# Abstract

**Background**

All-cause age-specific mortality risks have tended to be decreasing in England & Wales for more than a century. The period 2008-2015 has seen both a global recession, and since 2010, two Conservative-led governments pursuing an ‘austerity’ agenda of reduced investment in public services.

**Aim**

To estimate trends in age-specific mortality risks from 1990 to 2010, use these trends to produce estimated age-specific risks over the period 2010 to 2015, and compare actual against projected numbers of deaths by various ages to produce estimates of total excess deaths by age 95 years in each year from 2010 to 2015.

**Methods**

Office for National Statistics (ONS) data on population counts and death counts at each age in single years from birth to age 95 years (2010 to 2014 data) or to age 89 years (2015 data) were used to construct linear regression models of mortality risk against year for each age in single years from 1990 to 2010, including dummy variables to control separately for effects of the New Labour (NL) government (1997-2010) and the 2008-2009 global financial crisis (GFC). The models were used to estimate the mortality risks that would have been expected if mortality trends during the New Labour period had continued. The number of age-specific deaths at each age in each year from 2011 to 2015 were estimated given population counts in each year, and compared with observed number of deaths in each year.

**Results**

There were slightly fewer deaths than predicted from the models in 2010 and 2011, but from 2012 to 2015 there have been an additional 42,800 deaths than predicted from up to age 90, and an additional 61,000 additional deaths up to age 95 years. Most additional deaths occurred after retirement age, and were more likely among males than females.

**Discussion**

Falling levels of investment in social and health care services in England & Wales since 2010 may be responsible for mortality rates at older ages either increasing or falling more slowly than would have been expected if previous improvements had continued.

# Introduction

In England & Wales, as in much of the rich world, continual, incremental, and predictable rates of progress in matters of wealth and health have been the norm for many decades. To not make progress, year on year, at rates that have continued for generations is therefore to underperform as a society, and so to regress in absolute terms and achieve less than has been achieved before is to fail badly. In recent years macroeconomists have been puzzled at the UK’s slow rate of per capita growth in gross domestic product (GDP) since 2008, with arguments made about the world economy may have entered a new epoch of ‘secular stagnation’, permanently slower growth in a metric that has for more than sixty years considered a key measure of societal progress. The economic slowdown and stagnation in the UK has, however, been considered exceptionally poor, and linked to the Austerity agenda of the Conservative led government of 2010 to the present day, in contrast to similarly affected countries which pursued policies of economic stimulus and investment instead. [REF: Wren Lewis; Stuckler]. In the UK, this persistent gap between actual and projected GDP per capita grew from around £6,800 per person in 2008 to more than £13,400 per person in 2015. Income inequalities have also grown exceptionally sharply in the UK since 2010, meaning divergences against long term trends in median earnings have been larger still [REF]

Progress in health, at least as measured in life expectancy, has tended to improve continually for an even longer period. In the UK, the greatest gains in life expectancy at birth occurred during the first half of the twentieth centuries, in large part due to exponential falls in infant mortality rates. These rates appear to be continuing to fall exponentially, but because the absolute risk of infant mortality is so much lower than it was three or four generations ago, the effect of these further declines on overall life expectancy have declined. Instead, what contributes most to overall changes in longevity are continuing, incremental falls in age-specific mortality risks throughout adulthood, and in particular in older years. The probability of dying with each additional year of life typically increases, by between 10% and 11% in the UK, from around the age of 35 years onwards in both males and females. This compound growth in probability of death at each age turns a risk of less than 0.2% at age 40 into a risk of over 6.0% at age 80 for men, and from less than 1-in-1000 at age 40 to over 4.3% for women. [own calculations, year 2000] The total probability of dying between any two ages is of course an accumulation of these individually compounding age-specific mortality risks.

Age specific mortality risks (ASMRs) throughout much of adulthood have tended to continue to decline for almost the entirety of the twentieth century. Although some earlier forms of medical discoveries (e.g. antibiotics) and public health interventions (e.g. improved sanitation) may have picked much of the low hanging fruit in health and longevity improvements, and so the trend in ASMR improvement might be expected to be more gradual towards the end of the twentieth century than at the start, sudden reductions in these ASMR trends, like the sudden change in actual against long-term projected per capita GDP following 2008, could signal either a worrying shift in the fundamentals, a ‘secular stagnation’ in health, or a worsening

0.4 years for males and 0.7 years for females

Links:

<http://oxrep.oxfordjournals.org/content/31/2/217.full.pdf+html>

<http://ner.sagepub.com/content/231/1/R17.full.pdf+html>

<http://behl.berkeley.edu/files/2015/07/WP2015-06_Eichengreen.pdf>

<http://search.proquest.com/openview/2ff879b9c765e297515ce17b0e947e8c/1?pq-origsite=gscholar&cbl=736333>

