Why is life expectancy in England & Wales falling behind? A decomposition approach.

Jennifer Beam Dowd[1,2], Antonino Polizzi[1,2], José Manuel Aburto[1,2,3], Luyin Zhang[4], Andrea M. Tilstra[1,2]

[1]Leverhulme Centre for Demographic Science, University of Oxford
[2] Nuffield College, University of Oxford
[3] London School of Hygiene and Tropical Medicine
[4] Office of Population Research, Princeton University

Abstract

Continued improvements in maximum global life expectancy suggest that the stagnation in life expectancy at birth recently observed in England and Wales is avoidable. Existing research on the lagging life expectancy in England and Wales has compared trends to the average of a group of peer countries. Here, we extend this research by decomposing life expectancy differences between England and Wales and 17 individual countries in Western Europe using data from the World Health Organization and the Human Mortality Database from 2001 to 2019. Applying the contour decomposition method, we distinguish contemporary gaps in male and female life expectancy due to (1) differences in age- and cause-specific death rates around 2001; and (2) diverging trends in these rates thereafter. Disaggregating life expectancy gaps into initial differences and differential trends allows us to disentangle whether the health of the English and Welsh is losing ground or whether there are signs of a longer-term mortality disadvantage. For both sexes, we find that the relative life expectancy gap between England & Wales worsened for almost all countries from 2011-2019. Diverging trends in external causes, circulatory/metabolic & dementia/Alzheimer's were the most significant contributors to growing English disadvantage. Mid-life age groups contributed to diverging life expectancy gaps, but older ages were also significant, especially for females.

Introduction

After decades of steady improvements, life expectancy gains in England and Wales slowed considerably in the 2010s prior to the COVID-19 pandemic.[1] The 2000s saw annual average improvements in life expectancy for English males of 0.31 years, falling to 0.07 per year for the period 2011 to 2017, with a similar trend for females. Life expectancy at birth fell for both sexes in England between 2014 and 2015 for the first time since 1993, partly due to high winter mortality[2]. Early explanations for this mortality stagnation focused on the impact on older adults of austerity cuts to health and social care which coincided with these mortality changes[3,4], but later work has shown that the slowdowns reflect mortality changes at younger ages as well[5]. Slowdowns in mortality improvements have also been seen in other European countries including Germany, Sweden, and the Netherlands which did not experience harsh austerity[3]. Overall, how recent changes in mortality reflect the impact of contemporaneous events vs the legacy of changes in population health decades prior remains unclear.

While the UK continues to perform better than world laggard the United States, recent work has shown a divergence in UK life expectancy compared to peer countries[5]. Leon and colleagues examined trends in life expectancy from 1970-2016 in England and Wales compared to the median of 22 high-income comparison countries. They found a slowdown in life expectancy improvements in many countries, but this slowdown was steeper in England and Wales from 2011-2016. They also identified a pattern of higher mortality among men and women aged 25-50 years in England and Wales compared to other countries, a pattern also observed by Dowd, et al.[6]

We extend this previous work to provide a comprehensive assessment of the UK deterioration relative to its European peers from 2010-2019. We examine how differences in life expectancy trends in England and Wales compare to individual peer countries. We also identify the ages and causes of death contributing to life expectancy gaps between the UK and its peers. While comparisons to the mean of peer countries provide a good overview of the relative performance of the UK, they can obscure variations in patterns compared to specific countries that may better identify potential mechanisms underlying these trends. Decomposing differences by cause of death may help point to specific mechanisms driving mortality trends in some countries compared to others.

Data and Methods

We use data for the 2001-2019 period for England and Wales and the following 17 individual countries in Western Europe. Year-, sex-, and age-specific all-cause mortality rates for these countries were sourced from the Human Mortality Database (HMD). Annual cause-specific death counts by sex and 5-year age group were retrieved from the World Health Organization (WHO) Mortality Database, a leading data source for comparative mortality studies covering cause-of-death data from 1950 to date.

