The impact of calculating mortality rates using the 2013 European Standard Population on causes of death

Introduction

This report examines the impact of a revision to the current methods used in calculating age-standardised rates (ASRs). This document focuses solely on the impact of applying the new methods to previously published mortality data for 2012.

The majority of indicators in ONS's mortality outputs are based on rates that are directly age-standardised using the European standard population (ESP). Starting from this financial year (2014/15), the rates in these outputs will be based on the new methods for age-standardisation.

This methodological revision will also affect age-standardised cancer incidence rates, and there will be a separate report analysing the impact of the change on these data. The ASRs presented in this document were calculated using standard methods.

What is the European Standard Population?

The ESP is an artificial population structure which is used in the weighting of mortality or incidence data to produce ASRs. Eurostat, the statistical office of the European Union, decided at the end of 2012 to bring this population structure up to date.

The ESP has become an accepted methodological standard in health statistics in the UK and the rest of Europe, and is used in the calculation of ASRs by ONS, other government departments, the NHS and academic health researchers. The ESP currently in use was first introduced in 1976 but it has since been recognised that it is no longer representative of the age-structure of the population of European Union Member States. In light of this, Eurostat implemented a new version of the ESP in 2013. In addition, ONS, on behalf of the Government Statistical Service (GSS), has carried out a public consultation on how to implement the new ESP in the UK.

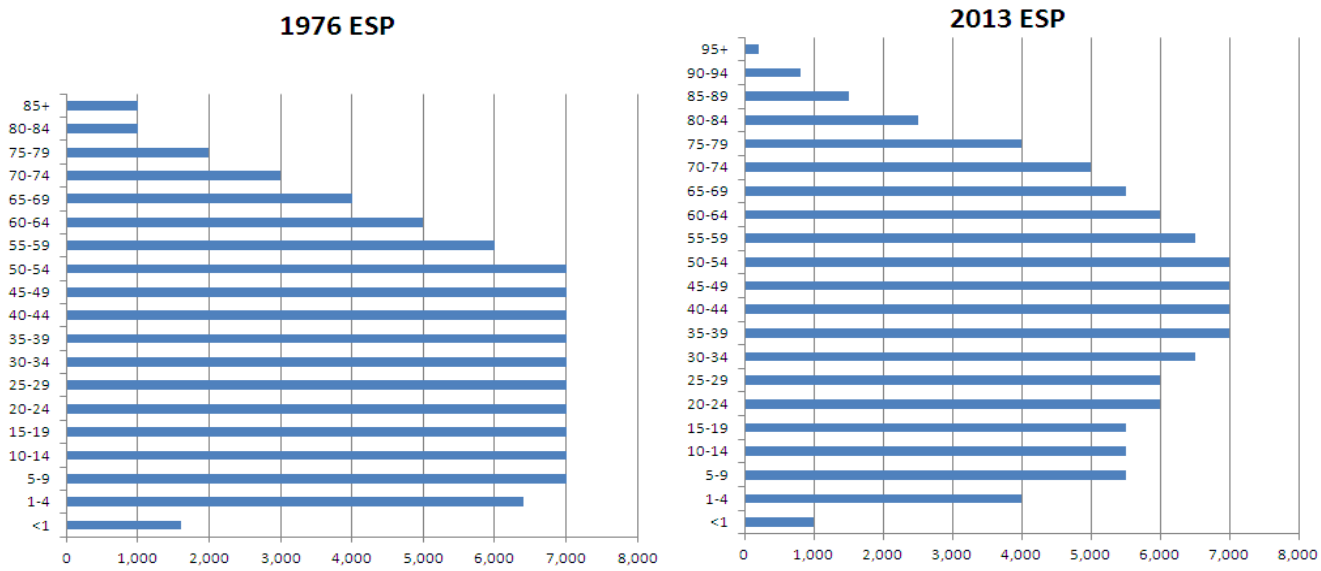
The existing ESP is referred to in this document as 'the 1976 ESP' and the new one as 'the 2013 ESP'.

What is the difference between the 1976 ESP and the 2013 ESP?

The European population is ageing and Eurostat expects the age distribution of the population to continue to show a progressive shift towards older ages. Not only is the share of the population aged 65 and over expected to increase in all countries between 2008 and 2060, the population aged 80 and over will increase both in relative and absolute terms (Eurostat, 2013).

The 2013 ESP takes into account changes in the EU population, providing a more current, methodologically sound and widely acceptable basis for the calculation of age standardised rates (Eurostat, 2013).The 1976 and 2013 ESPs differ in two ways. First, the 2013 ESP gives the populations in older age groups greater weighting than the 1976 ESP. Second, the age distribution of the 1976 ESP has an upper limit of 85 years and over, while the 2013 ESP is further disaggregated to include age groups 85-89, 90-94 and 95+ (Figure 1).

