Age-standardised death rates using the European Standard Population

Background

A time-series of death rates which have been age-standardised should show more clearly if there is any underlying trend in mortality because changes in the values of an age-standardised rate should not be affected by any changes in the distribution of the population by age. Similarly, a comparison of the age-standardised death rates for different countries will be unaffected by any differences in the age-distributions of their populations.

The World Health Organisation (WHO)'s rationale for using age-standardised mortality rates is as follows.

> The numbers of deaths per 100 000 population are influenced by the age distribution of the population. Two populations with the same age-specific mortality rates for a particular cause of death will have different overall death rates if the age distributions of their populations are different. Age-standardized mortality rates adjust for differences in the age distribution of the population by applying the observed age-specific mortality rates for each population to a standard population.

WHO adds that:

> The age-standardized mortality rate is a weighted average of the age-specific mortality rates per 100 000 persons, where the weights are the proportions of persons in the corresponding age groups of the WHO standard population.

and:

> [The] WHO Standard Population is defined to reflect the average age structure of the world's population over the next generation, from the year 2000 to 2025.

For the purposes of producing age-standardised death rates solely for European countries, the WHO Standard Population is not particularly appropriate, because its age-structure differs markedly from those of European populations (for example, 26% of the WHO Standard Population is aged 0-14 compared with 16% of the population of Scotland in 2010; for ages 65 and over, the corresponding figures are 8% and 17%).

Instead, use is made of the European Standard Population (ESP). This is a theoretical population, which is defined as having a particular distribution by age. The first version of the ESP was introduced in 1976, and the second version in 2013. The age-distributions of the two versions are shown on the next page. Demographic changes since the 1976 ESP was developed mean that it is not an ideal standard population for use today, but (compared with the WHO Standard Population) its age structure is a bit more like Scotland's: for example, the 1976 ESP has 22% aged 0-14 and 11% age 65 and over - both these figures are nearer to the

Scottish percentages than are the WHO Standard Population's percentages (go to the figures that were given earlier).

The 1976 and 2013 European Standard Populations: distributions by age

Age-group	1976 European Standard Population	2013 European Standard Population
0 *	1.6% *	1.0%
1 - 4 *	6.4% *	4.0%
0 - 4	8%	5.0%
5 - 9	7%	5.5%
10 - 14	7%	5.5%
15 - 19	7%	5.5%
20 - 24	7%	6.0%
25 - 29	7%	6.0%
30 - 34	7%	6.5%
35 - 39	7%	7.0%
40 - 44	7%	7.0%
45 - 49	7%	7.0%
50 - 54	7%	7.0%
55 - 59	6%	6.5%
60 - 64	5%	6.0%
65 - 69	4%	5.5%
70 - 74	3%	5.0%
75 - 79	2%	4.0%
80 - 84	1%	2.5%
85+ ** / 85 - 89	1%	1.5%
90 - 94 **	(included in 85+)	0.8%
95+ **	(included in 85+)	0.2%

* the definition of the ESP distinguishes between ages "0" (or "under 1") and "1-4", and specifies a separate weight for each of those age-groups. However, for the calculation of rates based on the 1976 ESP, NRS combined these into a single "0-4" age-group (whose weight is the sum of the weights for the separate age-groups). This has changed now that we have moved to calculate rates based on the 2013 ESP.
** the 1976 ESP has a single age-group for "85+": it does not separate the 85-89, 90-94 and 95+ age-groups in the way that is done in the 2013 ESP. For calculation of the 2013 ESP we combine the 90-94 age group with the 95+ age group due to a lack of availability of population estimates at the 95+ level.

Some points to note about age-standardised death rates that were calculated using the 1976 ESP

Because the distribution of the ESP by age differs from that of the Scottish population by age, a death rate which has been standardised using the ESP is <u>not</u> comparable to an actual death rate which was calculated using Scotland's total number of deaths and its total population. For example, the overall death rate for Scotland in 2010 was 10.3 per 1,000 population, or 1,033 per 100,000 population -

but it is only 656 per 100,000 population when age-standardised using the 1976 ESP.