We code seven mutually exclusive causes of death based on the International Classification of Diseases (ICD) 10th Version:, 1) lung cancer, 2) all other cancers, 3) circulatory/metabolic 4) dementia and Alzheimer's diseases, 5) diseases of the respiratory system, 6) external causes of death, and 7) all remaining causes of death.

We decompose life expectancy gaps between England & Wales and seventeen Western European peer countries. For each 1-to-1 comparison, we select the latest shared observation time point before 2020 (i.e., the onset of the COVID-19 pandemic) for decomposition. For most comparisons this is 2019. We decompose life expectancy gaps at the selected time point into contributions by age (age groups 0, 1-4, 5-6 …, 90-94, 95+) and causes of death.

Our decompositions are based on the contour decomposition method,[7] an extension of the stepwise-replacement method. As its name suggests, the stepwise-replacement method decomposes life expectancy gaps between a population α and a population β at a given time point by replacing, in a stepwise fashion, age-specific mortality rates A in population α with mortality rates B in population β, starting from the youngest age group. The contributions of all age groups are additive, and their sum is equal to the total life expectancy gap.

Preliminary Results

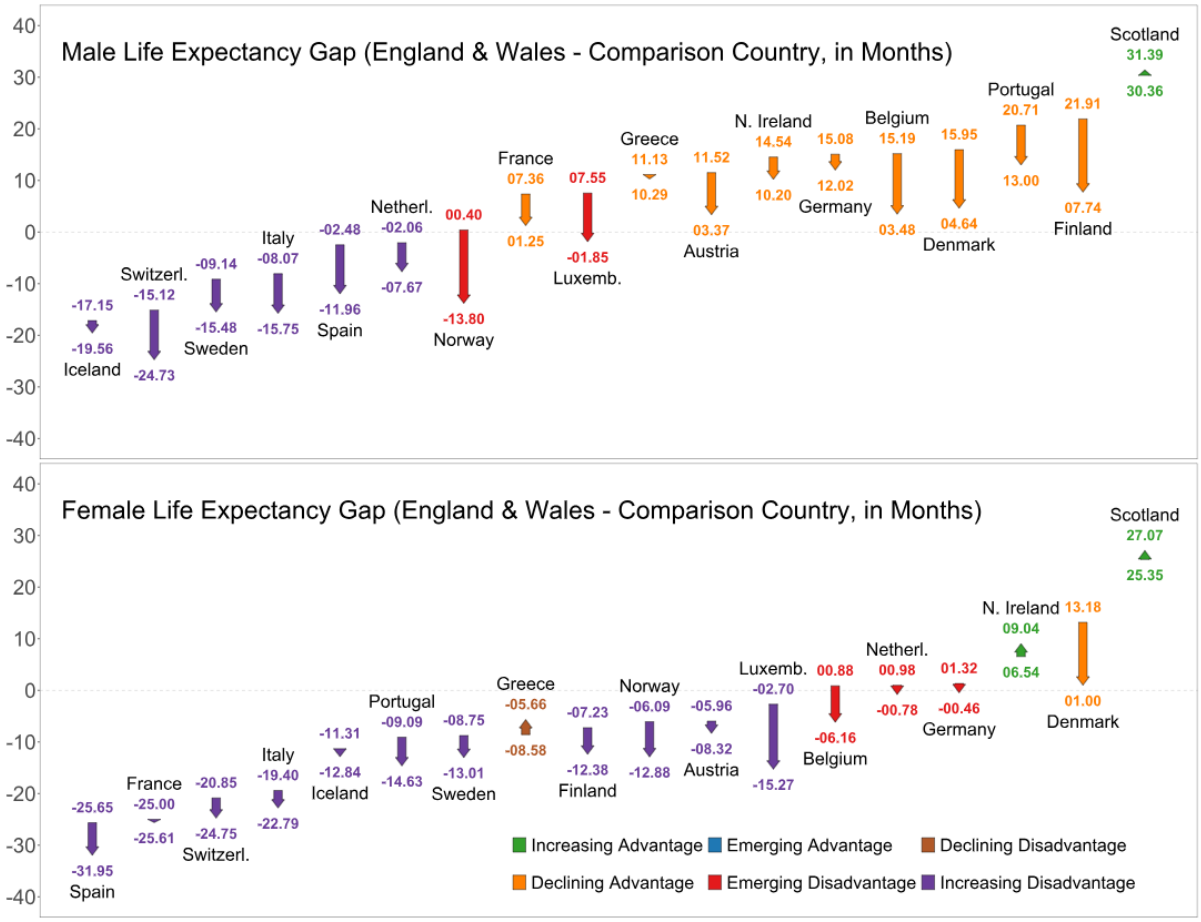
CHANGING LIFE EXPECTANCY GAPS

Figure 1 shows the change in the male (top panel) and female (bottom panel) life expectancy gap between England and Wales and all Western European comparison countries in months since 2011. For each panel, the countries are listed according to the size of the life expectancy gap in the first observation year. Downward-pointing arrows indicate that the life expectancy gap between England and Wales and a given comparison country became worse for England and Wales. In contrast, upward-pointing arrows indicate that the life expectancy gap became more favorable for England and Wales.

For male life expectancy at birth, England and Wales outperformed most Western European countries at baseline, except for Iceland, Switzerland, Sweden, Italy, Spain, and The Netherlands. Female life expectancy showed a different pattern, with lower levels in England and Wales in the first observation year than in most Western European comparison countries. Female life expectancy was only higher in England and Wales than in Belgium, The Netherlands, Germany, Denmark, and the fellow United Kingdom countries Northern Ireland and Scotland.

For males, the dominant pattern over time was a smaller improvement in life expectancy at birth in England and Wales compared to other countries, as seen by the downward arrows in the male panel of Figure 1. The only life expectancy gap that became more favorable for England and Wales over this period was for Scotland. This pattern of relative deterioration was largely true for females as well, as seen in the downward arrows in the female panel of Figure 1. Only three life expectancy gaps became more favorable for England and Wales, with upward-pointing arrows for Greece, Northern Ireland, and Scotland.

