Has mortality due to other causes increased during the Covid-19 pandemic? Early evidence from England and Wales

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Abstract

The covid-19 pandemic has claimed many lives in the UK and globally. The objective of this paper is to study whether this has also caused any increase in death rates for those who have not contracted the disease. Reasons behind this may include avoiding visits hospitals or GPs, health system capacity, and the effects of the lockdown. I used a differences-in-differences econometric approach to study whether there was a relative increase in non-covid-19 deaths in England and Wales, compared to a control. Results of the differences-in-differences provide some evidence that there is a relative increase in non-covid-19 deaths during the pandemic. However, we have to rely on limited data for the time being, and results should be treated with caution. As additional mortality data become available every week, additional analysis may allow us to study this research question further. Analysing the cause of death for non-covid-19 deaths will shed light upon the reasons for any increase in such deaths and will help design appropriate policy responses to save lives as the pandemic unfolds.

Keywords: Covid-19; lockdown; social distancing; deaths; mortality; spillover effects
1. Background

Almost 2 million covid-19 cases have been reported globally, leading to over 160,000 deaths. In the United Kingdom, the death toll has reached 15,000, while over 110,000 people have been diagnosed with the virus. The novel coronavirus is directly claiming lives, but this unprecedented situation and the lockdown imposed in the UK and other countries might also be triggering other effects. People with other, unrelated health conditions may be reluctant to visit their GP or a hospital in order to avoid the risk of contracting the virus. Furthermore, to increase capacity for the overstretched NHS, routine operations have been postponed. While these do not concern life-threatening conditions, this gives an indication that the covid-19 pandemic has been attracting resources from the treatment of other conditions.

Furthermore, the lockdown may also have unintended health effects. Lack of social contact can affect mental health, and big events or disasters at the national level can have a similar impact. Staying at home can limit physical activity, which is associated with obesity and mental health. Furthermore, the lockdown and bar and restaurant closure may affect other health-related behaviours, such as drinking, smoking and diet. There are also reports of a rise in domestic abuse, while the current financial and public health situation may also cause additional uncertainty and stress. Apart from the negative effects, there may also be improvement in certain areas. The lockdown has reduced traffic volume and may thus lead to a decrease in motor vehicle collisions and related deaths. Reduced traffic has also led to lower levels of air pollution, which is associated with mortality. The lockdown may have also helped reduce crime rates.

The objective of this paper is to study whether the covid-19 pandemic has caused any increase in deaths for those who have not contracted the disease, using data that have just been released by the Office for National Statistics.
2. Data and Methods

This study used weekly (provisional) mortality data from England and Wales for years 2019 and 2020, obtained from the Office for National Statistics (ONS). Data were extracted on 7 April 2020 and updated on 14 April 2020 following the new release on the same day. Please note that the data used in this study are based on the data released on 14 April 2020, and values included in this dataset may be changed in later releases, as is sometimes the case, possibly due to a delay in registrations. Data were reported by sex, age group and Region. I used the total number of deaths (regardless of cause) as well as the number of deaths where Covid-19 was mentioned on the death certificate, in order to calculate the number of deaths that were not officially related to Covid-19. Data on Covid-19 deaths are also available by the Department of Health and Social Care, but these exclude deaths that occurred outside hospital, which is why I used the ONS data. According to the data source, data by sex or age group may be incomplete, so they might not necessarily sum to the total number of deaths.

