Public Health England

Protecting and improving the nation's health

Technical summary

Public Health England data series on deaths in people with COVID-19

Updated 1 June 2020 for the incorporation of pillar 2 testing data

Updated 23 June 2020 to update data linkage procedure (Section 4.4)

Updated 12 August 2020 for the changes to measures (Section 5)

Note: this document will not be updated on a regular basis. For most up to date information on the England and UK death data, see the gov.uk Coronavirus Dashboard: https://coronavirus.data.gov.uk/about

About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing and reduce health inequalities. We do this through world-leading science, research, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health and Social Care, and a distinct delivery organisation with operational autonomy. We provide government, local government, the NHS, Parliament, industry and the public with evidence-based professional, scientific and delivery expertise and support.

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1. Summary

a. Monitoring the number of deaths in people with COVID-19 is a vital part of tracking the pandemic. Public Health England (PHE) has developed a data series that collates reports from multiple sources to give a daily number of deaths in people with a positive COVID-19 test (polymerase chain-reaction, or PCR, detecting the Severe Acute Respiratory Syndrome Coronavirus 2, or SARS-CoV-2) in England, regardless of where they died.

b. There are 2 definitions of a death in a person with COVID-19 in England, one broader measure and one measure reflecting current trends:

   1) A death in a person with a laboratory-confirmed positive COVID-19 test and either died within 60 days of the first specimen date **or** died more than 60 days after the first specimen date, only if COVID-19 is mentioned on the death certificate

   2) A death in a person with a laboratory-confirmed positive COVID-19 test **and** died within (equal to or less than) 28 days of the first positive specimen date

c. A measure of acute deaths which can be used to understand current trends is further defined as a "a death in any person with a laboratory-confirmed positive COVID-19 test **AND** within (equal to or less than) 28 days of the first positive specimen date

d. PHE combines data from 4 different sources on a daily basis:
   i. Deaths occurring in hospitals, notified to NHS England by NHS trusts
   ii. Deaths notified to local PHE Health Protection Teams in the course of outbreak management
   iii. Laboratory reports where a person has had a laboratory confirmed COVID-19 test linked to death reports from electronic hospital records; from 1 June this includes laboratory reports from both Pillar 1 and Pillar 2 testing:
      i. Pillar 1: swab testing in PHE labs and NHS hospitals for those with a clinical need, and health and care workers
      ii. Pillar 2: swab testing for the wider population aged 5 and over, as set out in government guidance.
   iv. Office for National Statistics (ONS) death registrations which can be linked to laboratory confirmed COVID-19 tests.

e. The PHE data series includes deaths in anyone with laboratory confirmed COVID-19, including those who die outside of hospital settings. It aims to be a timely and complete measure by combining information from multiple sources.

f. Death data are checked for errors and a semi-automated program is run to match records and ensure as far as possible a person who died is not counted twice across different reporting systems.

g. On 29 April 2019, PHE commenced daily reporting of deaths in people with COVID-19, including people who died at any point following a positive test because the duration and sequelae of this new and emerging disease was poorly understood, and any other approach risked producing an underestimate of COVID-19 deaths. PHE has since undertaken an assessment of different time limits following the positive test result, on the mortality series which has undergone external statistical peer review.

h. The PHE data series is not designed to provide definitive information on the causal role of COVID-19 in relation to individual deaths. The weekly publication of deaths statistical bulletin from the Office of National Statistics includes all deaths where COVID-19 is recorded on the death certificate, regardless of whether a laboratory result is available or not.

2. Background

Monitoring the number of deaths due to COVID-19 is a vital part of tracking the pandemic. It is critical to ensure death data are as accurate, comprehensive and timely as possible.

Public Health England (PHE) has developed a methodology that links data from 4 sources to provide broader coverage of deaths among people with a confirmed COVID-19 laboratory test, whether they occurred in hospitals, care homes or the wider community. The purpose of this reporting is to fulfil a need to rapidly report numbers of deaths each day, balancing the need for:

- understanding the overall burden and societal impact of COVID-19 and characterising clinical outcomes and demographics of those infected
- real-time surveillance of immediate trends in mortality and underlying transmission

3. Aims

This paper explains the process for reporting deaths and describes the advantages and limitations of the reporting method. It provides an explanation of how to interpret the PHE COVID-19 death data series, explains changes made to the data series since reporting first commenced, and sets out answers to frequently asked questions.

4. Outline of PHE data series

4.1 Definition of COVID-19 related deaths

There are 2 definitions of a death in a person with COVID-19 in England, one broader measure and one measure reflecting current trends:

1) A death in a person with a laboratory-confirmed positive COVID-19 and either:
   died within 60 days of the first specimen date
   or
   died more than 60 days after the first specimen date, only if COVID-19 is mentioned on the death certificate

2) A death in a person with a laboratory-confirmed positive COVID-19 test **and** died within (equal to or less than) 28 days of the first positive specimen date.

