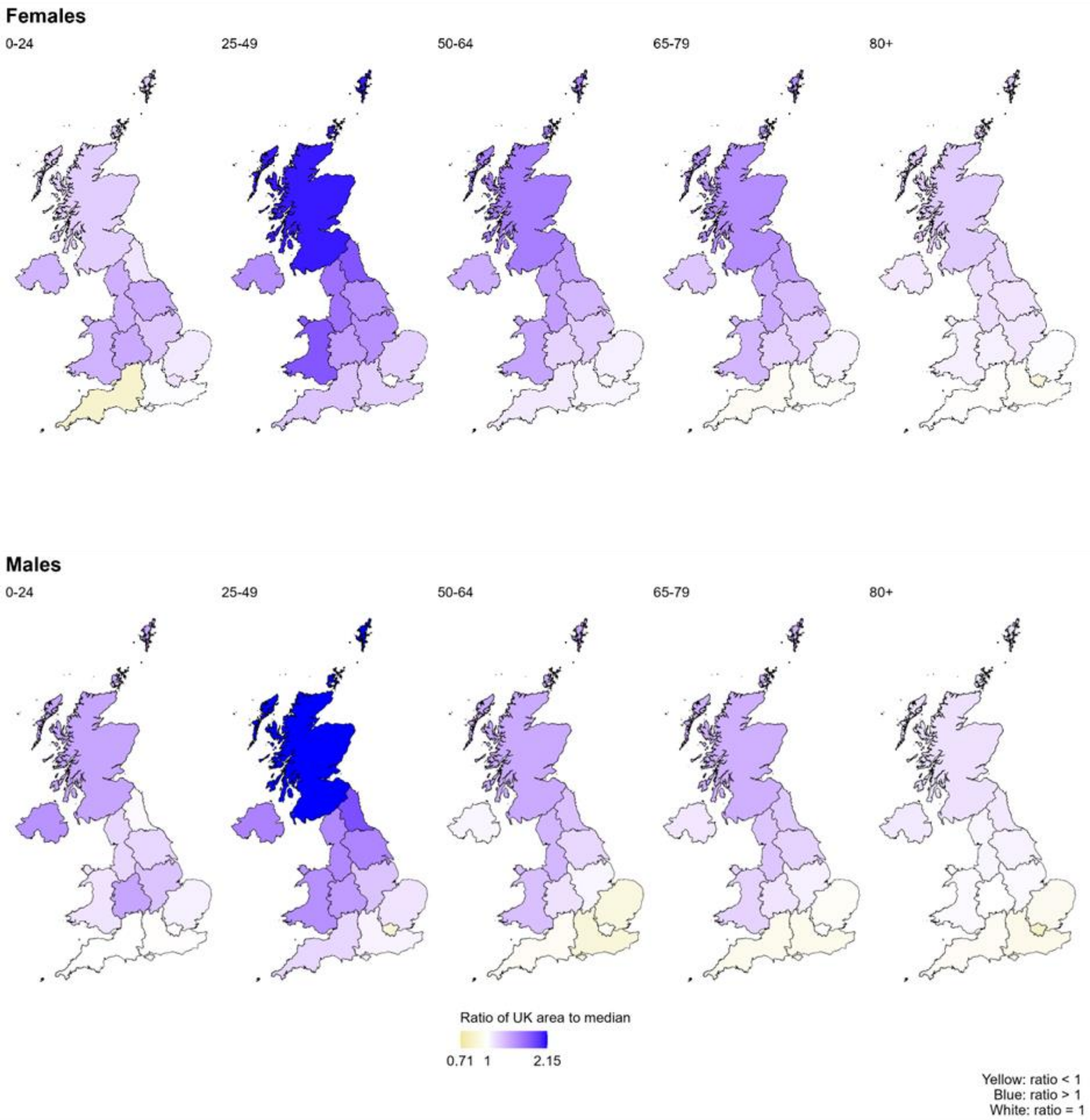
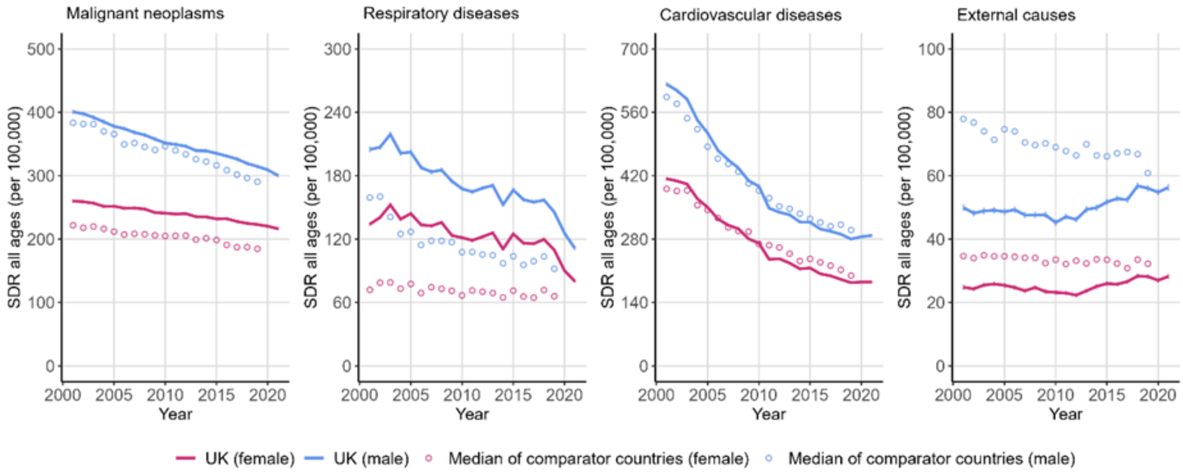


Figure 6. Age-standardised mortality rates per 100,000 with 95% confidence intervals by year (2001 – 2021) at all ages for selected causes of death by sex in the United Kingdom plus the median for the 21 comparator countries.