In order to compare trends in deaths excluding covid-19 deaths to the control group, I used a differences-in-differences (D-I-D) econometric approach. Studying trends of a variable alone before and after a “treatment” can be misleading as there may be other factors driving any change. For that purpose, a control group can help filter out any other effects. Such a control group will have to remain unaffected by the treatment. The covid-19 pandemic is a major global crisis, so identifying a control population for the same period seems impossible as it would be highly likely to be contaminated. Instead, I follow an approach similar to that by Metcalfe et al who used trends in the same variable, in earlier years, as a control group. Likewise, I used deaths in the first 14 weeks in previous years as a control group for non-covid-19 deaths in the 14 first weeks in 2020. The “treatment” period starts in week 10 of the year, when the first covid-19 death occurred in England and Wales.
I considered using the number of deaths in the previous year (2019), or the average of the five previous years, as a control group. Including only one year may lead to short-term spikes (possibly due to a bad flu season), which would be smoothed out by using a five-year average – but a longer time span would be subject to changes in medical technology and other factors that may affect mortality, as well as changes in the population (population data for 2020 by demographic group are yet to be released). Nevertheless, a differences-in-differences approach requires that the trends (rather than absolute values) in treatment and control groups are parallel prior to the intervention. To test whether this common trend assumption is met, I followed the approach by Autor, who used a model with interactions including lags and leads (prior to and after the treatment). I performed this test for both controls: 2020 vs. 2019, and 2020 vs. the 5-year average. Results are presented in Tables A1 and A2, respectively, in the Appendix. Results in Table A2 show that the common trend does not hold for the model that includes 2020 and 2019, as some of interaction lags are significant. However, all interaction lags are insignificant in the model including 2020 and a 5-year average (Table A1). Therefore, I used the average of years 2015-2019 as a control in the differences-in-differences model. Trends can also be observed graphically (Figures 1 in text and Figure A1 in the Appendix).

The dependent variable in the main model is the number of deaths in each of the 14 first weeks of 2020 and previous years, excluding any deaths that mentioned covid-19 in the death certificate. The “treatment group” dummy variable, takes the value of 1 for the group that is affected by the intervention, and zero otherwise. In this case, observations in 2020 take the value of 1, and observations in previous years take the value of zero. Another dummy that is included is an “after” variable, which takes the value of 1 in the period after an intervention (for both groups), and zero otherwise. We consider the treatment period to start in week 10, as that is the week when the first covid-19 death was reported, thus indicating an escalating situation and capturing any spillover effects of the virus. One might argue that the treatment
period should start later, when the number of deaths started increasing steeply, but a question that remains is where we should draw the line, and this would possibly relate with the cause of any spillover effects on the number of deaths, which is currently unknown – so identifying where the treatment period should start becomes particularly challenging. The interaction of these two dummy variables (treatment*after) is the main variable of interest. I also used dummy variables for sex and age groups, or region fixed effects (where applicable). Robust standard errors were used in all regressions.

3. Results

There were four Covid-19-related deaths reported in week 10; 35 in week 11; 374 in week 12; 1,704 in week 13; and 4,117 in week 14, demonstrating an increasing rate of change. There are 1,965 additional non-covid-19 deaths in week 14 of 2020, compared to the same week in years 2015-2016 on average, which constitutes a 19.1% increase (Table 1). Such large percentage differences are not observed in any other week of the calendar year so far. This is clear in Figure 1, which shows the weekly number of deaths by sex in England and Wales in the first 14 weeks of 2020 and the corresponding 5-year average, excluding any novel coronavirus deaths. In week 14, 2020, there is a steep jump in non-covid-19 deaths, compared to the trend in previous years. It is important to note that this phenomenon is only observed in week 14, i.e. in the fifth week of reported covid-19 fatalities. In week 13 2020 (which was the fourth week of covid-19 fatalities), the number of non-covid-19 deaths demonstrated a decrease. Figure A2 in the Appendix provides a breakdown by age group and sex, for age groups 65-74; 75-84; and 85 or over, which account for over 85% of all deaths.

Results of the baseline differences-in-differences econometric analysis are presented in Table 2, where weekly deaths enter the model by sex. There is an increase in non-covid-19 deaths in the post-treatment period compared to the control group [D-I-D coeff: 450.19;
95%CI: 11.76 - 888.62]. I performed a placebo test, restricting the sample to the pre-treatment period (up to week9), using an earlier random treatment period starting in week 7. Statistically insignificant results would lend additional support that the findings of the baseline model are not random. Results are provided in Table A3 in the Appendix, and indeed, there is no effect in this placebo regression [D-I-D coeff: -23.27; 95%CI: -463.56 - 417.02].

Table 3 provides results by age group and sex, in which case there seems to be no effect on non-covid-19 deaths during the pandemic [D-I-D coeff: 114.09; 95%CI: -73.33 - 301.51]. Results of the regressions by Region (Wales and the 9 regions of England) are presented in Table A4 in the Appendix. There appears to be a relative increase in non-covid-19 deaths after the treatment, compared to the control group [D-I-D coeff: 68.07; 95%CI: 27.72 - 108.43].

