Guest Blog: Dr Jon Minton, College of Social Sciences, University of Glasgow – The Future of Life Expectancy: Shifting mortality hurdles and why ageing isn't what it used to be

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This blog is one in a series of blogs on the Future of Ageing, published in the lead up to the ILC-UK Future of Ageing conference on the 24th November. To register to attend this conference, click here.

"No one wins. One side just loses more slowly."

This statement, made by Prez, a character on the critically acclaimed TV show The Wire, isn't a bad way to start thinking about longevity. Of course no one can live for ever; all we can do is lose more slowly, travelling further along the life course to reach ever older ages. The life course is a series of hurdles, age specific mortality risks, each of varying heights, each of which have to be cleared before we can continue to live another year. We hope to clear more of these hurdles, travelling further into older ages, and hope to do so without sustaining too many sprains and injuries (acquiring multiple morbidities) along the way. A life expectancy is a way of summarising many individual mortality risks faced by populations at different ages, a single number for describing the difficulty of the course. Thinking of these age specific mortality risks as hurdles of different heights, which have to be cleared before someone can travel further across the life course, then the life expectancy is when around half the people travelling the life course will have failed to clear one of these hurdles.

These hurdles are different for males and females: in their late teens and early twenties, males experience markedly higher

mortality rates than females, often from external causes. Plotting age specific mortality risks for males compared with females shows the mortality risk jumping upwards once the protective confines of parental supervision have been shed, producing a male ‘plateau of misadventure’ that lasts until around the mid thirties for young men; this male excess mortality in young adulthood has if anything even tended to increase while overall mortality risks at these have fallen, even more so as maternal morbidity related to childhood has fallen (alongside infant mortality) due to improved medical care.

But even once the plateau of misadventure has been survived, age specific mortality rates due to ageing tend to be higher for males than for females; any given mortality hurdle faced by women at one age tends to be faced by men at a slightly younger age. By older adulthood, from the age of 50 onwards, the differences in the placing of particular mortality hurdles for males and females tends to be marked and substantive, each contributing to the well-known overall differences in life expectancies.

The hurdles also differ between countries: People in England & Wales (sadly treated as a single region by many statistical agencies) have amongst the highest life expectancies in Western Europe, whereas people in neighbouring Scotland have amongst the lowest life expectancy. These Scottish deficits in life expectancy, compared with England & Wales, are nothing new, as the figure XX demonstrates.

Within figure XX, four shaded contour plots are presented. On the horizontal axis, ages are presented, running from 50 one the left to 90 on the right. On the vertical axis, successive birth cohorts are presented, running upwards from those born in 1860, a ‘completed cohort’ whose mortality risks up to the age of 90 years have already been observed; through to those born in 1960, who have only just started to reach into their fifties, and so whose mortality risks at older ages are therefore ‘unobserved’. The white triangles at the top left corners therefore show the extent of ‘missing data’ for these newer cohorts, and the key reason why population projections, in

particular projections of the size of older populations likely to require large health care needs and pension schemes, can be inaccurate. (An issue I will return to later in this blog.) Within each of the four subfigures, the same the same colour scheme to represent age specific mortality risk, and the same specific mortality hurdles, shown as labelled contour lines, are presented for each of the four sub-figures. The labels of these contours define the base 10 logarithm of the age specific mortality risks faced at the ages at which these contours pass through; more intuitively, this means the contour labels define the 'number of zeros' in the mortality risks: -1.0 meaning a 10^{-1}, i.e. 0.1 (10%) risk of dying in the next year, -2.0 meaning a 10^{-2}, i.e 0.01 (1%) risk, and so on.
Given this information for orienteering these complex demographic topographies, let's now look first at the older age mortality trends for males and females in England & Wales, and then compare these against those observed in Scotland.

England & Wales
In England & Wales, as with everywhere else in Western Europe, the overwhelming trend has been for each new birth cohort that enters the race to face an easier course to travel from the age of 50 years onwards. High hurdles that one cohort used to face at the age of 60, for example, later cohorts would instead face at the age of 61, 62, 63, and so on. These shifting mortality hurdles can be visualised like orienteering maps, with contour lines indicating specific mortality risk levels, like specific heights above sea levels. By arranging the age specific risks by birth cohort on the vertical axis and age on the horizontal dimension, we can see these hurdles to have been shifted ever further back for almost all cohorts; the notable exception being the 1918 birth cohort, hobbled both by the legacy of the First World War and the Spanish Flu pandemic which wreaked havoc across the world.

