

INTRODUCTION

In December, we published a short note on the effect of seasonal variation on stalling mortality in England (1). ONS have now published updates to the end of 2019 of the annual life expectancy and quarterly mortality rates used in that note. Life expectancy at birth had been increasing in previous decades. However, these improvements which had been around a one-year increase every five and a half years for women and every four years for men in the period 1981 to 2010, slowed to a rate that is now a one-year increase every 17 years for women and 13 years for men in the years 2011 to 2019 (2) (3). There has been a considerable amount of discussion of the possible causes of this slowdown - seasonal factors (principally flu and cold weather) and factors affecting all seasons (austerity, material deprivation, demographic factors, disease patterns, statistical artefacts) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15). This note presents an updated estimate of the proportion of the slowdown associated with seasonal factors and examines the trend in year-on-year variation in seasonal mortality.

Using ONS quarterly mortality reports, Murphy produced a graph comparing quarterly mortality data for the years 2001 to 2018/9 (16). We have used these data, updated to the end of 2019, to compare seasonal and non-seasonal stalling.

RESULTS

Table 1 compares the trends in quarterly mortality rates in 2001-10 with those in 2011-19. This shows that trends in 2001-10 were similar in each quarter, except that the first quarter (Q1) trend for males, an annual reduction of 39.4 per 100,000 population, was steeper than for other quarters and rate reduction for males were between around 60 and 90 percent greater than for females. The slowing of mortality reduction in 2011-19 was similar in subsequent quarters (Q2, Q3 and Q4) and in every quarter, the percentage change in trend was similar for males and females.

Table 1 Trends in quarterly mortality rates, 2001-10 and 2011-2019

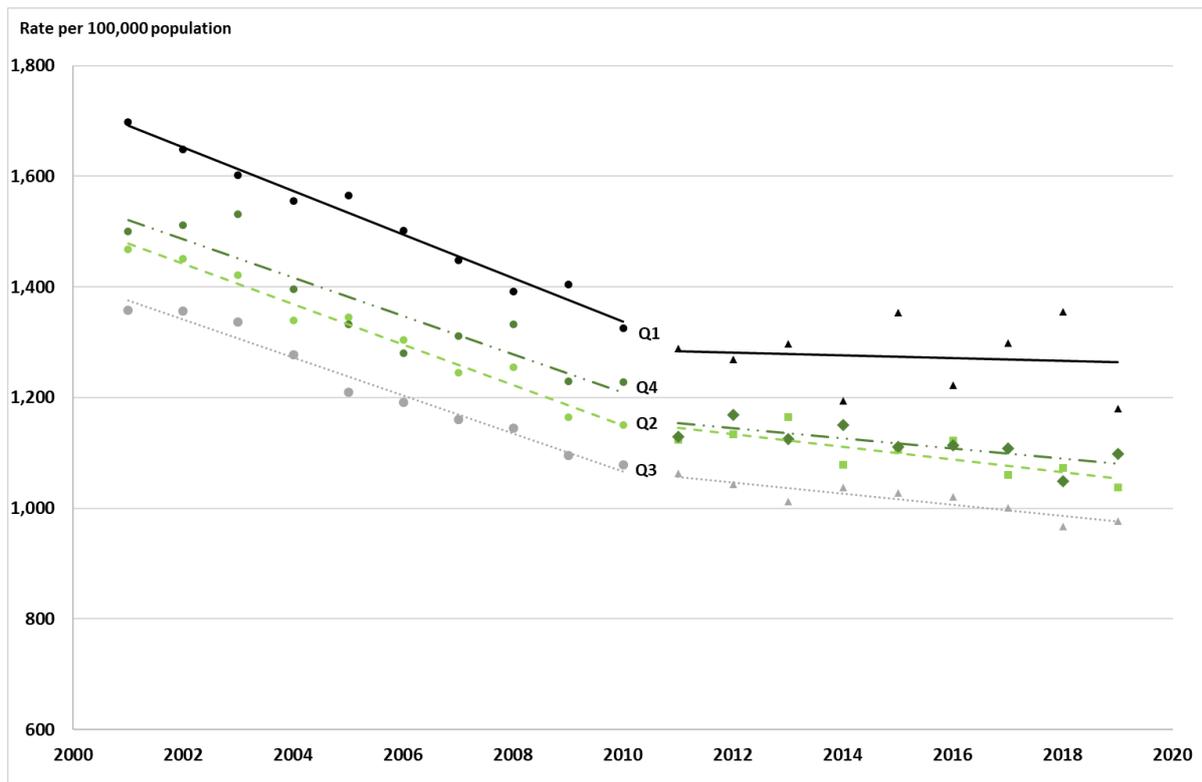
	Males				Females			
	2001-2010	2011-2019	Change	Percent change	2001-2010	2011-2019	Change	Percent change
Q1	-39.4	-2.5	36.9	-93.7	-21.0	1.5	22.5	-107.2
Q2	-36.5	-11.5	25.0	-68.5	-20.9	-7.4	13.4	-64.4
Q3	-34.4	-10.1	24.3	-70.7	-21.1	-6.6	14.5	-68.8
Q4	-34.7	-9.2	25.4	-73.3	-19.4	-4.2	15.2	-78.5
Difference between Q1 and Q3	-5.0	7.6	12.7		0.05	8.1	8.1	
Applying Q3 trend change to Q1								
Revised Q1	-39.4	-15.1	24.3	-61.7	-21.0	-6.5	14.5	-68.9