Figure 1. Change in male and female life expectancy gap between England and Wales and other Western European countries over observation period, in months.



Note: Countries in each panel listed in ascending order by difference in life expectancy compared to England & Wales in first observation year. Observation period 2011–2019, except Belgium (2011–2018), France (2011–2017), Greece (2014–2019), Norway (2011–2016), and Sweden (2011–2018). "Advantage" and "Disadvantage" are from the perspective of England and Wales.

Decomposition Results for Life Expectancy Gaps

The final paper will show decomposition results for the male and female life expectancy gaps between England and Wales and each Western European comparison country in the final observation year by age group and cause of death.

The diamonds in each panel of Figures 2 indicate the total cause-specific contributions of a given age group (0–14, 15–24, …, 75–84, 85+) to the total life expectancy gap. Each of the age- and cause-specific contributions is also broken down into (1) the contribution from mortality differentials between the two countries in the first observation year (represented by the circles in each panel); and (2) the net contribution from different mortality trends in the two countries between the first and the final observation year (represented by the lines connecting each circle and diamond). We focus our discussion on the trend component of the contour decomposition, or how age- and cause-specific mortality in England and Wales and each comparison country converged or diverged over time. In Figure 3 we break down the net contribution from trends by country.

Four causes of death stand out in the decomposition results for male and female life expectancy gaps. First, England and Wales consistently showed larger increases in dementia-and-Alzheimer's mortality at older ages (75 and over) compared to most peer countries. Second, with exceptions such as Scotland and Northern Ireland, external mortality at young and middle ages (15 to 64) in England and Wales tended to increase or increase more than in

the peer countries. Third, circulatory/metabolic mortality at middle and older ages (45 and above) typically improved less in England and Wales or increased in England and Wales but declined in the peer countries. Finally, lung cancer mortality showed divergent patterns by sex. Among males, lung cancer mortality at middle and older ages (45 and above) typically improved less in England and Wales, while, among females, lung cancer mortality usually improved more in England and Wales or changed little in England and Wales but increased in the peer countries. In Figures 2–3, we illustrate these patterns with Belgium, a comparison that is illustrative of the general patterns between England and Wales and the group of Western European comparison countries. While the comparison with Belgium is representative of the general age- and cause-specific patterns, there are some notable deviations, which we describe below.