Figure 1: Comparing the 1976 ESP and the 2013 ESP population structures



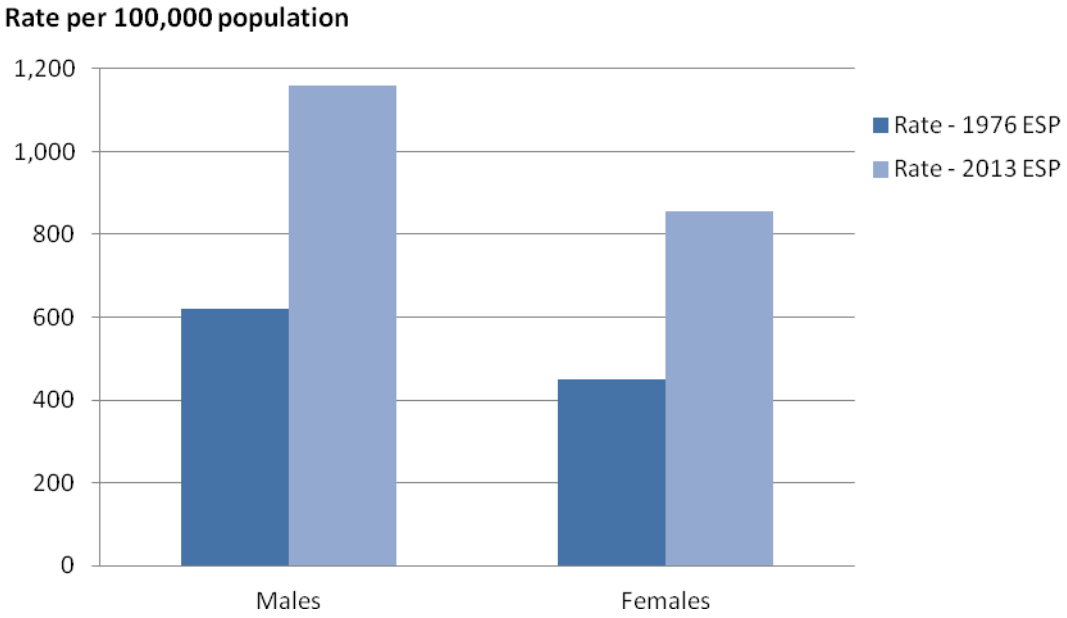
While deaths data are often available by single year of age, allowing for these data to be aggregated using a variety of upper age limits, population data, particularly at sub-national levels, are often produced using specific upper age limits (often 85+ or 90+). Consequently, analysis using the 'full version' of the 2013 ESP (up to 95+) may not be feasible and there might be a need to aggregate both the deaths data and the ESP to match the age-structure of the available population data. In April 2014, ONS published an article examining the impact of varying the 2013 ESP upper age limit on mortality statistics. This article recommended the use of 90+ for the 2013 ESP in all National Statistics publications. Comparisons in this document are therefore based on rates standardised using the full 1976 ESP (85+) and the recommended version of the 2013 ESP (based on 90+).

What impact does the 2013 ESP have on mortality rates by cause of death?

Impact on ASRs for all causes of death, England and Wales, 2012

For both sexes, mortality rates for all causes of death registered in 2012 were significantly higher when calculated using the 2013 ESP compared with the 1976 ESP (Figure 2). This is to be expected as deaths predominantly occur at older ages and the larger number of older people in the 2013 ESP exerts more influence on these summary figures.

Figure 2: Sex-specific age-standardised rate for all causes of death, England and Wales, 2012



In addition, the 2013 ESP had a slightly greater effect on females than males in terms of the percentage increase in ASRs. This is largely due to the difference between the distributions of male and female deaths at older ages. While the number of female deaths in 2012 increased steadily with age up to 90+, the number of male deaths increased steadily before peaking at 80-84 years and then dropping off in the last two age groups (Figures 3 and 4).

Figure 3: Age distribution of deaths from all causes, Males, England and Wales, 2012