4. Discussion

This paper studied whether there are any spillover effects of the covid-19 pandemic on other types of mortality (for those who did not contract covid-19), using a differences-in-differences econometric approach by comparing trends in 2020 to the average trends in the previous five years. I find some evidence of a relative increase in non-covid-19 deaths during the pandemic, compared to the control.

Results should be interpreted with caution, as a spike in deaths (albeit of smaller magnitude) may occasionally occur. Furthermore, there is an absolute and relative dip in non-covid-19 deaths in week 13 of the current year, well into the pandemic, when there were already 2,000 covid-19 deaths in England and Wales, prior to the large increase in week 14. Results may raise questions on whether this has anything to do with how deaths are reported or registered, or whether any covid-19 patients die without being diagnosed.

Any increased non-covid-19 mortality may be the result of avoiding treatment for unrelated health conditions in order to avoid contracting the virus in hospitals or GP clinics;
prioritisation of covid-19 patients by health services; stress and anxiety related to the current financial and public health environment; domestic violence; and lack of activity or other effects due to the lockdown. The relative increase occurs despite reasonably expecting a reduction in some types of deaths, such as those relating to motor vehicle collisions, crime, pollution and smoking.

If more people without covid-19 are dying as a result of the pandemic, this is something that we need to know and act upon immediately, to minimise any tragic spillover effects. More research is urgently needed, and as more data become available every week we may be able to get a better idea of whether there is such an effect. Access to data on the causes of non-covid-19 deaths would allow us to understand the mechanism of any effect and would help design appropriate responses to save lives.

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Data availability: The data used in this study are freely available online from the Office for National Statistics.
Checklist: There is no relevant checklist of observational studies.

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TABLES

Table 1. Weekly difference between non-covid-19 deaths in 2020 and the average of 2015-2019

| Week | Non-covid-19 deaths: Weekly difference between 2020 and average of 2015-2019 | % change |
|------|--------------------------------------------------------------------------------|----------|
| 1    | 79                                                                           | 0.6%     |
| 2    | 236                                                                          | 1.7%     |
| 3    | -226                                                                         | -1.7%    |
| 4    | -904                                                                         | -7.1%    |
| 5    | -594                                                                         | -4.9%    |
| 6    | -939                                                                         | -7.9%    |
| 7    | -683                                                                         | -5.9%    |
| 8    | -707                                                                         | -6.1%    |
| 9    | -367                                                                         | -3.3%    |

First covid-19 death in week 10

| Week | Non-covid-19 deaths: Weekly difference between 2020 and average of 2015-2019 | % change |
|------|--------------------------------------------------------------------------------|----------|
| 10   | -607                                                                         | -5.3%    |
| 11   | -221                                                                         | -2.0%    |
| 12   | -302                                                                         | -2.9%    |
| 13   | -693                                                                         | -6.8%    |
| 14   | 1,965                                                                        | 19.1%    |

Table 2 – D-i-D regression results by sex

Dependent variable: Weekly number of non-covid-19 deaths

| DID coefficient | treatment group | [11.76 - 888.62] |
|-----------------|-----------------|------------------|
| 450.19**        | -.874.74***     | [-1,076.03 - -673.45] |
| treatment period| -.762.59**      | [-1,499.42 - -25.77] |
| female          | -.384.20***     | [-566.01 - -202.39] |
| week dummies    | yes             |                  |
| Constant        | 7,057.72***     | [6,674.32 - 7,441.12] |
| Observations    | 56              |                  |
| R-squared       | 0.86            |                  |
| F-statistic     | 26.52           |                  |

Robust ci in brackets. Dependent variable: Number of weekly deaths by sex in first 14 weeks of calendar year. Years: 2020 and average of 2015-2019. Based on ONS data published on 14 April 2020. Treatment period starts in week 10.
Table 3 – D-i-D regression results by sex and age group

| Dependent variable: Weekly number of non-covid-19 deaths |
|----------------------------------------------------------|
| DID coefficient                                            |
| 114.09                                                    |
| [-73.33 - 301.51]                                         |
| treatment group                                           |
| -202.80***                                                |
| [-312.24 - -93.36]                                        |
| treatment period                                          |
| -235.30*                                                  |
| [-482.12 - 11.53]                                         |
| female                                                   |
| 63.89                                                    |
| [-25.55 - 153.34]                                         |
| age group dummies                                         |
| yes                                                      |
| week dummies                                             |
| yes                                                      |
| Constant                                                 |
| 1,134.46***                                               |
| [945.69 - 1,323.23]                                        |
| Observations                                             |
| 168                                                      |
| R-squared                                                |
| 0.87                                                     |
| F-statistic                                              |
| 54.36                                                    |