DECOMPOSITION RESULTS: MALES

The male life expectancy advantage of England and Wales over Belgium declined from 15.19 to 3.48 months (-11.71 months) between 2011 and 2018 (Figure 1), indicating smaller mortality improvements in England and Wales. Consistent with this, and as seen from the relative locations of diamonds and circles in Figure 2 (i.e., diamonds usually left of circles), the net contributions of the trend components were negative for most ages and causes of death. These negative contributions usually resulted from smaller mortality improvements, or, in the case of dementia/Alzheimer's and external causes, from (larger) mortality increases in England and Wales vs. Belgium (Figure 3).

As shown in Figure 3, dementia-and-Alzheimer's mortality at older ages (75 and older) increased in both countries, but more so in England and Wales. Similarly, external mortality increased at middle and older ages (15 and older) in England and Wales but improved across most ages in Belgium (except for ages 65 and older). Next, there were improvements in circulatory/metabolic mortality in Belgium at ages 45 and above, while, in England and Wales, circulatory/metabolic mortality declined only at ages 55 and above but increased at ages 45–54. As shown in Figure 2, the latter pattern caused the net contributions for the trend components of circulatory/metabolic mortality to be negative at ages 45 and above. Finally, improvements in lung cancer mortality at ages 45 and above were smaller in England and Wales than in Belgium, also leading to negative net contributions for the trend components in these age groups (see Figures 2 and 3).