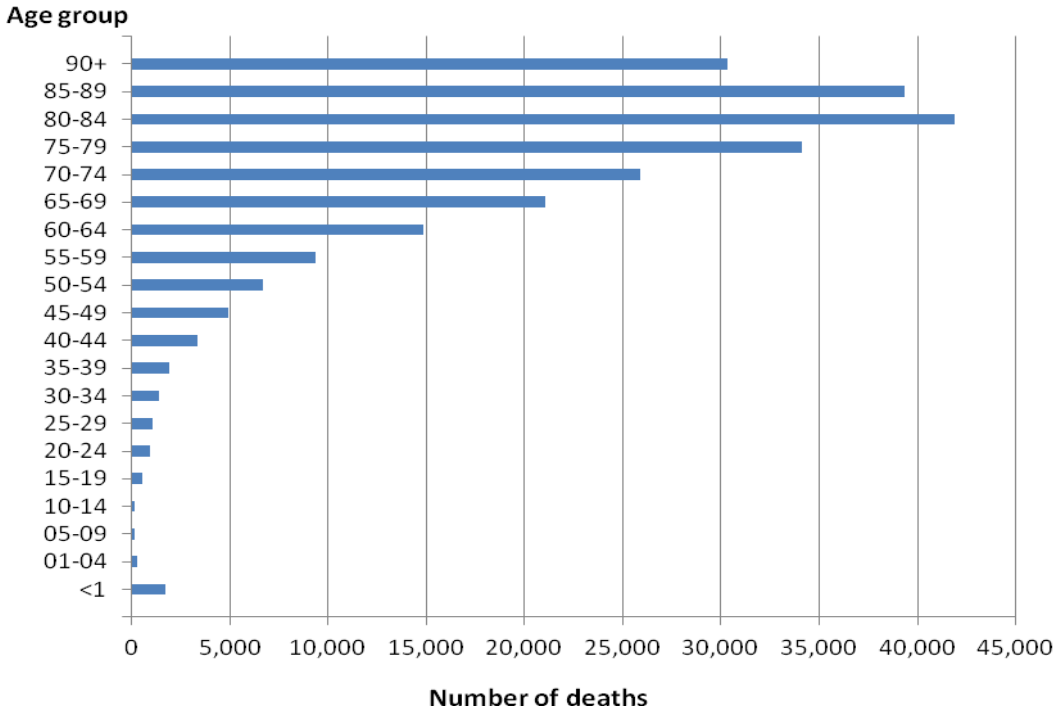
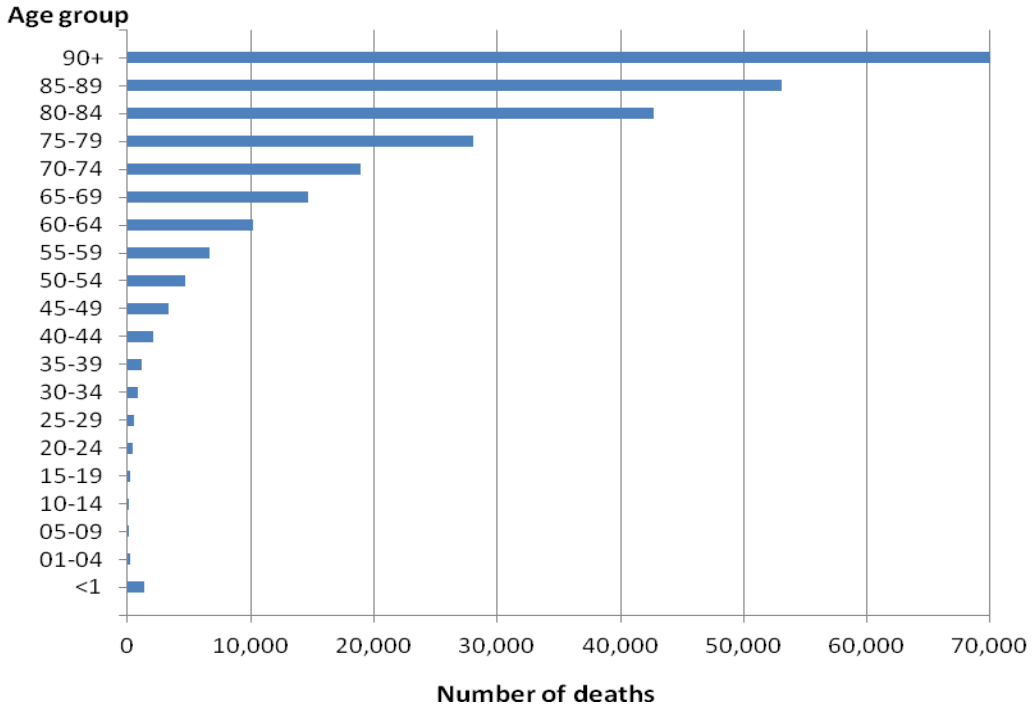


Figure 4: Age distribution of deaths from all causes, Females, England and Wales, 2012



Impact on ASRs by International Classification of Diseases tenth revision Chapters, England and Wales, 2012

The impact of the change in ESP varies by cause of death, ranging from no significant change to significant increases or decreases between 2012 ASRs calculated using the 1976 ESP and the 2013 ESP. This impact was greatest for conditions commonly associated with older ages and those almost exclusive to very young ages. ASRs based on the 2013 ESP were significantly higher than those based on the 1976 ESP for the majority of ICD-10 chapters. Rates for chapters containing conditions such as dementia, Alzheimer's and pneumonia, for example, were approximately twice as high under the new ESP compared with the old.