Source: Based on ONS (3)

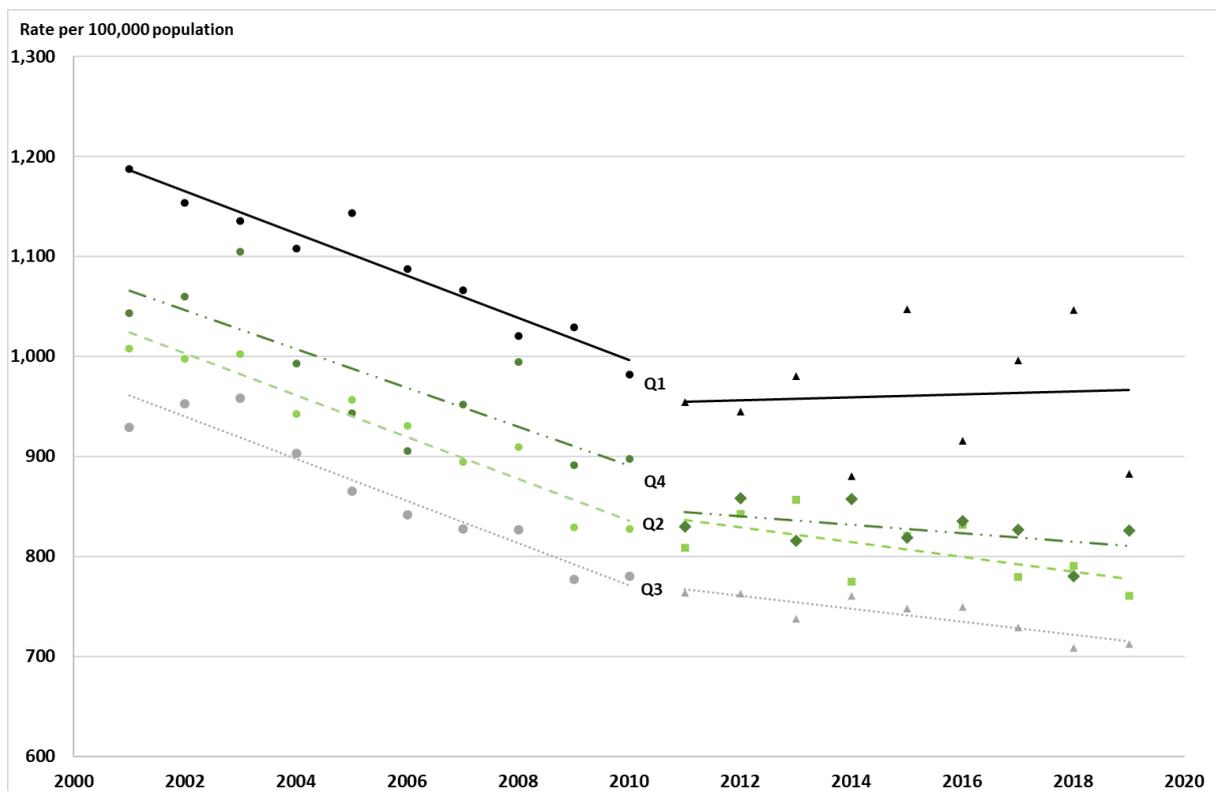
The stand-out point was that there was virtually no reduction in mortality rates for males and females in Q1 in the period 2011-2019. As Figure 1 shows, this reflected a huge increase in year on year variability, which is known to coincide with seasonal flu epidemics. The same degree of year on year variation does not appear to have affected Q3, which has the lowest mortality rates of any quarter and the least year on year variability.