Robust ci in brackets. Dependent variable: Number of weekly deaths by sex and age group (over 64) in first 14 weeks of calendar year.
Years: 2020 and average of 2015-2019. Based on ONS data published on 14 April 2020.

FIGURES

Panel A – Females

Panel B – Males

Figure 1 - Weekly deaths in England and Wales unrelated to covid-19, first 14 weeks, year 2020 and average of years 2015-2019. First covid-19 death in week 10. Based on ONS data published on 14 April 2020.
APPENDIX

Table A1. Testing the common trend assumption: Time-varying regression. Years 2020 and average of 2015-2019.

| Dependent variable: Weekly number of non-covid-19 deaths |  |
|----------------------------------------------------------|---|
| female                                                   | -384.20*** |
|                                                          | [-566.24 - -202.16] |
| treatment group                                          | -603.50 |
|                                                          | [-1,517.70 - 310.70] |
| week dummies                                             | yes |
| **lags:**                                                |  |
| year2020*week2                                          | 4.00 |
|                                                          | [-1,283.50 - 1,291.50] |
| year2020*week3                                          | -224.30 |
|                                                          | [-1,389.95 - 941.35] |
| year2020*week4                                          | -525.70 |
|                                                          | [-1,641.63 - 590.23] |
| year2020*week5                                          | -334.20 |
|                                                          | [-1,475.05 - 806.65] |
| year2020*week6                                          | -507.40 |
|                                                          | [-1,718.49 - 703.69] |
| year2020*week7                                          | -330.70 |
|                                                          | [-1,513.37 - 851.97] |
| year2020*week8                                          | -368.20 |
|                                                          | [-1,445.85 - 709.45] |
| year2020*week9                                          | -164.70 |
|                                                          | [-1,252.54 - 923.14] |
| **Leads:**                                               |  |
| year2020*week10                                         | -261.20 |
|                                                          | [-1,392.21 - 869.81] |
| year2020*week11                                         | -57.00 |
|                                                          | [-1,084.51 - 970.51] |
| year2020*week12                                         | -67.00 |
|                                                          | [-1,129.99 - 995.99] |
| year2020*week13                                         | -252.20 |
|                                                          | [-1,367.95 - 863.55] |
| year2020*week14                                         | 1,092.00** |
|                                                          | [71.76 - 2,112.24] |
| Constant                                                 | 6,922.10*** |
|                                                          | [6,726.42 - 7,117.78] |
| Observations                                             | 56 |
| R-squared                                                | 0.90 |
| F-statistic                                              | 13.61 |

Robust CI in brackets. Dependent variable: Number of weekly deaths per week in first 14 weeks of calendar year. Years: 2020 and average of 2015-2019. Based on ONS data published on 14 April 2020.
Table A2. Testing the common trend assumption: Time-varying regression. Years 2020 and 2019.