Panel A. Major categories of cause of death



Panel B. Selected grouped causes of death

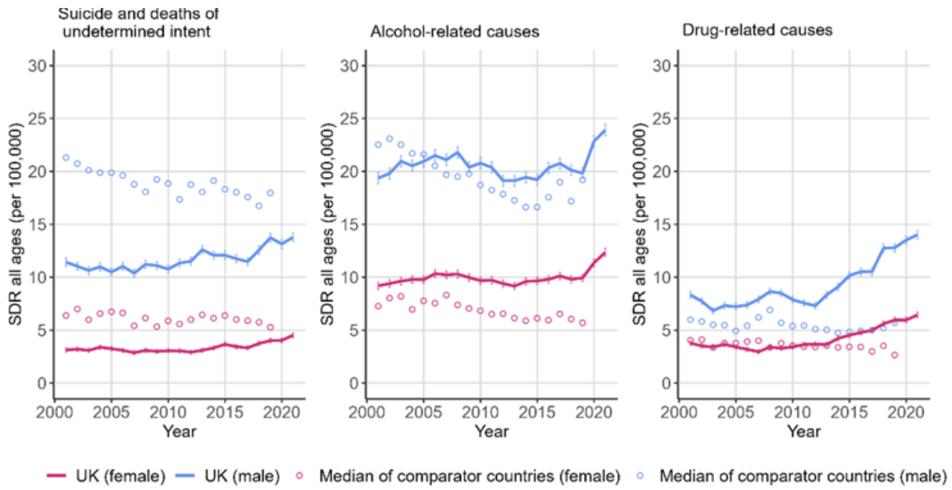
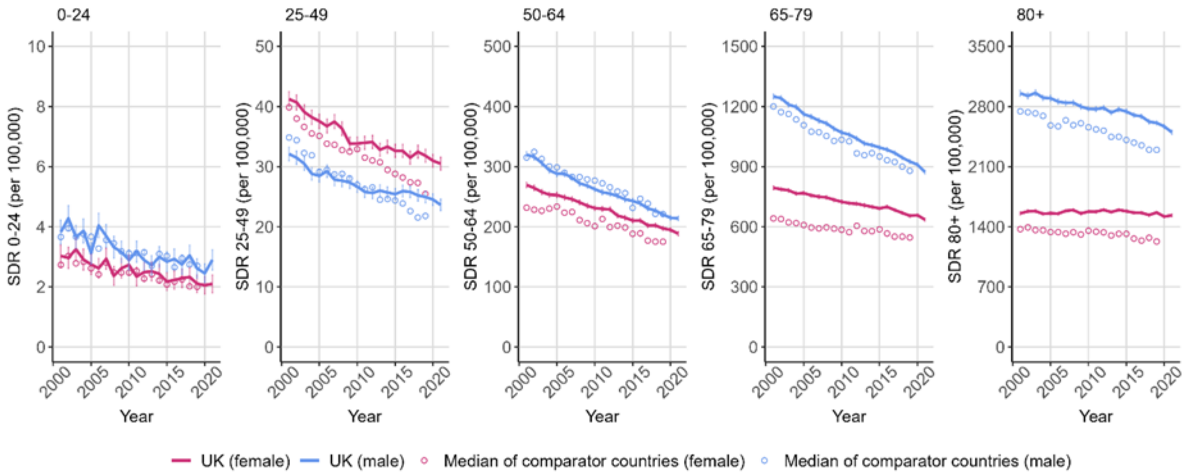
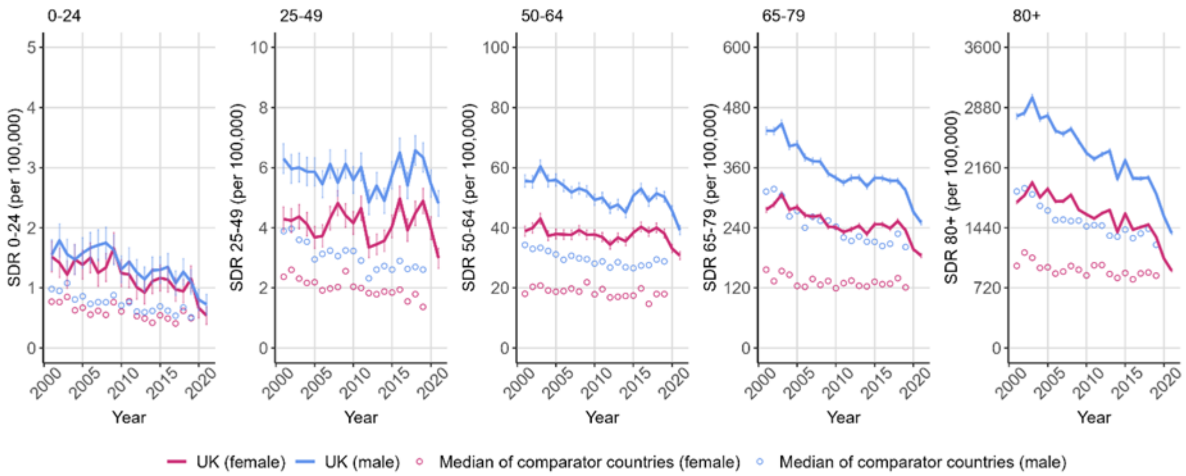


Figure 7. Age-standardised mortality rates per 100,000 with 95% confidence intervals by year (2001 – 2021), age group, and sex for major categories of causes of death in the United Kingdom plus the median for the 21 comparator countries.

Malignant neoplasms



Respiratory diseases



Cardiovascular diseases

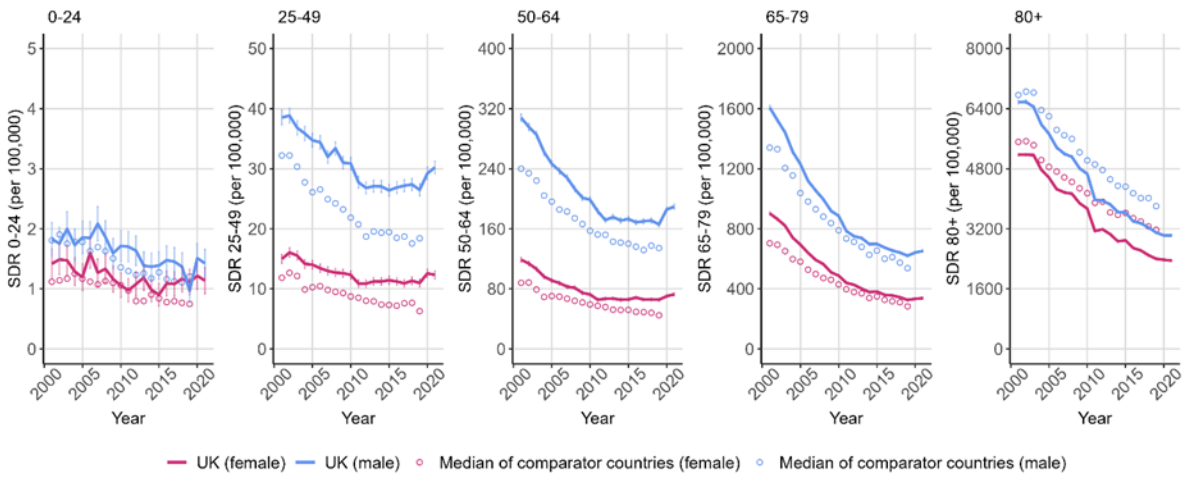


Figure 7 (continued)