The PHE data series does not include deaths where COVID-19 is mentioned on the death certificate but a laboratory test was not carried out or failed. All deaths within 60 days of a positive specimen are counted regardless of the cause of death. This aims to provide the most comprehensive measure of mortality burden possible.

All deaths reported to Public Heath England that have a laboratory confirmed report of COVID-19 (including at post-mortem), in any setting. The daily number represents new deaths reported to PHE in the 24 hours up to 5pm the previous day. Report date does not necessarily equate to date of death as it may take up to a week for deaths to be reported to PHE.

4.2 Data sources and processing

Public Health England receives reports of death from 4 sources:

a. Deaths occurring in hospitals, notified to NHS England by NHS trusts using the COVID-19 Patient Notification System (CPNS) (previously the source of daily COVID-19 deaths in England before 29 April 2020)
b. Deaths with a confirmed COVID-19 test, notified to PHE Health Protection Teams during outbreak management (primarily in non-hospital settings) and recorded in an electronic reporting system
c. All people with a laboratory confirmed COVID-19 test reported to PHE via the Second Generation Surveillance System (SGSS) (a centralised repository of laboratory results). This list is submitted on a daily basis to the Demographic Batch Service (DBS) to check NHS patient records for reports of individuals who died in the previous 24 hours in any setting. From 1 June this includes laboratory reports from both Pillar 1 and Pillar 2 testing:
    i. Pillar 1: swab testing in PHE labs and NHS hospitals for those with a clinical need, and health and care workers
    ii. Pillar 2: swab testing for the wider population, as set out in government guidance.
d. Office for National Statistics (ONS) death registrations which can be linked to a laboratory confirmed COVID-19 test. Reported on an 11-day lag.

Data from each source are collected and automated programmes check for errors and avoid deaths being counted twice.

4.3 Quality assurance

Quality assurance is undertaken by PHE using semi-automated programmes, with manual checking before and after processing. This involves sense checking data in relation to key information (for example age at death, date of birth, hospital admission, death report). Data from each source are merged and duplicate reports are removed.

4.4 Data linkage

Multiple records for a single individual are linked principally on NHS number. Records without NHS numbers are linked on a combination of other patient identifying information (PII) such as first name, surname, date of birth and postcode.

On 23 June 2020, an update was made to the data linkage process for laboratory records whereby previously only the PII returned after DBS tracing was used to link records; this was revised to also link on PII that had been sent along with the laboratory specimen. This resulted in an improved linkage rate and 109 historic deaths reported by ONS with COVID-19 listed on the death certificate were then confirmed with a positive laboratory result and reported in the national totals.

4.5 Advantages of the PHE data series

The PHE data series has the following advantages:

- broad coverage by including deaths in anyone diagnosed with COVID-19, including those outside of hospital settings
- more timely reporting of deaths: there is a time lag between the date of death and the date it is reported to PHE. Using multiple overlapping data sources, the delay is reduced by approximately 1-2 days
- optimises completeness of hospital reporting by combining information from multiple sources, making it less likely that deaths are missed
- ensures England COVID-19 death reporting is consistent with how deaths are reported in the rest of the UK. Scotland, Wales and Northern Ireland capture deaths outside hospitals

4.6 Limitations of the PHE data series

The PHE data series does not include deaths in people where COVID-19 is suspected but not confirmed by testing (SARS-CoV-2 PCR either negative or not done). Furthermore, the PHE data series does not report cause of death, and as such represents *deaths in people with COVID-19* and not necessarily caused by COVID-19.

5. Including a time limit to the PHE data series

5.1 Background

In April 2019, as the duration and sequelae of this emerging disease was poorly understood, the number of deaths in people with a positive test at any point was reported to avoid an underestimation. This methodology was agreed with the Department of Health and Social Care and is supported by a statement from the World Health Organization (WHO) Regional Office for Europe on 4 June 2020 that “WHO has no defined time-limitation for COVID-19 related deaths. This should be a clinical decision.”

5.2 Assessment of time limit on the PHE data series

PHE has undertaken an assessment of the impact of different time periods from the first positive COVID-19 specimen and date of death (with and without mention of COVID-19 on the death certificate) on the mortality series which has undergone statistical peer review.

The conclusion from the review was that the vast majority (88%) of COVID-19 related deaths occurred within 28 days of the first positive specimen date, and that for those deaths 95% have a mention of COVID-19 on the death certificate. The proportion of deaths with a mention of COVID-19 on the certificate decreases for deaths with a longer interval between the first positive specimen and date of death; however this is 73.4% for those with an interval of 29-42 days and 48.1% for those with an interval of 43-60 days between specimen date and date of death (Table 1).