Figure 1 Mortality rates by quarter and sex, England, 2001-10 and 2011-18

a) Males



b) Females

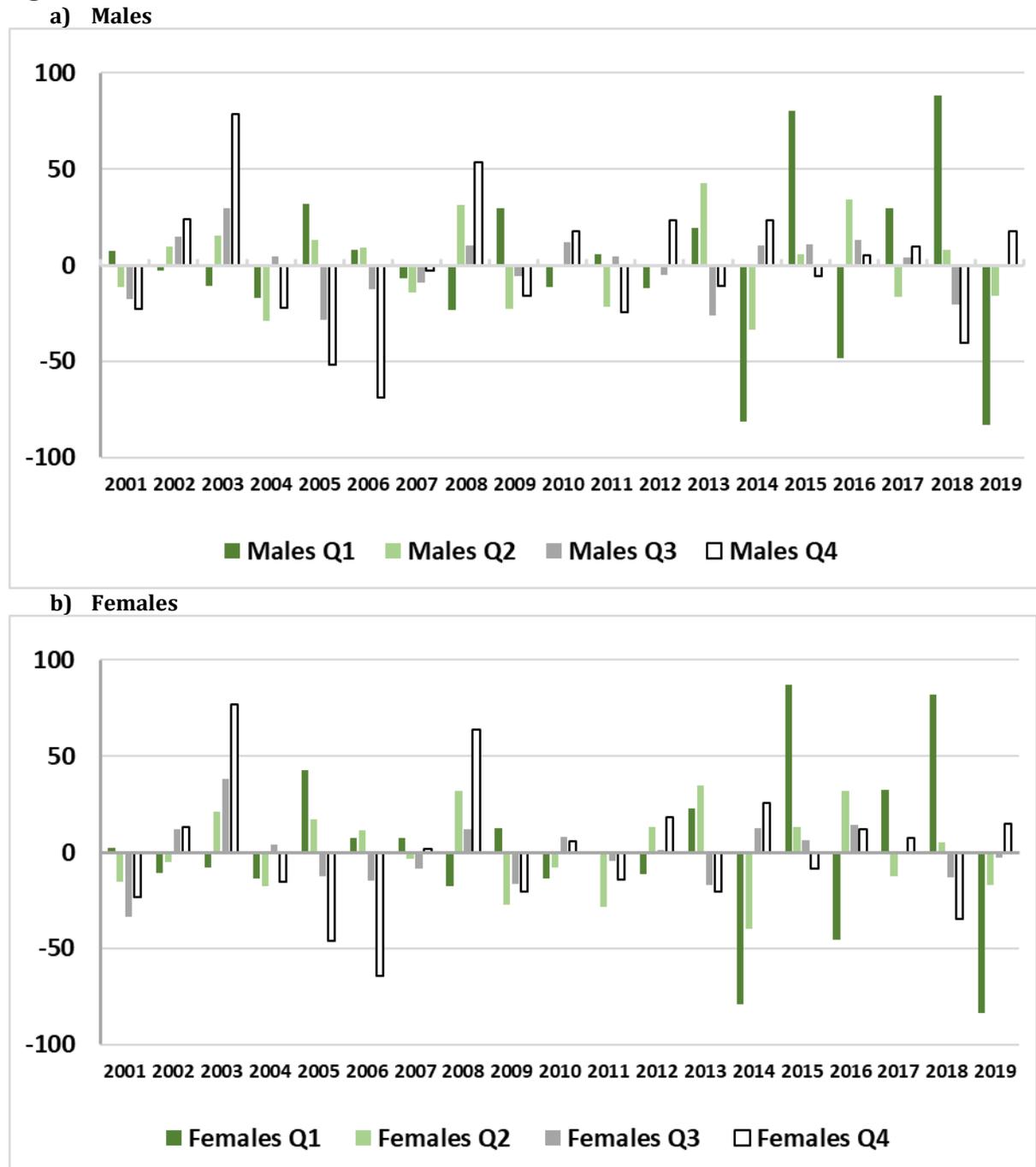


Source: ONS (3)

Table 1 shows how trends in Q1 and Q3 differed in 2001-10 and 2011-19, as well as how the change in trend differed between the two periods. The table also shows what the 2011-19 trend line for Q1 would have been had it only been reduced by the same amount as Q3 i.e. been unaffected by the increased variability due to factors such as flu epidemics.

Figure 2 shows how variability from the trend lines in Figure 1 has changed over time. In the period 2001-10, seasonal variation was cyclical with the largest peaks and troughs in death registration rates in Q4 – with large peaks in 2003 and 2008 and large troughs in 2005 and 2006. However, since 2014 the pattern and magnitude of seasonal mortality has shifted – with larger variability in Q1 and less in Q4. Additionally, the cycles have become shorter – with a large trough in Q1 in 2014 being followed by a large peak in 2015 and a smaller trough in 2016. Similarly, a peak in 2018 was followed by a comparably large trough in 2019.

Figure 2 Annual variation from the trends in 2001-10 and 2011-19



Source: ONS (3)