External causes

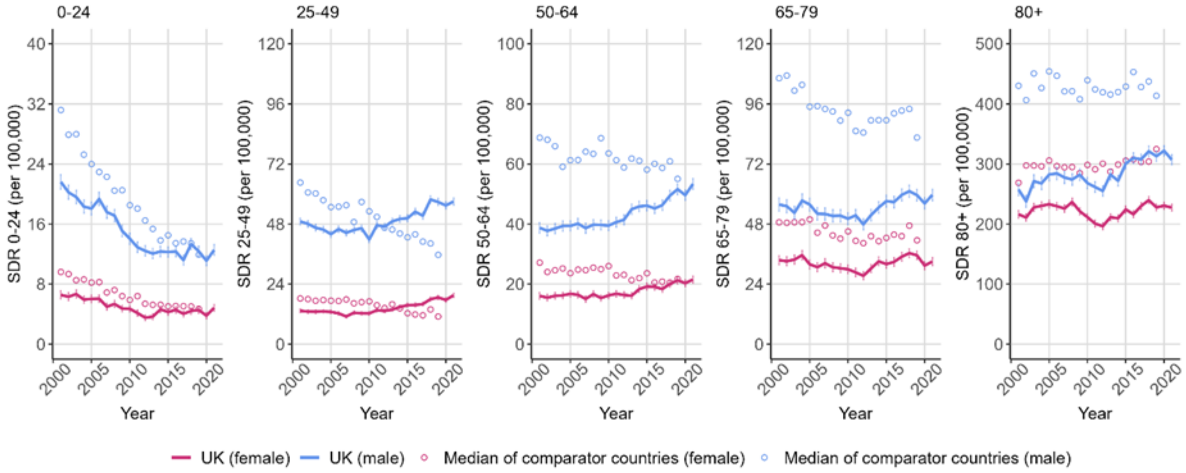
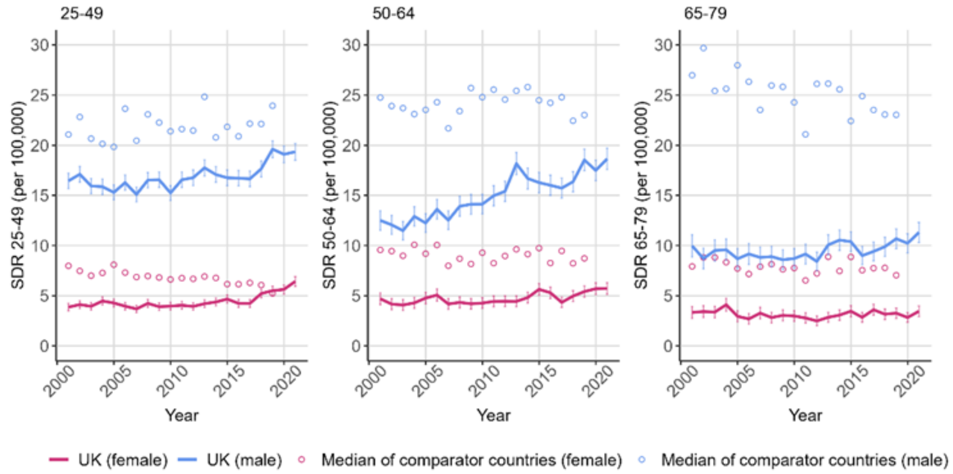
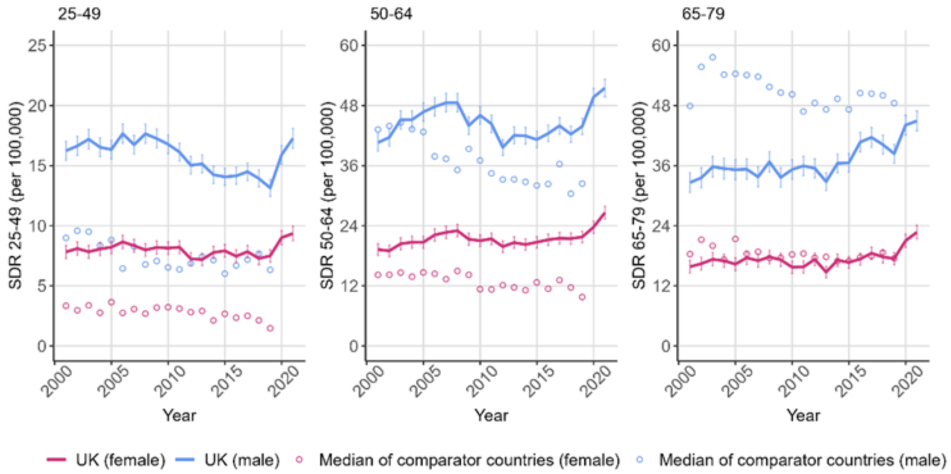


Figure 8. Age-standardised mortality rates per 100,000 with 95% confidence intervals by year (2001 – 2021), age group, and sex for selected grouped causes of death in the United Kingdom plus the median for the 21 comparator countries.

Suicide and deaths of undetermined intent



Alcohol-related causes



Drug-related causes

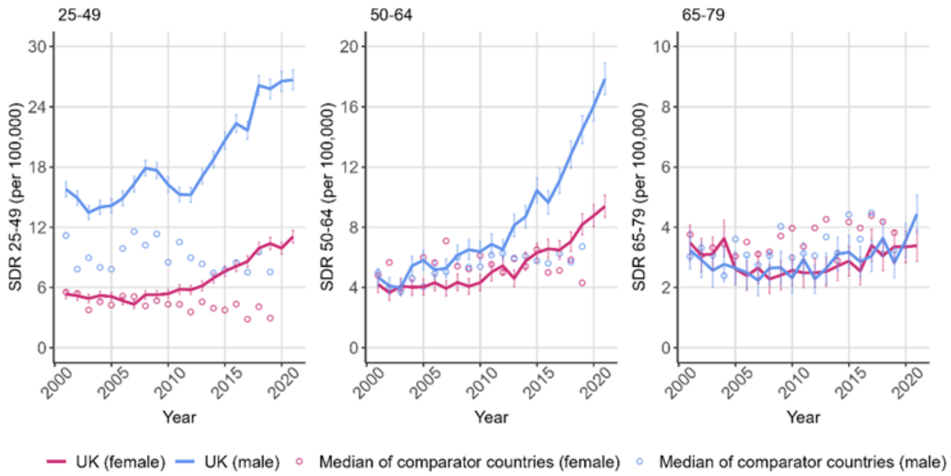


Figure 9. Ratio of age-standardised mortality rates at all ages for major categories of cause of death by sex in each area of the UK relative to the median value for 21 comparator countries by sex, 2019.