The opposite was true for conditions originating in the perinatal period (Chapter 16) with sex-specific ASRs being at least 37% higher under the 1976 ESP than the 2013 ESP. This is because the conditions in this ICD-10 chapter are almost exclusive to very young ages and are therefore more heavily influenced by the younger population structure of the 1976 ESP.

There was no significant difference between ASRs based on either ESP for congenital malformations, deformations and chromosomal abnormalities (Chapter 17) for both sexes, and conditions related to pregnancy, childbirth and the puerperium for females (Chapter 15).

Diseases of the eye and adnexa (Chapter 7) and of the ear and mastoid process (Chapter 8) were excluded from these analyses as the numbers of deaths were below the threshold recommended by ONS for calculating statistically meaningful rates. In general, only ICD-10 chapters used in coding the underlying cause of death are included in this report.

A full description of the conditions in each ICD-10 chapter is available in the reference table accompanying this document.

Figure 5: Age-standardised rate by ICD-10 Chapter, Males, England and Wales, 2012

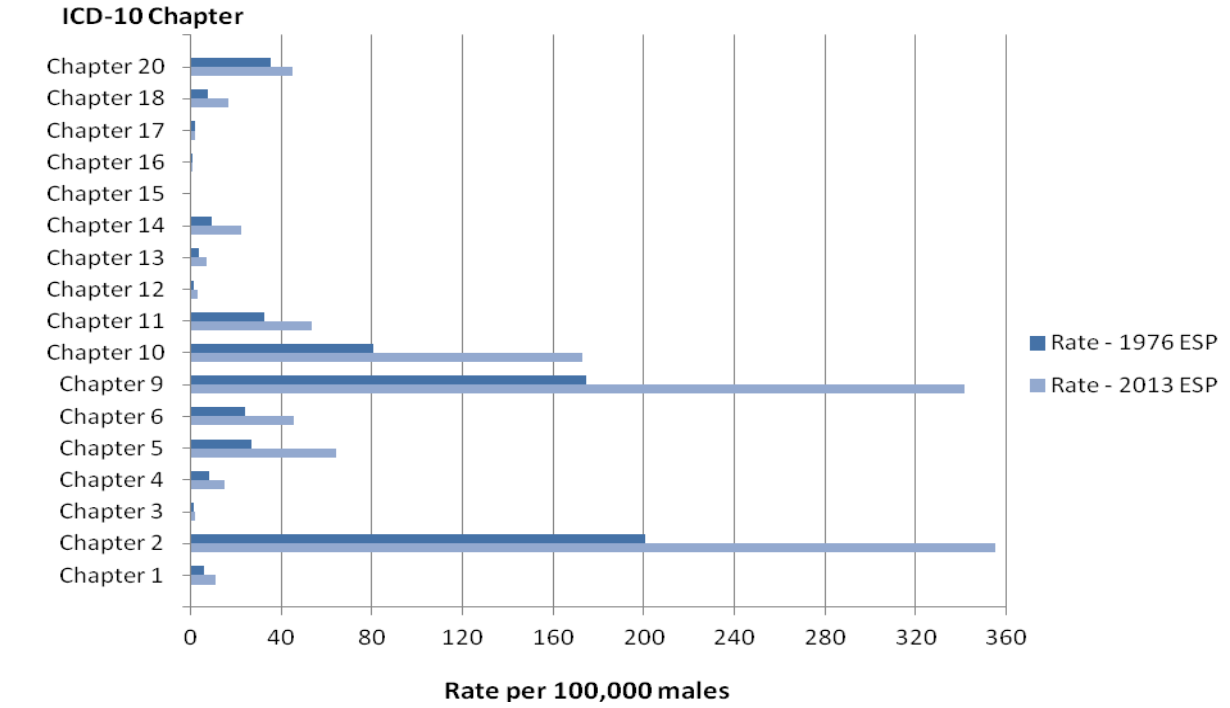
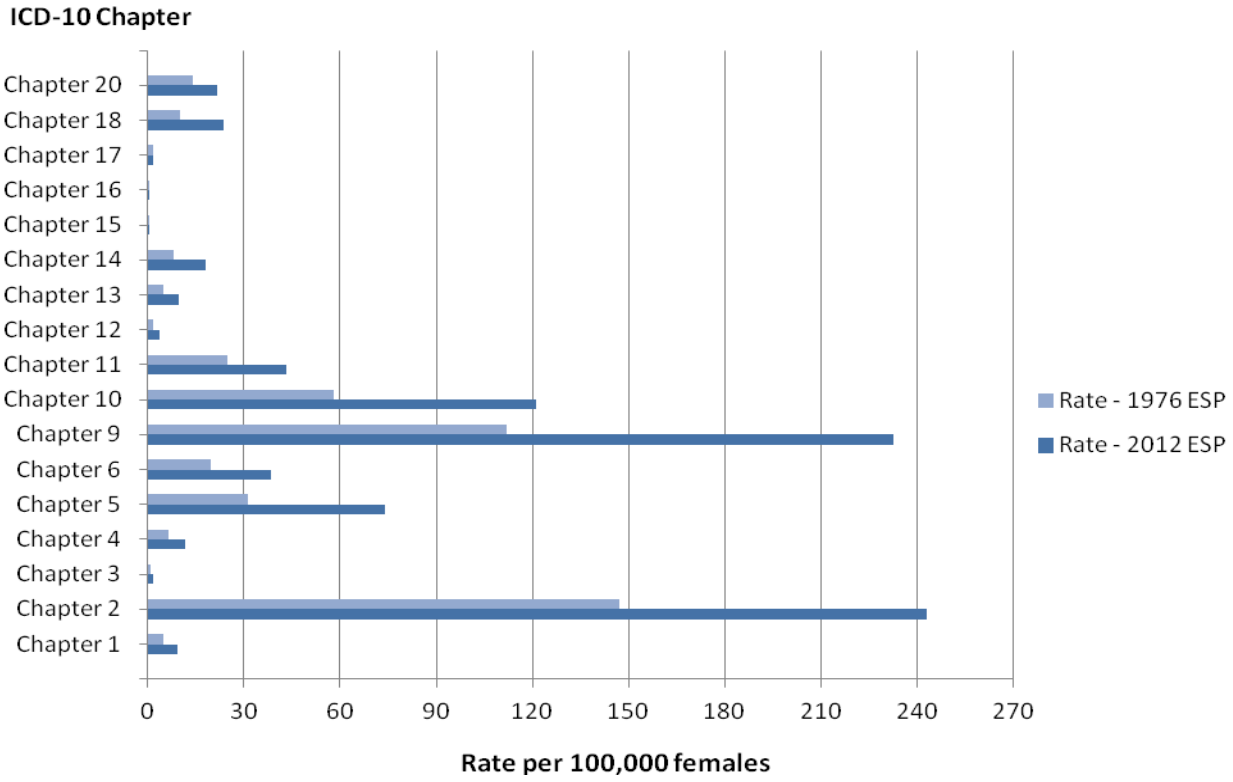