The overall effect of these changes in seasonal variation from the longer-term trend can be seen in Table 2, which shows the standard deviation around the trend lines. Variation in Q3 and Q4 decreased between 2001-10 and 2011-19, while that in Q1 increased substantially, with a smaller increase in Q2. Some of the shift in the peak from Q4 to Q1 may, in part, reflect increased delays in death registration particularly over the Christmas period since 2011 (17). However, the increased magnitude and frequency of extreme mortality events in Q1 cannot be explained by this.

They are more likely to reflect the pattern of recent winters in which more severe cold and/or flu outbreaks in the UK and also across much of Europe were followed by milder winters. (11) (14).

Table 2 Standard deviation around trend lines, 2001-10 and 2011-2019

Years	Q1	Q2	Q3	Q4
	Males			
2001-2010	18.6	19.0	17.5	45.4
2011-2019	62.7	25.4	13.9	22.1
	Females			
2001-2010	18.1	19.1	20.1	44.2
2011-2019	62.6	26.1	10.7	20.3

Table 3 and Figure 3 show the impact on average annual rates of excluding this extreme change in the mortality rates in Q1. While the trend in 2001-10 had been a reduction in annual mortality of 36 and 21 per 100,000 population for males and females, respectively, this slowed to 8 and 4, respectively, in 2011-19. By removing this extra variability from Q1, the annual slowing is less great, 12 and 6, respectively. The change in trends by excluding the extra variability in Q1 is thus 3.2 and 2.0 respectively. This accounts for 11 per cent of the change in trend among males and 12 per cent among females.