There are important differences between males and females in England & Wales: firstly, we see that for males the mortality hurdles faced by successive cohorts only shifted to the right (i.e.

improved) slightly for cohorts born between around 1850 to 1860, and then hardly changed at all for cohorts born between around 1870 to 1900. For perhaps half a century, for those born at the height of the British Empire of Queen Victoria, therefore, there was very little improvement in mortality risk for males. By contrast, for females born during these decades the mortality hurdles tended to move progressively to the right, to be delayed for each generation to be faced at slightly older ages. There is evidence that these improvements increased even more quickly after World War 2: a diagonal disruption running top left to bottom right is apparent, seen most clearly by looking at the contour lines marked -2.0 and -1.8, which shift sharply to the right for the 1880 compared with the 1900 cohort in their mid to late 50s, and for 1870 to 1890 cohorts in their late 50s and early 60s. For comparable males, there was no equivalent improvement. The diagonal disruption appears only to have affected mortality risks in the fifties and sixties, with little change in the seventies and eighties.

For males and females alike, the most rapid improvements in these older age mortality risks occurred for those cohorts born after World War 1: the pace of the 'rightwards march' of the mortality hurdles increased rapidly for both genders, and shows no sign of stabilising at any age. This is one of the great success stories for a great many countries throughout Western Europe and North America, though sadly not replicated within Russia and former Soviet block countries in Eastern Europe. It also is the source of a great many demographic, fiscal and demographic challenges now facing the ageing societies of the West. For England & Wales, the seat of the once dominant British Empire, it suggests that longevity at older age improved most quickly as the Empire fell into decline and transformation as a loose Commonwealth, and Britain's military might and imperial dominance gave way to the radical social security and state reforms, including the formation of the National Health Service, which were initiated during World War 2, undertaken in haste with the election victory of Labour in 1945, and canonised within William Beveridge' s 1942 report Social Security and

Allied Services. It is notable that the males and females born soon after 1920 would be in their fifties in the 1970s, and had spent much of their working life under the Keynesian ‘Butskellite’ consensus of low unemployment, high social security, and high levels of state involvement in economic matters. However it is interesting to note that even those cohorts who experienced a combination of ‘Butskellite’ and ‘Thatcherite’ labour markets saw similar levels of mortality hurdle improvements in older age: The post-war consensus appeared to ‘switch on’ an acceleration of improvements in older age mortality which have not (so far) been ‘switched off’.

Scotland

So, how does Scotland compare with England & Wales? Given the shared history, economy, population, government and geography of these two regions, it can only be expected that trends at older ages will be similar. Indeed, females in Scotland appear similar to females in England & Wales, in seeing both improving older age mortality hurdles earlier than for males. And like in England & Wales, for both genders the rate of rightwards shift in hurdles accelerated after the 1920 birth cohorts.

However, there are also one or two notable differences: whereas for males in England & Wales, for birth cohorts born up until around 1900, the older age hurdles were largely static, for males in Scotland they appear to be more variable, with some hurdles for males in their sixties and early seventies even appearing to move to the left. However, given the much smaller population size in Scotland compared with England & Wales, especially for these cohorts, there is a high risk of misinterpreting ‘noise’ for ‘signal’ and the likelihood that male trends for these cohorts are similar in both countries cannot be discounted.

More subtle but impactful differences can be discerned by analysing the figures more carefully, and in particular by

comparing mortality risks for the same cohort and age within the two countries. Many such comparisons can be made, but to start with compare the top left corners of each of the four subfigures. For females in England & Wales, the mortality hurdle -2.6 is apparent, and behind it is the darkest blue shade seen within the figures, corresponding to the lowest observed mortality risk shown in the figure. For females in Scotland, the smallest visible mortality hurdle is the next contour, -2.4, and these lowest shades are not visible. Similarly, for males, the contour labelled -2.4 is visible in the top left corner within England and Wales, whereas for males the lowest observed risk is -2.2.