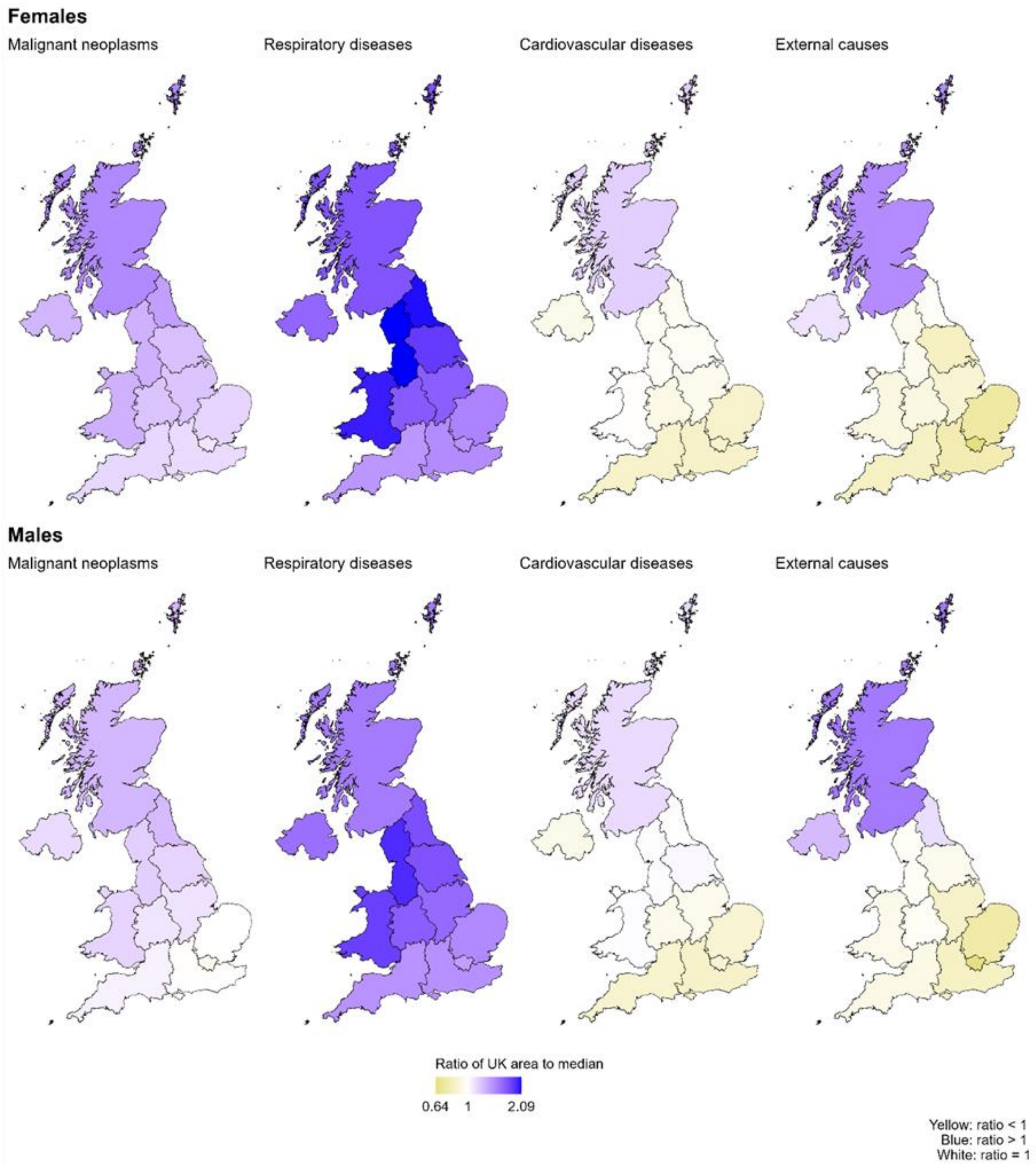


Figure 10. Ratio of age-standardised mortality rates at all ages for selected grouped causes of death by sex in each area of the UK relative to the median value for 21 comparator countries by sex, 2019.

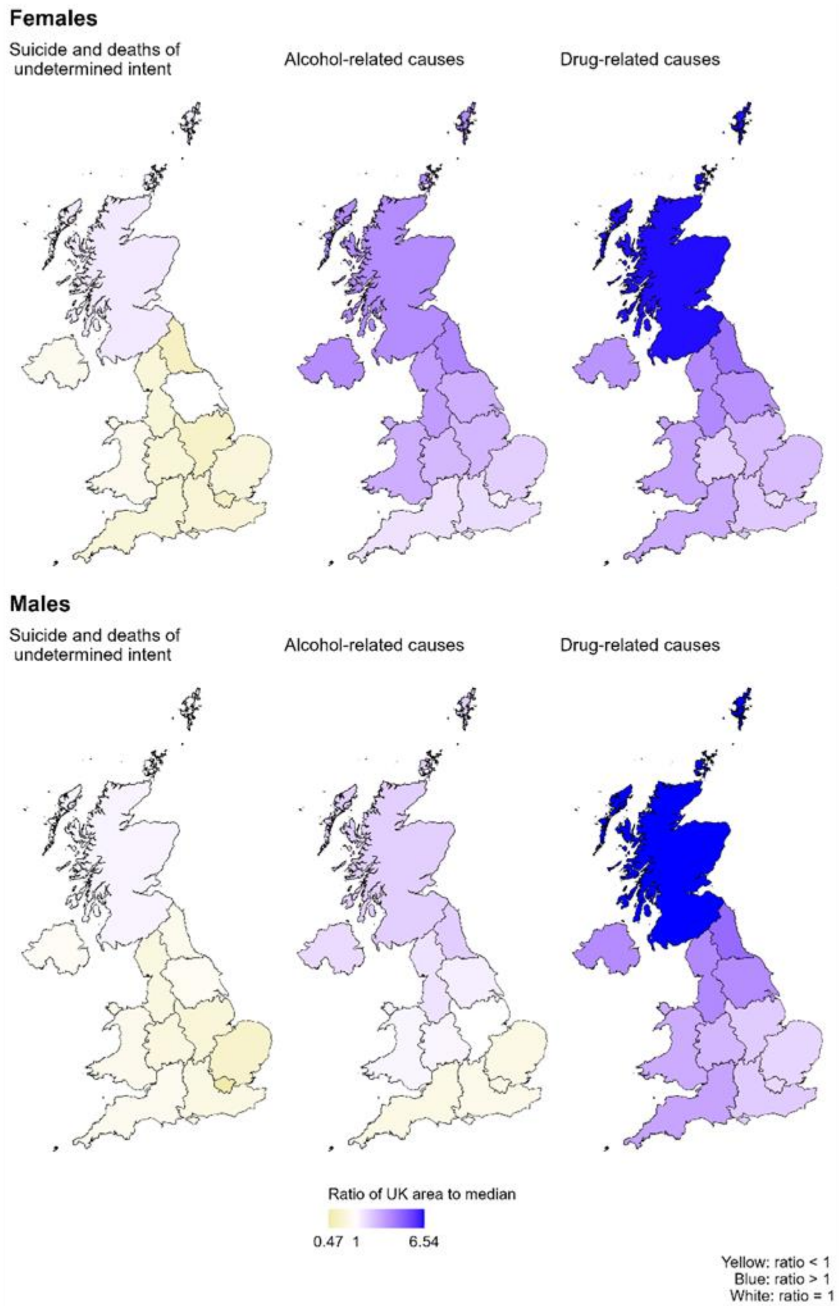


Figure 11. Ratio of age-standardised mortality rates at ages 25-49 years for drug-related causes for selected years by sex in each area of the UK relative to the median value for 21 comparator countries by sex.