Figure 6: Age-standardised rate by ICD-10 Chapter, Females, England and Wales, 2012



Impact on selected causes of death, England and Wales, 2012

Age-standardised rates were calculated for ten causes of death in 2012. These causes were chosen because they are strongly associated with increasing age or certain age groups. Similar conditions such as dementia and Alzheimer's, and influenza and pneumonia were combined.

For males, ASRs based on the 2013 ESP were significantly higher than those using the 1976 ESP for seven out of the ten selected causes of death examined. Deaths from these seven conditions occur predominantly at older ages and for three of them - Dementia including Alzheimer's, influenza and pneumonia and cerebrovascular diseases - ASRs more than doubled under the 2013 ESP.

Interestingly, for males, the older age structure of the 2013 ESP did not exert as much influence on the ASR for Ischaemic heart disease (IHD) as it did for these three causes of death. This is because for dementia including Alzheimer's, influenza and pneumonia and cerebrovascular diseases, the very old (90+) accounted for a higher proportion of deaths among older people (65+) than they did for IHD. For dementia including Alzheimer's for example, while 33% of men over 65 years died in their 90s, the comparable proportion for IHD was only 14%.

The results were broadly similar for females for these seven causes of death.

As shown in figures 8 and 10, male and female deaths from suicide occurred at relatively younger ages and there were more deaths from congenital anomalies in the first year of life than in any other age group. For land transport accidents, male deaths were more common at younger ages but there was no clear pattern in the distribution of female deaths. For these three conditions, rates based on the 1976 ESP were smaller in magnitude than those based on the 2013 ESP but not statistically significantly different from them.