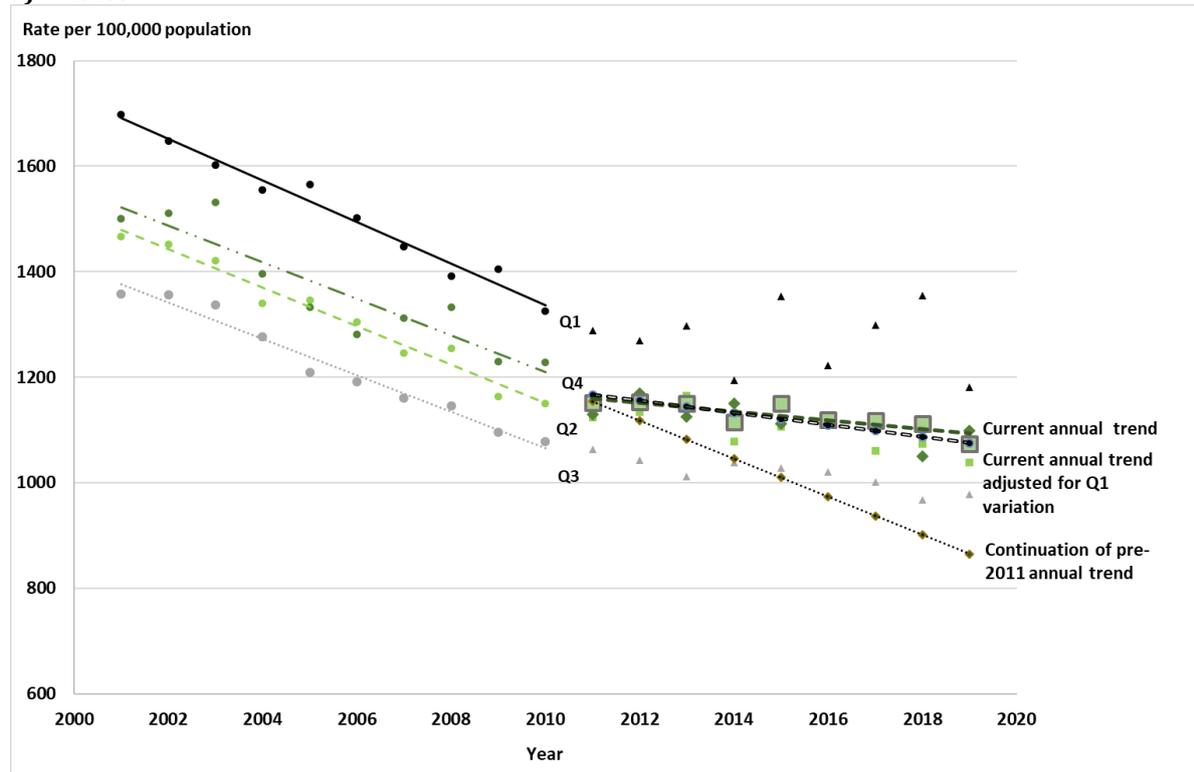
Table 3 Change in annual trend if the mortality trend in Q1 had been the same as that for Q3 in 2011- 2018/19

Change in average annual trend			
	Males		Females
Continuation of previous quarterly trends	-36.2		-20.6
Actual trend	-8.3		-4.2
New trend if Q3 trend change applied to Q1	-11.5		-6.2
Actual change in trend	27.9		16.4
Change in trend if Q3 trend change applied to Q1	24.8		14.4
Difference	3.2		2.0
Percent change accounted for by Q1 differing from Q3	11.3		12.3