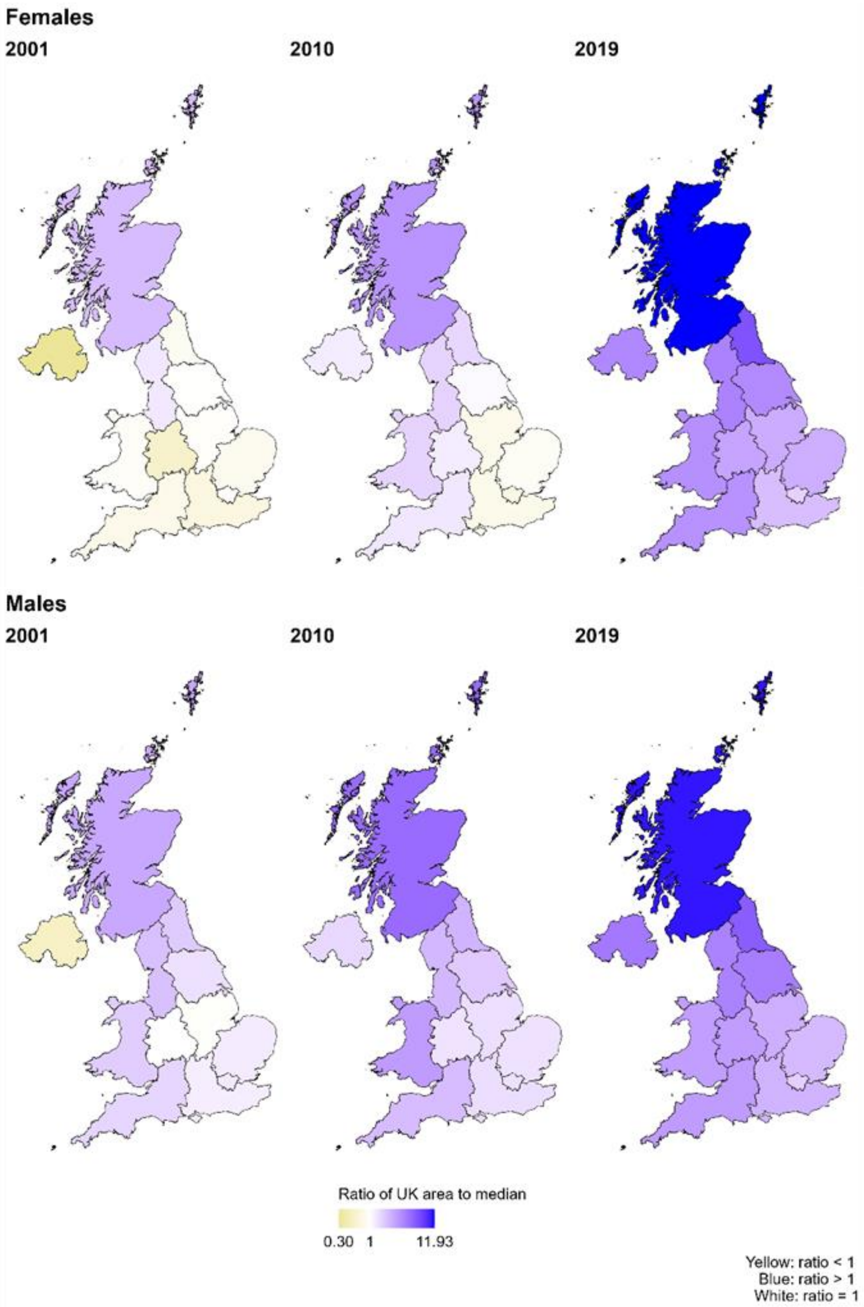


Figure 12. Mortality rate ratios in the UK relative to the median for the 21 comparator countries by age, year, and sex for 1970 – 2023.

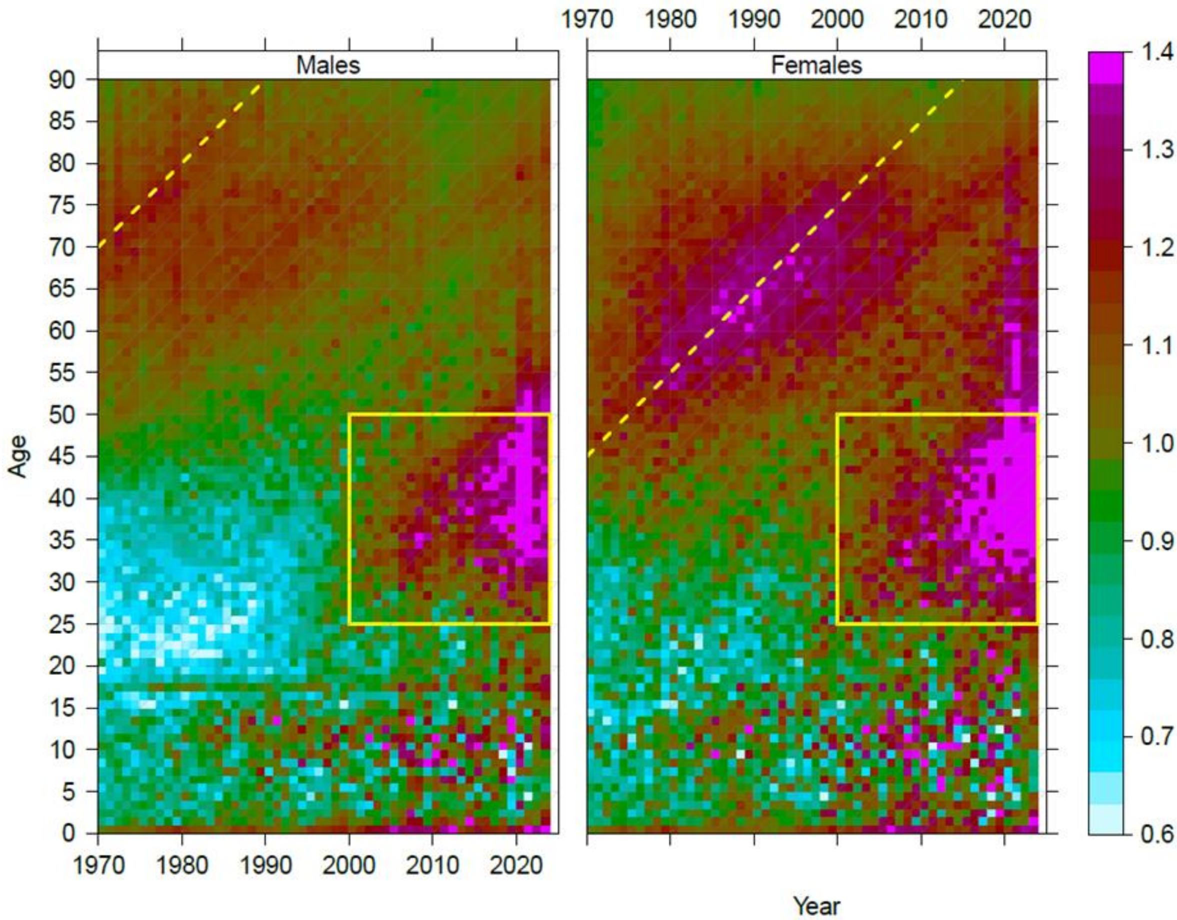


Figure shows the ratio of total mortality rates in each 1-year age group in the United Kingdom to the median of the comparator countries. The magnitude of the rate ratios in each cell are denoted by different colours as shown in the legend on the right hand side. The yellow dashed lines correspond to the 1900 male birth cohort and the 1925 female birth cohort. The continuous yellow lines in the bottom of the figures delineate the area of UK mortality excess relative to the 21-country median that has emerged since 2000.