Figure 2

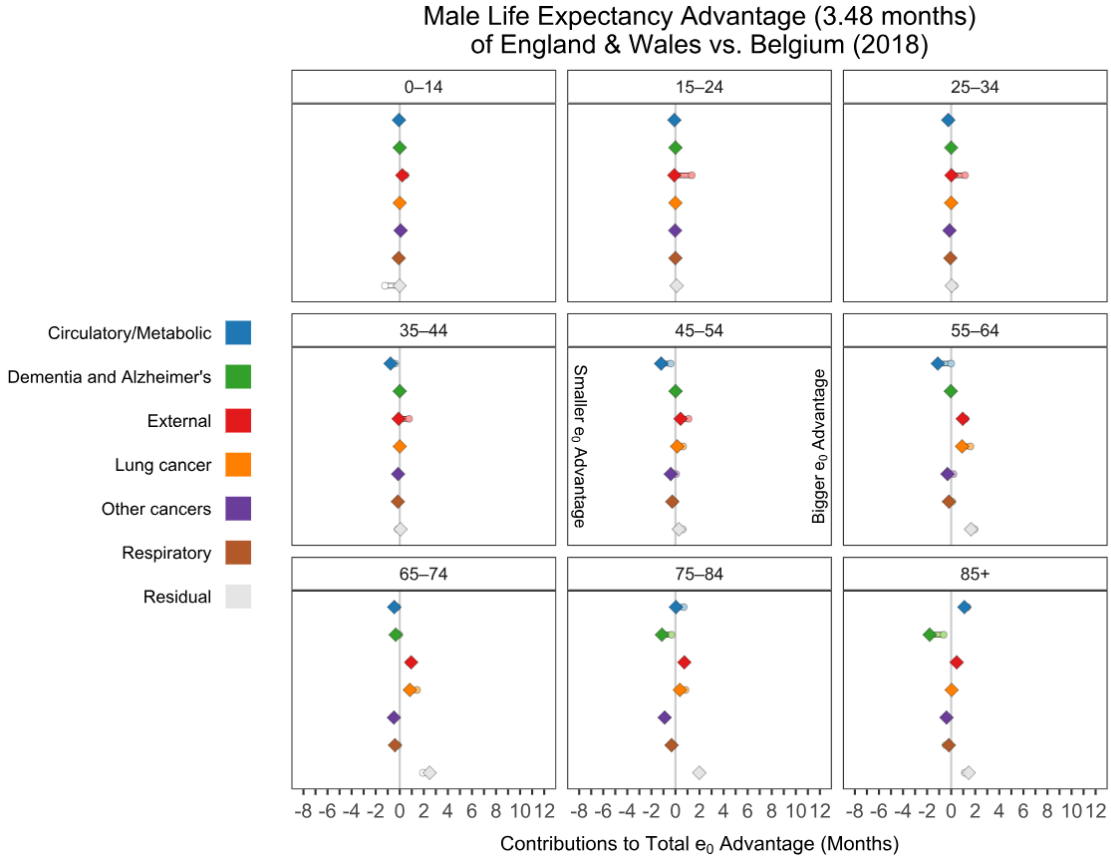
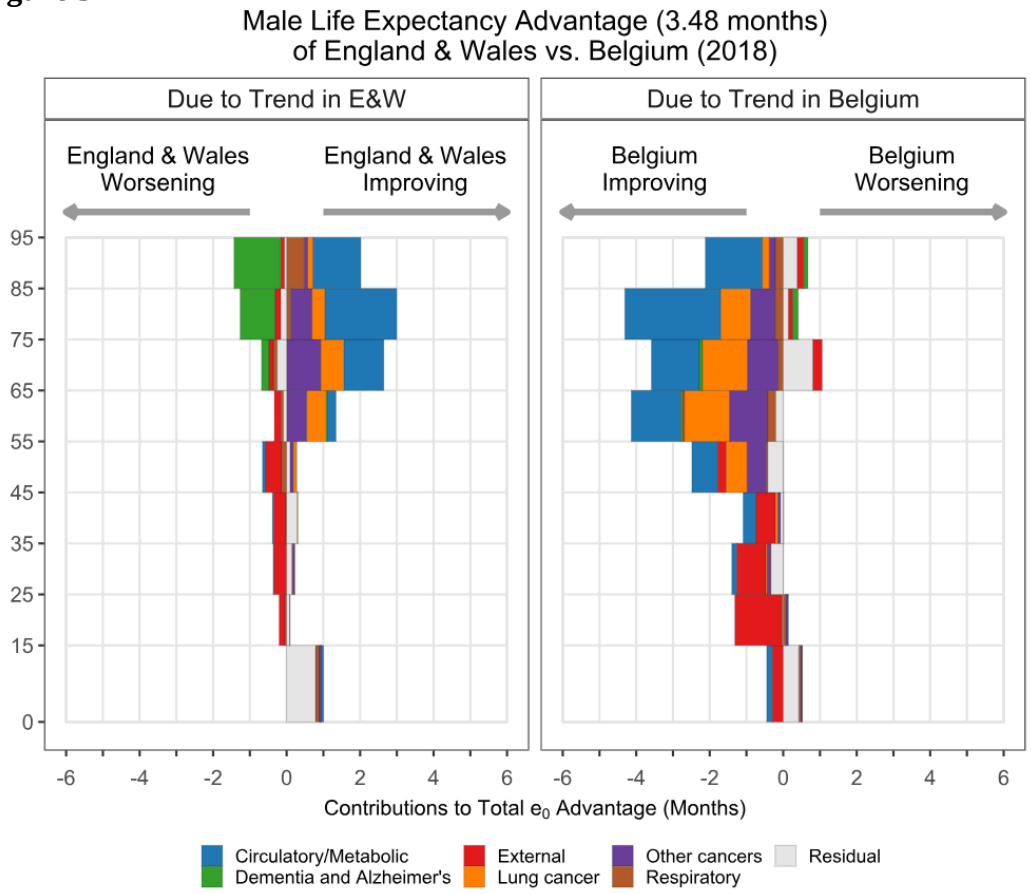


Figure 3



In the full paper, we will discuss results by country, age and sex more thoroughly and draw conclusions about the potential causes of diverging life expectancy in England & Wales compared to their European peers.

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