| Dependent variable: Weekly number of non-covid-19 deaths |
|----------------------------------------------------------|
| female                                                   |
| 69.64*                                                   |
| [-0.32 - 139.61]                                         |
| treatment group                                          |
| 649.00*                                                  |
| [-21.33 - 1,319.33]                                      |
| week dummies                                             |
| yes                                                      |
| lags:                                                    |
| year2020*week2                                          |
| 75.00                                                   |
| [-706.56 - 856.56]                                       |
| year2020*week3                                          |
| -84.00                                                  |
| [-757.34 - 589.34]                                       |
| year2020*week4                                          |
| -592.50*                                                |
| [-1,279.37 - 94.37]                                      |
| year2020*week5                                          |
| -491.50                                                 |
| [-1,163.83 - 180.83]                                     |
| year2020*week6                                          |
| -987.00***                                              |
| [-1,666.02 - 307.98]                                     |
| year2020*week7                                          |
| -1,087.00***                                            |
| [-1,766.97 - 407.03]                                     |
| year2020*week8                                          |
| -876.50**                                               |
| [-1,559.14 - 193.86]                                     |
| year2020*week9                                          |
| -763.50**                                               |
| [-1,448.23 - 78.77]                                      |
| Leads:                                                   |
| year2020*week10                                         |
| -654.00*                                                |
| [-1,383.23 - 75.23]                                      |
| year2020*week11                                         |
| -441.50                                                 |
| [-1,137.59 - 254.59]                                     |
| year2020*week12                                         |
| -714.00**                                               |
| [-1,413.79 - 14.21]                                     |
| year2020*week13                                         |
| -863.50**                                               |
| [-1,535.21 - 191.79]                                     |
| year2020*week14                                         |
| 423.00                                                  |
| [-317.22 - 1,163.22]                                     |
| Constant                                                 |
| 5,442.68***                                             |
| [4,921.89 - 5,963.46]                                    |
| Observations                                            |
| 56                                                      |
| R-squared                                               |
| 0.97                                                    |
| F-statistic                                             |
| 545.4                                                   |

Robust CI in brackets. Dependent variable: Number of weekly deaths per week in first 14 weeks of calendar year. Years: 2020 and 2019. Based on ONS data published on 14 April 2020.
### Table A3. Placebo test

| Dependent variable: Weekly number of non-covid-19 deaths |
|----------------------------------------------------------|
| **Placebo DID coefficient**                              |
| -23.27                                                   |
| [-463.56 - 417.02]                                       |
| treatment group                                          |
| -868.10***                                               |
| [-1,161.33 - 574.87]                                     |
| Placebo treatment period                                 |
| -625.02**                                                |
| [-1,144.41 - -105.62]                                    |
| female                                                  |
| -352.90***                                               |
| [-576.96 - -128.84]                                      |
| week dummies                                            |
| 900.00***                                                |
| Constant                                                |
| 7,038.75***                                              |
| [6,659.17 - 7,418.33]                                    |
| Observations                                            |
| 36                                                      |
| R-squared                                               |
| 0.86                                                    |
| F-statistic                                             |
| 24.09                                                   |

Robust ci in brackets. Dependent variable: Number of deaths per week in first 9 weeks of calendar year. Years: 2020 and average of 2015-2019. Placebo treatment: Week 7 onwards. Based on ONS data published on 14 April 2020.

### Table A4 – D-i-D regression results by Region

| Dependent variable: Weekly number of non-covid-19 deaths |
|----------------------------------------------------------|
| **DID coefficient**                                      |
| 68.07***                                                 |
| [27.72 - 108.43]                                         |
| treatment group                                          |
| -46.62***                                                |
| [-61.82 - -31.43]                                        |
| treatment period                                         |
| -127.65***                                               |
| [-188.93 - -66.36]                                       |
| region dummies                                           |
| yes                                                      |
| week dummies                                            |
| yes                                                      |
| Constant                                                |
| 1,343.99***                                              |
| [1,302.96 - 1,385.02]                                    |
| Observations                                            |
| 280                                                     |
| R-squared                                               |
| 0.97                                                    |
| F-statistic                                             |
| 367.0                                                   |

Robust ci in brackets. Dependent variable: Number of weekly deaths in first 14 weeks of calendar year, by Region. Years: 2020 and average of 2015-2019. Based on ONS data published on 14 April 2020.
FIGURES

Panel A – Females

Panel B – Males

Figure A1 - Weekly deaths in England and Wales unrelated to covid-19, first 14 weeks, years 2019 and 2020. First covid-19 death in week 10. Based on ONS data published on 14 April 2020.
Figure A2.1 - Weekly deaths in England and Wales unrelated to covid-19, first 14 weeks, year 2020 and average of years 2015-2019, age group 65-74

Figure A2.2 - Weekly deaths in England and Wales unrelated to covid-19, first 14 weeks, year 2020 and average of years 2015-2019, age group 75-84

Figure A2.3 - Weekly deaths in England and Wales unrelated to covid-19, first 14 weeks, year 2020 and average of years 2015-2019, age group 85+