Table 1. Age decomposition of difference in life expectancy at birth in years (comparator median minus UK) and life expectancy at birth in years by UK area and the median of the 21 comparator countries in 2019.

	0 – 24	25 – 49	50 – 64	65 – 79	80+	Total	Life Expectancy at Birth
Females							
London	0.05	-0.02	0.02	0.06	-0.59	-0.47	85.02
South East	0.01	0.12	0.04	-0.04	-0.11	0.02	84.52
South West	-0.08	0.14	0.10	-0.12	0.01	0.04	84.50
East	0.03	0.11	0.06	0.10	0.09	0.41	84.14
West Midlands	0.16	0.25	0.19	0.45	0.28	1.33	83.22
East Midlands	0.09	0.29	0.23	0.43	0.38	1.42	83.13
Northern Ireland	0.13	0.30	0.42	0.51	0.33	1.69	82.77
Yorkshire	0.13	0.29	0.34	0.65	0.42	1.83	82.72
Wales	0.13	0.48	0.44	0.69	0.27	2.01	82.45
North West	0.14	0.38	0.48	0.81	0.51	2.31	82.23
North East	0.04	0.48	0.51	0.96	0.60	2.59	81.96
Scotland	0.05	0.69	0.68	1.13	0.67	3.22	81.23
United Kingdom	0.08	0.25	0.27	0.43	0.18	1.20	83.26
Males							
London	0.00	-0.16	-0.05	0.00	-0.67	-0.88	81.29
South East	0.00	0.05	-0.22	-0.22	-0.23	-0.62	81.03
South West	0.02	0.09	-0.19	-0.12	-0.13	-0.33	80.64
East	-0.01	0.16	-0.08	-0.20	-0.10	-0.23	80.74
West Midlands	0.15	0.24	0.06	0.17	0.09	0.71	79.25
East Midlands	0.24	0.40	0.19	0.30	0.03	1.16	79.70
Northern Ireland	0.25	0.62	0.07	0.22	0.19	1.36	79.05
Yorkshire	0.10	0.53	0.26	0.49	0.18	1.56	78.85
Wales	0.05	0.46	0.44	0.47	0.14	1.57	78.84
North West	0.11	0.48	0.51	0.62	0.17	1.88	78.53
North East	0.01	0.84	0.43	0.62	0.26	2.16	78.25
Scotland	0.17	1.21	0.61	0.87	0.34	3.20	77.21
United Kingdom	0.09	0.33	0.15	0.24	0.04	0.85	79.56

*Life expectancy at birth for the median of the 21 comparator countries in 2019: 84.46 years (females); 80.41 years (males).

Annex – Data and Methods

Supplementary Table A1. Populations and data sources for all-cause mortality analysis

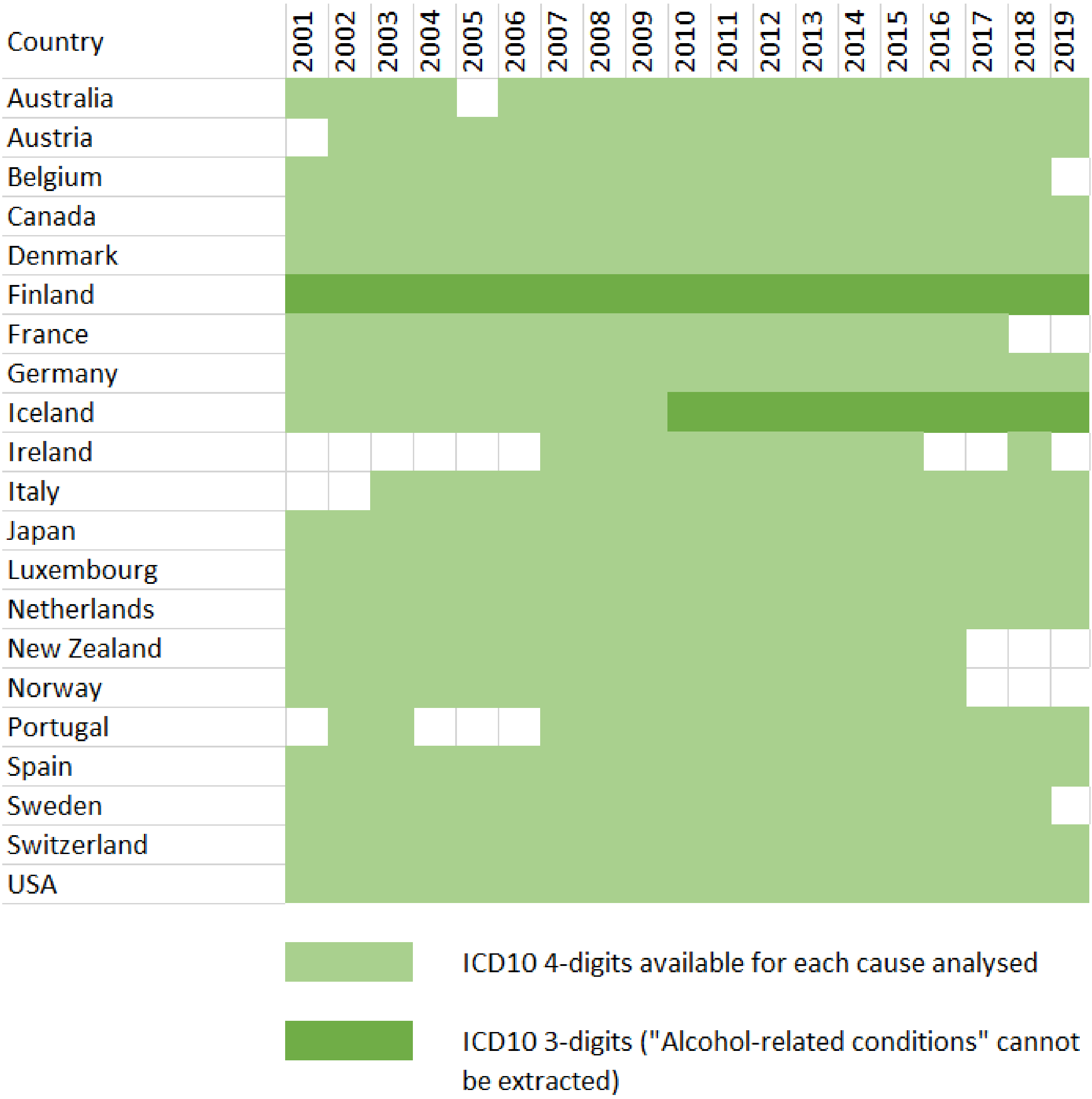
Population	Data source		
	HMD	HMD/STMF	ONS
United Kingdom	1970-2021	2022-2023	-
Constituent parts of the UK			
England	-	-	1981-2021
Wales	-	-	1981-2021
Northern Ireland	1970-2021	2022-2023	-
Scotland	1970-2021	2022-2023	-
Regions of England			
London	-	-	1981-2021
South East	-	-	1981-2021
South West	-	-	1981-2021
East	-	-	1981-2021
West Midlands	-	-	1981-2021
East Midlands	-	-	1981-2021
Northern Ireland	-	-	1981-2021
Yorkshire	-	-	1981-2021
North West	-	-	1981-2021
North East	-	-	1981-2021
Comparator countries			
Australia	1970-2020	2021-2023	-
Austria	1970-2022	2023	-
Belgium	1970-2022	2023	-
Canada	1970-2022	2023	-
Denmark	1970-2023	-	-
Finland	1970-2023	-	-
France	1920-2021	2022-2023	-
Germany, West	1970-2022	2023	-
Iceland	1970-2022	2023	-
Ireland	1970-2020	2021-2023	-
Italy	1970-2021	2022-2023	-
Japan	1970-2022	2023	-
Luxembourg	1970-2022	2023	-
Netherlands	1970-2021	2022-2023	-
New Zealand	1970-2021	2022-2023	-
Norway	1970-2023	-	-
Portugal	1970-2022	2023	-
Spain	1970-2021	2022-2023	-
Sweden	1970-2023	-	-
Switzerland	1970-2022	2023	-
USA	1970-2021	2022-2023	-