<http://link.springer.com/article/10.1057%2Fimfer.2015.6>

<http://heinonline.org/HOL/Page?handle=hein.journals/fora95&div=26&g_sent=1&collection=journals>

<https://assets.documentcloud.org/documents/1678017/growing-fast-and-slow.pdf>

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<https://mainlymacro.blogspot.co.uk/2015/04/mediamacro-myth-7-strong-recovery.html>

<http://www.voxeu.org/article/fiscal-policy-explains-weak-recovery>

<http://www.lrb.co.uk/v37/n04/simon-wren-lewis/the-austerity-con>

# Methods

## Data

Mid-year population count and death registrations for England & Wales for years up until 2015 were extracted from the ONS Excel spreadsheet ‘Population Estimates for England & Wales 1961 to 2014’[[1]](#footnote-1) for ages up to 95 years of age. For 2015 mid year population counts and death counts for each age in single years from birth to 89 years were extracted from the Components of Change database (table MYEB2).[[2]](#footnote-2)

## Model

For each sex, and for each age in single years each age in single years, a, from birth to 95 years old, a separate linear regression model was fit with the following specification:

|  |  |
| --- | --- |
|  | (1) |

Where is the mortality rate (death count divided by population count) in year t, at age a, and for sex s; t is year; L is a dummy variable indicating the years, 1997 to 2010, in which New Labour were in government; R is a dummy variable indicating 2008 and 2009, the years in which the UK economy entered a recession as a result of the GFC, and is an error term. The R term is included to capture any additional short-term changes in mortality rates to be captured in a separate term rather than influence the coefficients including New Labour years, and . The use of interaction terms Lt and Rt allowed for the gradients of change in log mortality rates over time to be different over the New Labour and GFC recession periods.

The above model specification was fit to ONS data for each year from 1990 to 2010 inclusive. Redefining , projected log mortality rates were calculated for years 2011 to 2015 inclusive by setting t to these year values and L to 1, i.e.

|  |  |
| --- | --- |
|  | (2) |

Predicted numbers of deaths at each age, for each sex, and in each year from 2011 to 2015 were therefore calculated by multiplying the relevant age-year-sex specific population counts by the requisite projected mortality rates, i.e.

|  |  |
| --- | --- |
| or equivalently | (3) |

Where is the projected mortality rate rather than log rate.

The age-sex specific differences in deaths are therefore , and the total difference in deaths by age A, shown in figures xxx, is .

As death and population counts from the ONS for the year 2015 was aggregated for years 90 and above rather than disaggregated by age in single years, for ages 90 to 95 years was estimated by extrapolating over ages 84 to 89 years.

All analyses were performed using the R programming environment using publically accessibly data, and the R scripts used to perform the analyses are made freely available to other researchers.

# Results

# Discussion

## Limitations

Population estimates for ages over 90 years are not routinely available disaggregated by age in single years as part of standard UK population estimates, and are estimated by the ONS within the main dataset used in these analyses based on population and mortality rates at younger ages. Given our results indicated that much of the additional burden of excess mortality has been at some of the oldest ages, however, we considered it important to produce estimates of total excess deaths which include ages up to 95 years, despite these limitations. These limitations in the quality and availability of highly disaggregated data at some of the oldest ages are not just limitations affecting our analyses, but limitations which may hide some of the greatest mortality excesses which have occurred in England & Wales within the previous decade. Effective measurement and dissemination of age-disaggregated population and death counts at and above the age of 90 years should therefore be a national record keeping priority.

As has been noted many times before, “all models are wrong, but some are useful”. This model is clearly ‘wrong’ in the sense that it applies projected mortality rates to observed population counts for a number of consecutive years, and of course different mortality rates at any particular age would affect the number of people alive and thus exposed to the mortality rate of people one year older in the following year. However, we argue this approach is appropriate for aggregate quantification of harms or benefits, because otherwise sufficiently large premature mortality could give the impression that deleterious trends are actually positive. For example, if there were a sudden rise in deaths due to cardiovascular events then there may a fall in deaths due to cancers, affecting people at slightly older ages, because there would be fewer people living long enough to die of cancer rather than cardiovascular causes. It would be wrong, however, to claim these reductions represent improvements rather than deteriorations in health. For similar reasons, we have not altered the population sizes exposed to age-specific mortality risks in each of the years, only the degree of risks such populations are exposed to at each age.

1. Accessed 1 July 2016 https://www.ons.gov.uk/file?uri=/peoplepopulationandcommunity/populationandmigration/populationestimates/adhocs/005825populationestimatesforenglandandwales1961to2014singleyearofage0to105/ewuksyoadeathspopdata19612014cmifilevaluesforissue10122015.xls [↑](#footnote-ref-1)
2. Accessed 1 July 2016 http://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland [↑](#footnote-ref-2)