Figure 7: Age-standardised rate by selected causes of death, Males, England and Wales, 2012

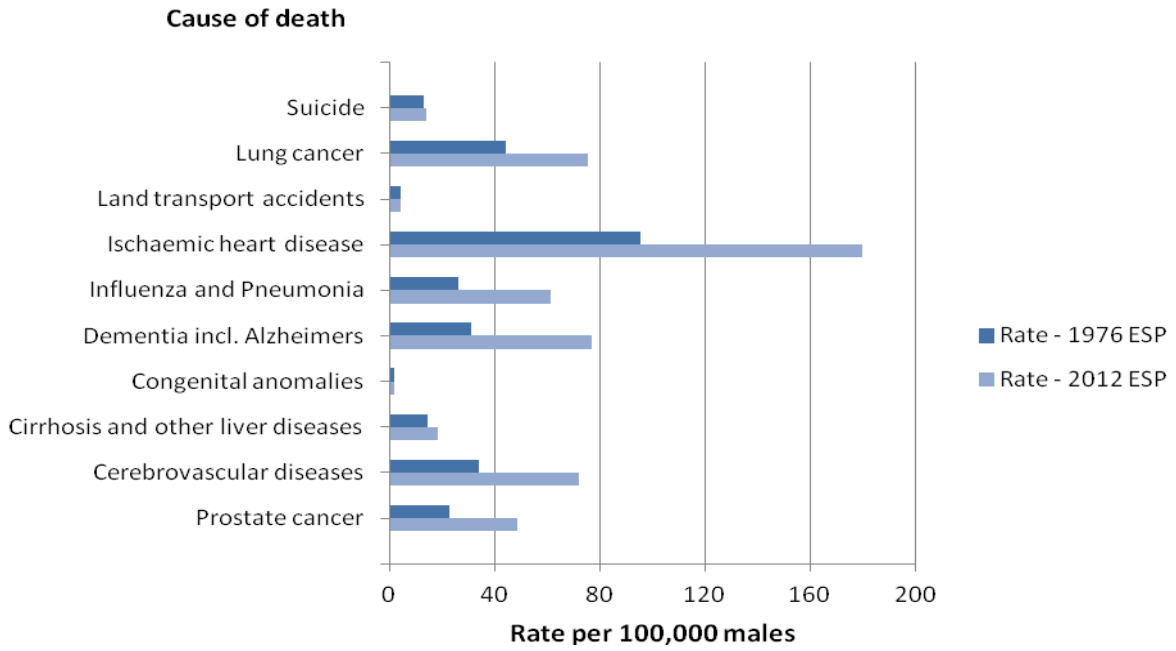


Figure 8: Age distribution of the number of deaths from some selected causes, Males, England and Wales, 2012