HMD - Human Mortality Database; HMD/STMF – Short-term Mortality Fluctuations data series of HMD; ONS – Office for National Statistics

Supplementary Table A2. Selection of causes of death for the cause-of-death analysis

Cause of death	ICD10 codes
All-causes combined	A00-Y98
Malignant neoplasms	C00-C96
Diseases of the circulatory system	I00-I99
Diseases of the respiratory system	J00-J99
Diseases of the digestive system	K00-K93
External causes	V01-Y98
Suicide and undetermined intent	X60-X84
Alcohol-related conditions	F10, G31.2, G62.1, I42.6, K29.2, K70, K73, K74.0-K74.2, K74.6, K86.0, X45, X65, Y15
Drug-related conditions	F11–F16, F18–F19, X40–X44, X60–X64, X85, Y10–Y14

Supplementary Figure A1. Data availability map for the WHO cause-specific mortality data used in this study



Human Mortality Database (HMD)

The HMD data[1] has unique strengths due to the strict comparability of data across time and space ensured by a comprehensive set of methods for the elimination of distortions caused by population re-enumerations at censuses and changes in data coverage as well as methods for treatment of mortality understatement at ages 80 and older. [2]

Data sources for England, Wales, Scotland and Northern Ireland

We obtained data on all-cause and cause-specific deaths and populations for England and Wales separately, together with the nine standard regions of England directly from the ONS. [3] For each sex-year-age combination, the ONS all-cause death and population numbers were adjusted to ensure strict equivalence of the sum of England plus Wales and the sum of nine regions of England plus Wales to the HMD death and population numbers for England and Wales as a unit.

For Scotland and Northern Ireland, all-cause death and population numbers were taken directly from the HMD. For the cause-specific analyses, death and population numbers for Scotland were obtained from the National Records of Scotland (NRS) and for Northern Ireland from the Northern Ireland Statistics and Research Agency (NISRA). These numbers were adjusted for the strict equivalence of their sums to the corresponding HMD numbers.

Estimation of median values for 21 comparator countries

For the analysis of cause-specific mortality, we utilise different benchmark indicators than for the analysis of all-cause mortality. For all-cause mortality analyses, we use the ASDR of the median country as a comparison, while for cause-specific analyses, we use the median of country-specific ASDRs as a comparison. Details of the calculations and sensitivity analysis are provided below.

All-cause mortality

First, we create a “median population” using age-specific death rates (25-49 years) of 21 comparator countries:

$$m_{x,t}^{median} = \mathrm{med}\left(m_{x,t}^{1}, m_{x,t}^{2}, \dots, m_{x,t}^{21}\right), x = 25-29, 30-34, 35-39, 40-44, 45-49, t = 1970, \dots, 2023 - calendar\ year$$

where $m_{x,t}^{i}$ is death rate at age *x* in year *t* in country *i*.

At the next step, we calculate ASDR^{median} as follows:

$$ASDR_t^{median} = \sum_x w_x m_{x,t}^{median}$$

where w_x are age-specific weights of the European standard population in 2013.

Cause-specific mortality

We estimated the median ASDR (medASDR) as follows:

$$medASDR_t = \mathrm{med}(ASDR_t^1, ASDR_t^2, \dots, ASDR_t^{21}), \qquad t = 1980, \dots, 2021$$

where $ASDR_t^i$ are country-specific age-standardized death rates:

$$ASDR_t^i = \sum_x w_x m_{x,t}^i$$

For the broad age group [a,b), the median ASDR is calculated as follows:

$$medASDR_{[a,b],t} = \text{med}\left(ASDR^1_{[a,b],t}, ASDR^2_{[a,b],t}, \dots, ASDR^{21}_{[a,b],t}\right), \qquad t = 1970, \dots, 2021$$