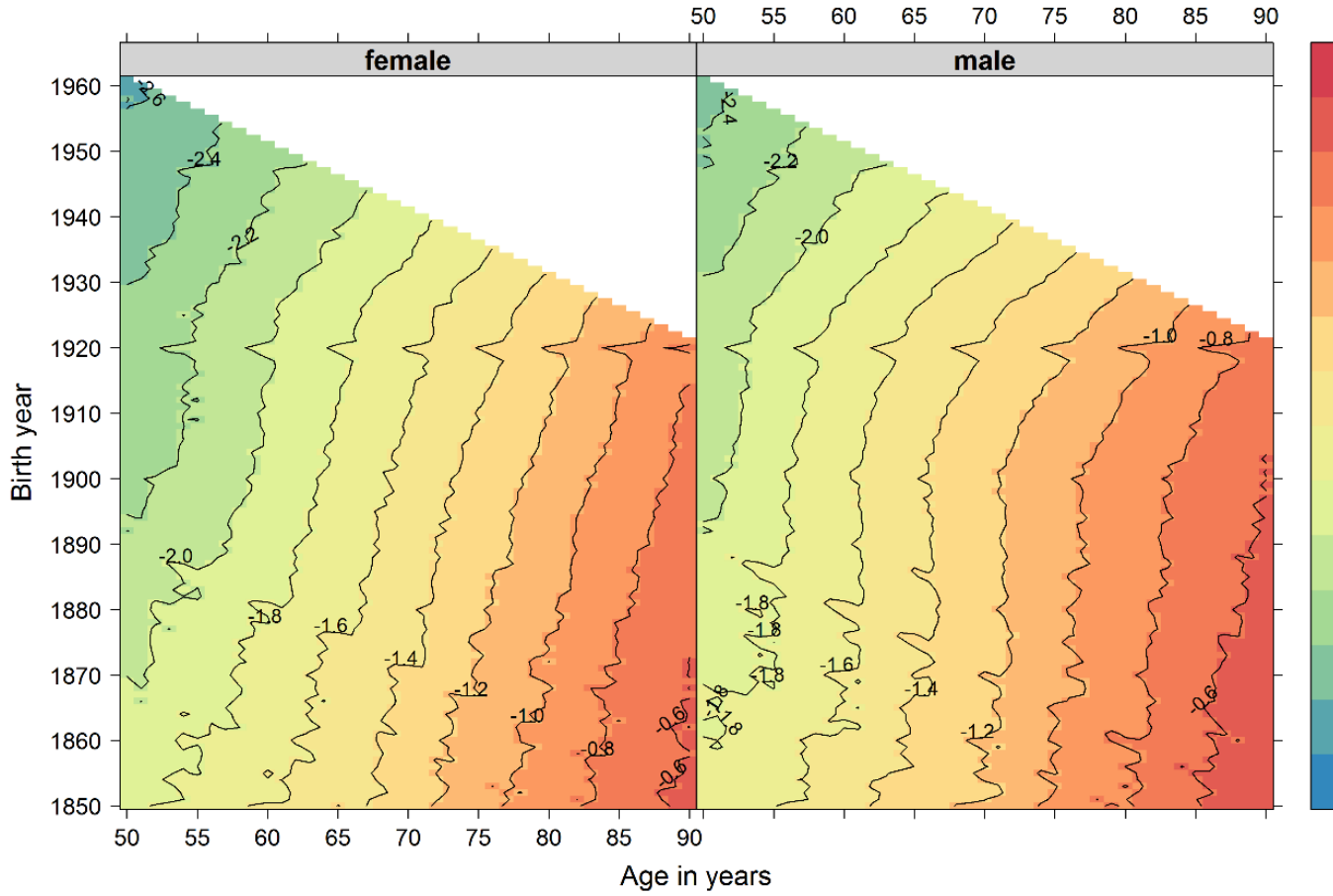
By looking at each of the labelled contour lines below and to the right of these lowest contour lines, and comparing the particular ages and cohorts they intersect in Scotland compared with people of the same gender in England & Wales, the many small differences that contribute to Scotland's overall lower life expectancy becomes clear. Though mortality risks have improved similarly in both countries, they have remained persistently worse in Scotland compared with England & Wales. The data used to produce these figures can also be used to estimate the 'excess' deaths at different ages, for different cohorts, in Scotland compared with England & Wales.

Discussion

Many life expectancy measures are known as period life expectancies, and are equivalent to assuming that each of these contour lines, which have been shifting steadily to older ages for each cohort, will suddenly stop shifting and become vertical lines. They make assumptions about the difficulty of life courses not yet travelled which are not compatible with more than a century of change.

The challenge for future healthcare and social provision is that we do not know how these mortality hurdles will continue to shift, and if we make the wrong assumptions, like the period life expectancy assumption, we are likely to be investing far too little in healthcare and social care provision than we should have

been. By seeing how these hurdles have moved, we can at least develop a better idea about how they could continue to change in the future, and what sort of population and society we are likely to become.



Shaded contour plot of age specific mortality risks for birth cohorts born from 1850 and 1960 in England & Wales (bottom row) and Scotland (top row), and for females (left column) and males (right column) over the age range 50 to 90 years. Reds indicate higher risks, blues lower risks, and yellows intermediate risks. Contours are labelled with log mortality risks on a base 10 scale, effectively the 'number of zeroes' in a mortality risk: -1.0 means a 1-in-10 risk of dying in the next year, and -2.0 a 1-in-100 risk of dying in the next year.
A period life expectancy involves assuming that the mortality hurdles will become vertical in the 'missing' top right corners of the maps. (Author's own analysis. Source: Human Mortality Database.)

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