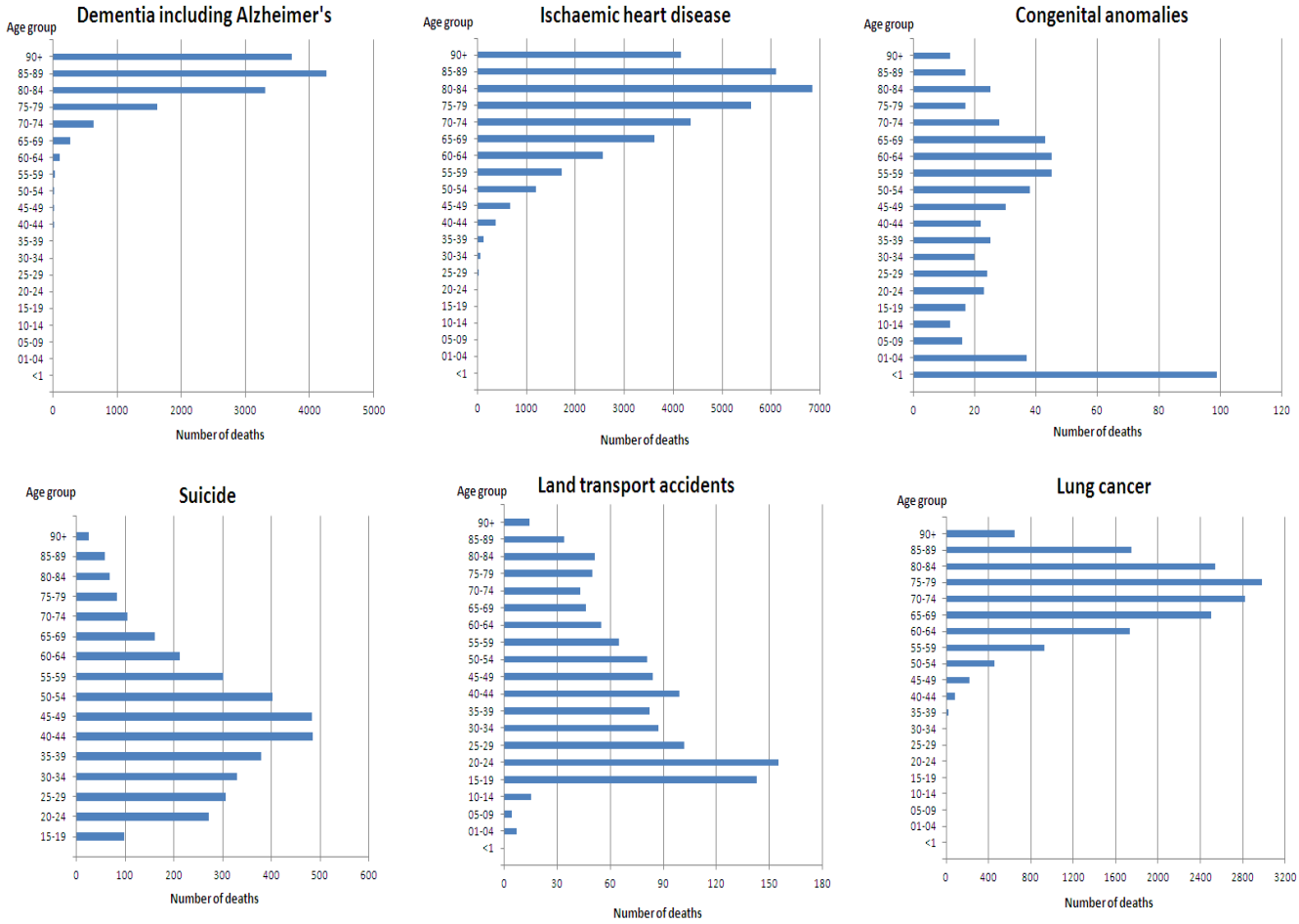


Figure 9: Age-standardised rate by selected causes of death, Females, England and Wales, 2012

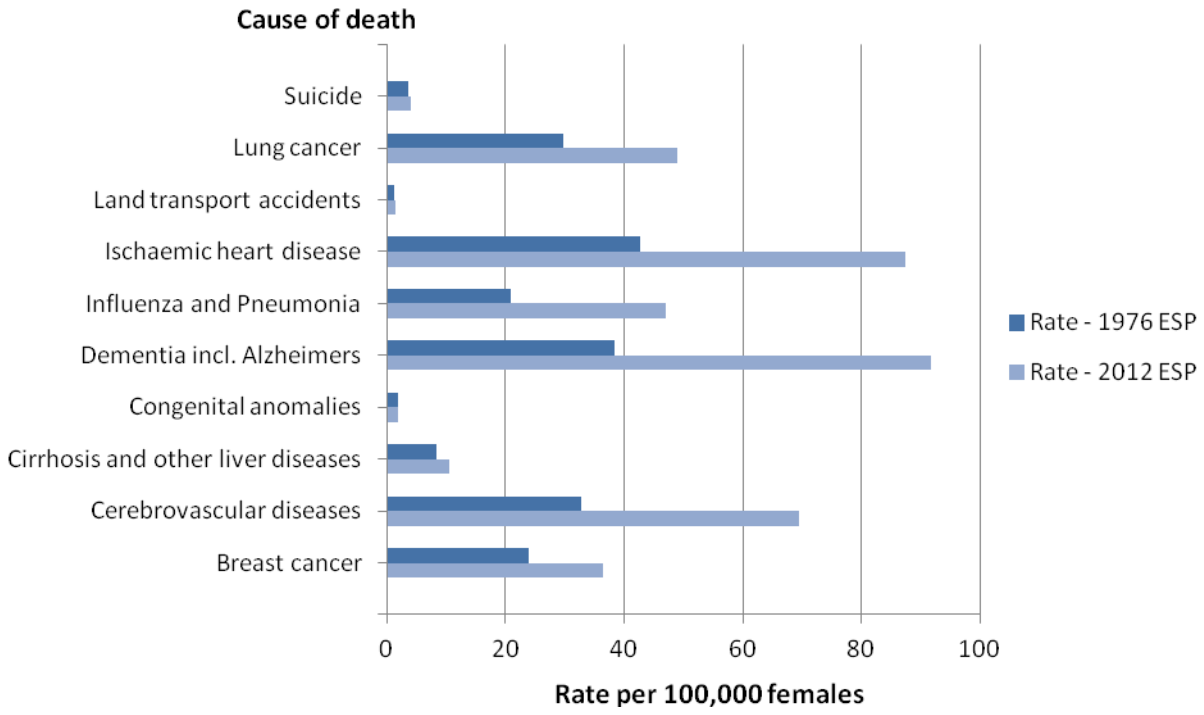
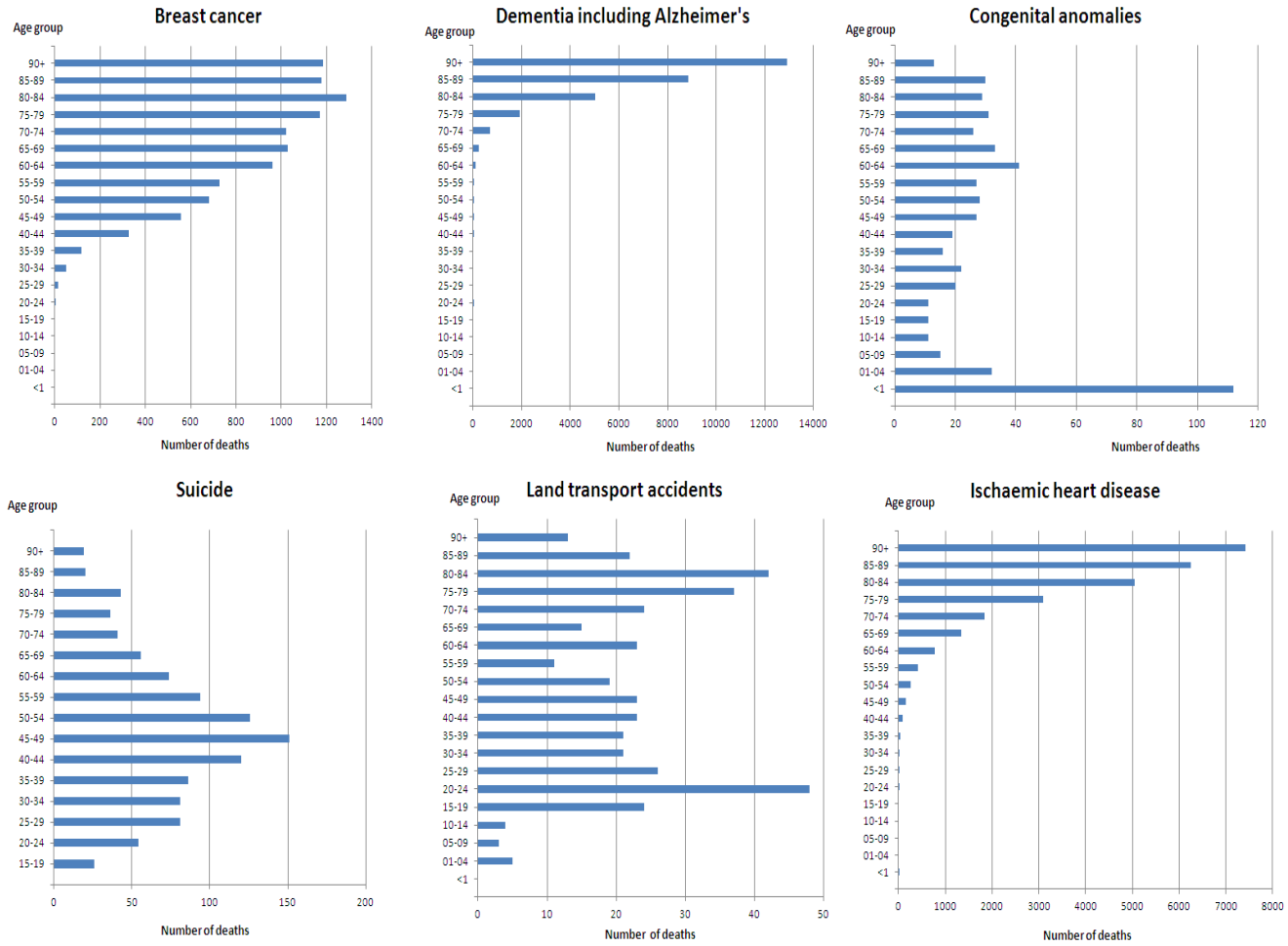