In general, death rates which were age-standardised using the 1976 ESP tended to be smaller than the actual death rates for Scotland. This is because the 1976 ESP gives less weight to the older age-groups (which usually have higher death rates) than the actual population of Scotland (for example, as mentioned earlier, in 2010, 17% of the population of Scotland was aged 65 and over, compared with only 11% of the 1976 ESP). So, when a weighted average of the death rates for different age-groups is produced by applying the 1976 ESP's age-distribution to the age-specific death rates, relatively high weights are given to the (usually) low death rates of the younger age-groups, and relatively low weights are given to the (usually) higher death rates of the older age-group. As a result, the final 1976 ESP-weighted average death rate will be disproportionately influenced by the death rates of the younger age-groups, and therefore will usually be lower than the actual overall death rate. It is for some of these reasons that Eurostat decided to bring the population structure of the ESP up to date.[1] 'National Records of Scotland (NRS) has now changed its methodology for calculating age-standardised rates to use the 2013 ESP and all age-standardised rates published from August 2014 will be calculated on this basis'. 'Other countries have already moved to using the 2013 ESP or are updating at a similar time which will keep our age-standardised mortality rates comparable with the rest of the UK and other European countries.

The impact of moving to ESP 2013

The impact is significant, but it is important to note that the change is due to an improvement in statistical methods and not due to any unusual increase in the actual numbers of deaths.
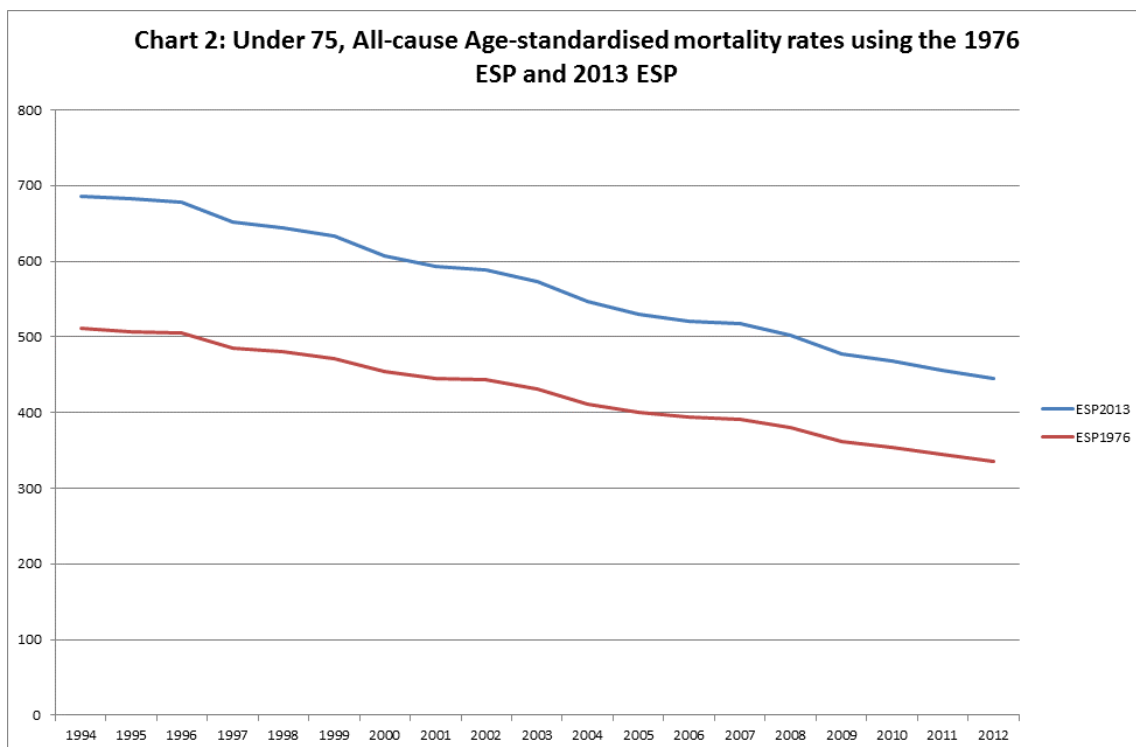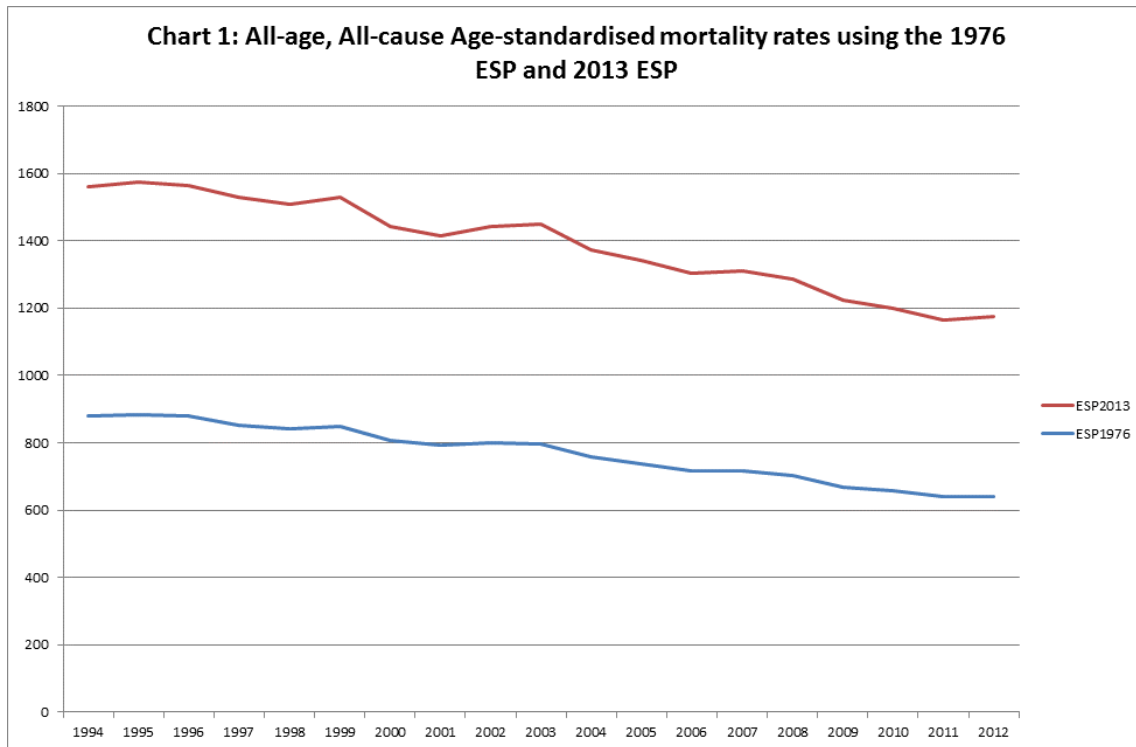
Because the 2013 ESP is more heavily weighted towards older ages than the 1976 ESP, and most deaths occur at older ages, there is a significant increase in most age-standardised mortality rates when using the 2013 ESP. For example, the all-age, all-cause age-standardised mortality rate in 2012 was 639.9 deaths per 100,000 persons using the 1976 ESP. Using the 2013 ESP, the equivalent figure is 1173.3 deaths per 100,000, an increase of 83%.