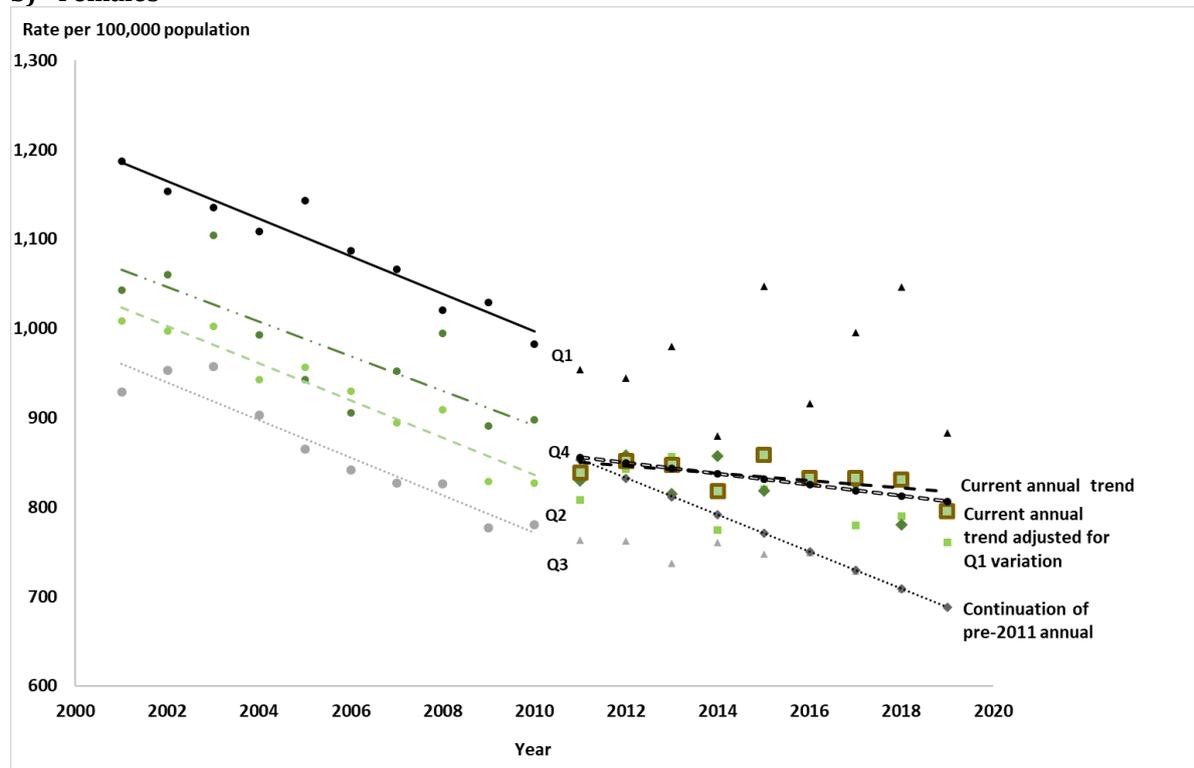
Source: Based on ONS (3)

Figure 3 Effects on annual mortality trends of adjusting Q1 mortality trends in 2011-18/19 to match the changes that occurred in Q3 mortality

a) Males



b) Females



Source: Based on ONS (3)

To the extent that mortality in the winter months of 2011-2019 was increased by an increase in periodic flu epidemics and cold spells, this analysis shows that if the change in mortality in winter was no greater than in summer this would account for one ninth of the slowdown in male mortality and one eighth of the

slowdown in female mortality. These proportions indicate that there has been a significant increase in potentially avoidable winter deaths in recent years.

However, they also indicate that over 80 percent of the annual slowdown was due to factors other than the effects of greater winter-associated mortality in 2011-19 compared to 2001-10. Similarly, sharp increases or decreases in mortality (and hence life expectancy) between adjacent years should not be interpreted as changes in trend. Their increased frequency and magnitude more likely reflect changes in the frequency and severity of severe cold and/or flu outbreaks in the UK and Europe.

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