Figure 10: Age distribution of the number of deaths from some selected causes, Females, England and Wales, 2012



Overall, the extent to which the rate for a cause of death is affected by the 2013 ESP is dependent on how strongly associated that cause is with age.

The underlying data (ASRs) for the charts in this document are available in the accompanying reference table

Plans for implementing the 2013 ESP

Further information on the implementation of the revised (2013) ESP in ONS's mortality and cancer outputs is available in the European Standard Population Timetable.

In future, ONS intends to publish all ASRs using the full 2013 ESP (with an upper age limit of 95+). However, until official population denominators are available for the oldest age group in the 2013 ESP, crude rates will be continue to be standardised using the 'condensed' 2013 ESP with an

upper age limit of 90+. The version of the ESP and upper age limits used will be clearly marked in all ONS publications.

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Background notes

Age-standardised rates and number of deaths from suicide are based on those aged 15 years and over in line with the National Statistics definition of suicide.

Eurostat. Revision of the European Standard Population – Report of Eurostat's Task Force

Office for National Statistics. Revised European Standard Population 2013 (2013 ESP)

Office for National Statistics. Age-standardised mortality rate calculation template, 1976 ESP (64 Kb Excel sheet)

Office for National Statistics. Age-standardised mortality rate calculation template 2013 ESP (93.5 Kb Excel sheet)

World Health Organisation. International Statistical Classification of Diseases and Related Health Problems 10th Revision