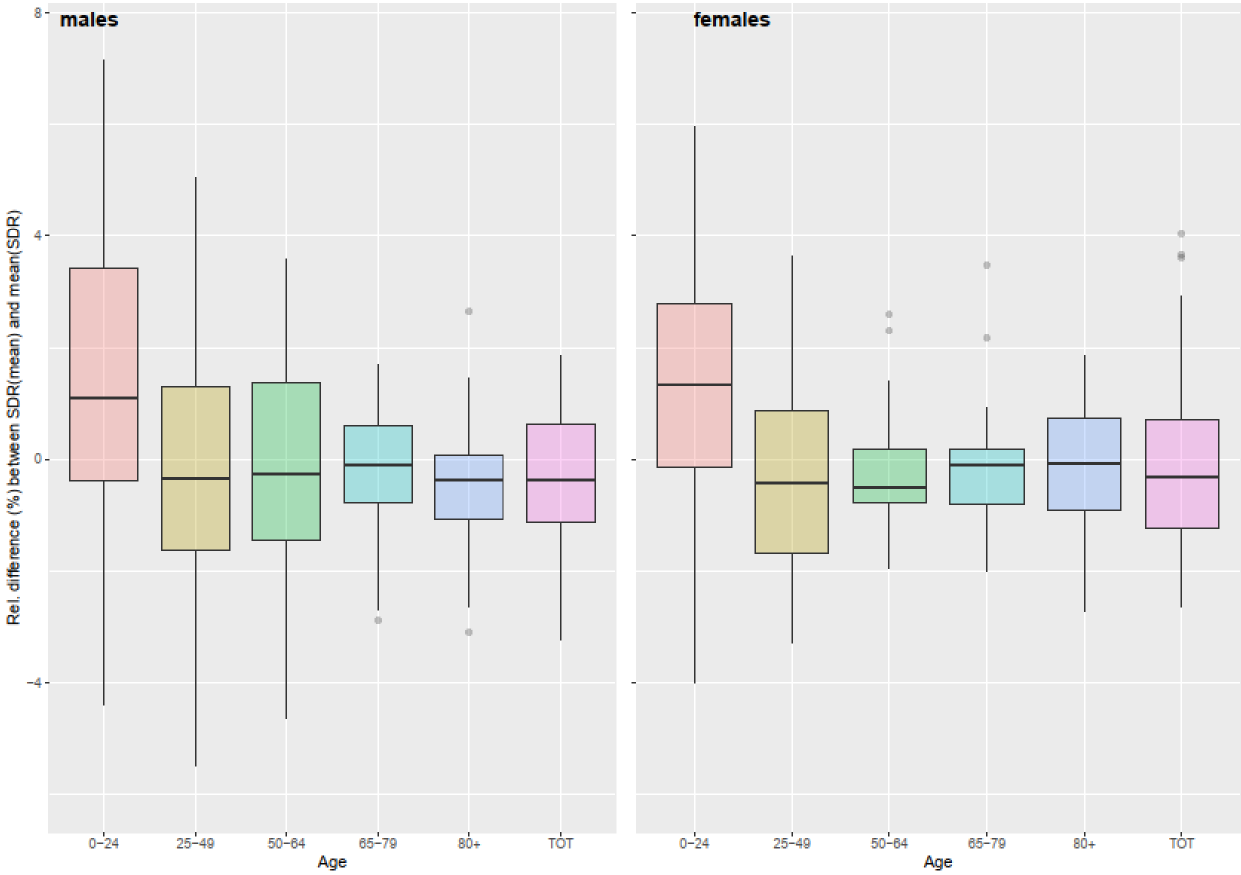
$$ASDR^i_{[a,b),t} = \sum_{a \le x < b} w^{ab}_x m^i_{x,t}, \quad i = 1,2,\dots,21$$

To ensure comparability with all-cause analysis which utilised ASDRs calculated using median age-specific rates, for every sex-year combination, we adjusted the cause-specific medians so that their sum equalled the all-cause median.

Sensitivity analysis: ASDR^{median} vs. medASDR

Theoretically, ASDR^{median} might significantly deviate from medASDR. Fortunately, in our case, the difference between these two indicators is minor. The bar plot in the Figure below shows distribution of relative difference (in %) between these two indicators by age group for the selected 21 countries for the period 1981 to 2021 for males and females.

Figure: Distribution of relative difference (in %) between ASDR^{median} and medASDR by age group for the selected 21 countries for the period 1981 to 2021 for males (left panel) and females (right panel).



Excess deaths

Excess deaths were calculated as the difference between the observed number of deaths and the number of deaths that would occur if mortality were equal to the median rates:

$$D^{excess}_{x,t} = D^{observed}_{x,t} - m^{median}_{x,t} \cdot P_{x,t}$$

where x and t denote age group x and year t, $m_{x,t}^{median}$ is the 21-country median death rate at age x in year t, and $P_{x,t}$ is population of the UK (or respective region) in year t and age group x.

The excess years of life lost were calculated by multiplying the excess deaths by the WHO standard values of potentially achievable (frontier) life expectancy[4] :

$$YLL_t^{excess} = \sum_x e_x^{standard} \cdot D_{x,t}^{excess} \ .$$

Coding of cause of death in the UK from 2001 and inconsistencies in cause-of-death series

The principal limitation in comparing cause-specific mortality across time and space is variability in practices of medical diagnostics and approaches to determining the underlying cause of death.[5] These differences are generally related to variations in medical technologies, healthcare infrastructure, and established medical practices. Significant inconsistencies in cause of death series may be produced by the ICD10 updates.[6] These updates are modifications of the WHO rules for cause-of-death coding recommended by the WHO for implementation by national statistical agencies during the ICD10 period.

Automated coding software changes and ICD10 updates

The 10th revision of the International Classification of Diseases (ICD10) was used in the whole of the UK from 2001. It was introduced in 2001 in England and Wales by the Office for National Statistics (ONS) and in Northern Ireland by the Northern Ireland Statistics and Research Agency (NISRA). In Scotland, it was introduced in 2000 by the National Records of Scotland (NRS).

Automated coding with the Mortality Medical Data System (MMDS) software, developed in the U.S., was utilized by ONS and NRS until 2010 to select and code the underlying cause of death using medical death certificates as an input. In Northern Ireland, manual coding was used until 2016. Since then, ONS has performed the selection of the underlying cause of death for Northern Ireland on behalf of NISRA.

In 2011, ONS and NRS implemented a new version of the MMDS software to account for the ICD10 updates accumulated by that time. To quantify the impact of the introduction of ICD10 v2010 instead of ICD10 v2001, ONS and NRS completed bridge coding studies in which the same sets of deaths were independently coded using the “old” and the “new” versions of ICD10. The ONS study detected impacts of the ICD10 update such as: a 32% increase in deaths from mental and behavioural disorders, a 5% decrease in deaths from diseases of the circulatory system, a 21% decrease in deaths from diseases of the genitourinary system, and a 2% increase in deaths from diseases of the respiratory system.[7] The Scottish bridge coding study revealed a 21% increase in deaths from external causes, a 5% decrease in deaths from diseases of the respiratory system, a 14% decrease in deaths from metal and behavioural disorders, and a 16% increase in diseases of the nervous system.[8]

The MMDS was subsequently replaced by the European IRIS Software – an automatic system for coding multiple causes of death and selecting the underlying cause of death.[9] The transition was made in 2014 for England and Wales[10] and in 2017 for Scotland.[11] The new software adopted the official ICD10 updates up to 2013. Iris Software has been used to code Northern Irish data on causes of death since 2016.

The transition to the IRIS software did not produce ruptures as evident as those between 2010 and 2011. However, the bridge-coding studies performed by ONS and NRS indicate that trends in some causes of death were still moderately affected. In particular, both ONS and NRS reported that the software change produced an increase in deaths from mental and behavioural disorders (+7% in England and Wales, +6.2% in Scotland) compensated by a decrease in respiratory diseases (-2.5% in England and Wales, -4.8% in Scotland).

The WHO does not provide information about the implementation of the ICD10 updates by the member states and also about their use of automated coding systems. Therefore, changes in cause-of-death coding and their potential effects on cause-specific mortality in the 21 comparator countries are unknown.

Specific changes in coding rules

As the previous section showed, distinct inconsistencies in the cause-of-death series were produced by changes in rules and practices of coding within ICD10. For our analyses, the most significant of these was related to changes in coding of drug-related deaths in 2011. The change resulted in some of the relevant deaths being transferred from mental and behavioural disorders to accidental poisoning. However, this change has not affected our analyses as we created a consistent category of drug-related deaths that accounts for this change in coding by combining together all relevant categories.

Annex references

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