Charts 1 and 2 below shows that although there is a step change in the level of age-standardised mortality rates, there is very little impact on the trend.

Causes of death which predominantly affect older age-groups (e.g. cancer) show the greatest change in rates whilst those affecting younger ages (e.g. alcohol-related deaths and probable suicides) are less affected.

Footnote

1) Eurostat: Revision of the European Standard Population – Report of Eurostat's Task Force: available on the Eurostat website.

Chart 1: All-age, All-cause Age-standardised mortality rates using the 1976 ESP and 2013 ESP

Chart 2: Under 75, All-cause Age-standardised mortality rates using the 1976 ESP and 2013 ESP

Some methodological issues to note

Although the 2013 ESP has separate categories for 90-94 and 95+, NRS combines these into a single category for 90+. This is because population data is not consistently available for the 95+ age group for all years or geographies. ONS

carried out a study[2] looking at the impact of using an 85+, 90+ or 95+ upper age limit for calculating age-standardised mortality rates and found no significant differences between rates calculated with upper age limits of 90+ and 95+. As there is currently not widespread availability of population estimates for the 95+ group, they recommend the use of an upper age limit of 90+ for the 2013 ESP.

Time series using the 2013 ESP go back to 1994 for the majority of analyses. This is the earliest year recommended for use of the ESP 2013 as the population structure is not relevant to earlier years, in the same way that the ESP 1976 population structure is no longer relevant now. All of our published outputs will provide data back to 1994, although any requests for longer time series will be considered on a case by case basis.

Footnote
2**)** Office for national Statistics (ONS): Implementing the 2013 European Standard Population: the impact of selected upper age limits on mortality statistics: available on the ONS website .