Table 1: Proportion of deaths with COVID-19 listed on the death registration by time elapsed between first positive specimen date and death date, England as 3 August 2020

Elapsed time from fist positive specimen date and death date	Total deaths	COVID-19 listed on death registration	Deaths where death registration information available**	% with COVID-19 on the death certificate, where information is available
≤28 days*	36,596	34,182	35,874	95.3%
29-42 days	1,968	1,378	1,878	73.4%
43-60 days	1,246	551	1,145	48.1%
>60 days	1,721	366	1,196	30.6%
Unknown lag	67	16	67	23.9%
Total	41,598	36,493	40,160	90.9%

*Including post-mortem samples

**These figures exclude 1,438 deaths not linked to a death registration. Over half of these occurred in the previous 3 weeks and therefore are likely to be received after registration delay.

Based on the PHE assessment, it was decided that from 12 August, the PHE data series would be revised to include 2 measures: deaths in laboratory-confirmed positive individuals where the death occurred within 28 days, and deaths within 60 days **or** if the death occurred after 60 days, COVID-19 is listed on the death registration. Both measures will be published daily on the GOV.UK dashboard and weekly in the PHE surveillance report.

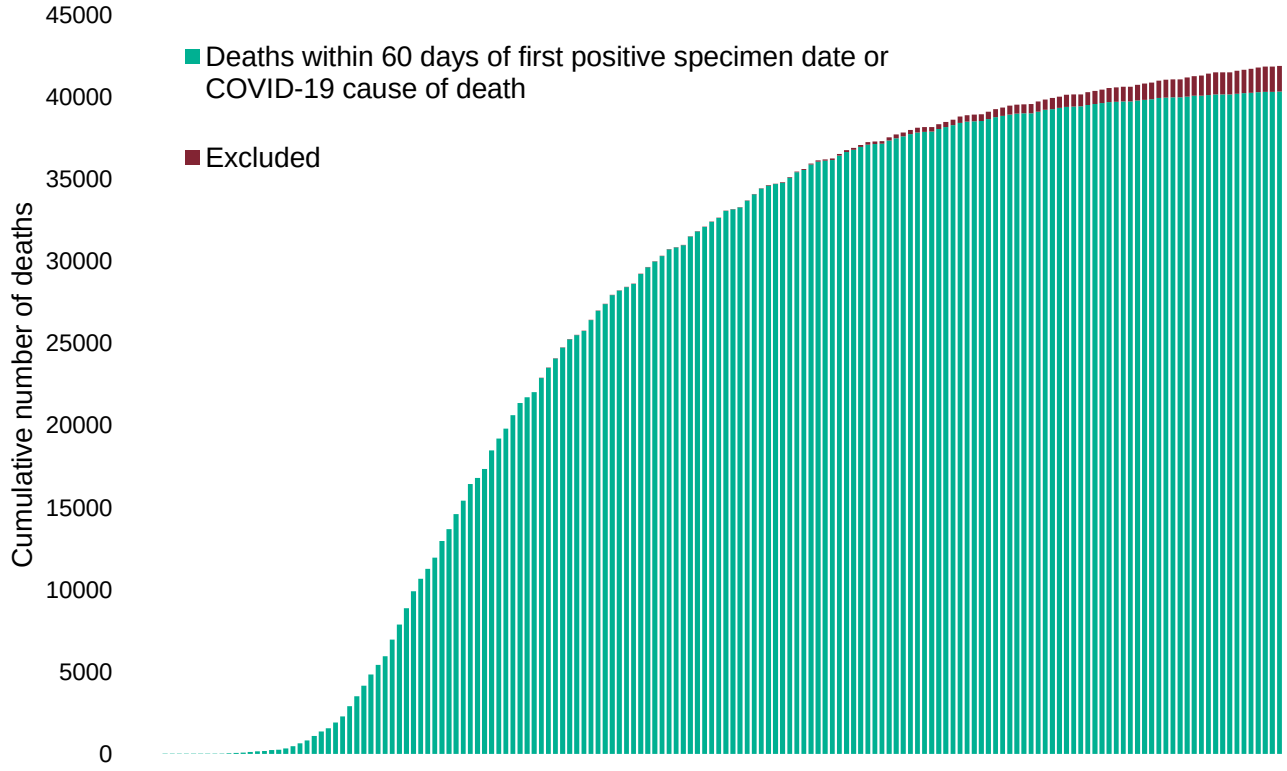
5.3 Impact of applying a time/clinical restriction to the PHE data series

On 12 August 2020[1], the number of deaths in people with laboratory-confirmed COVID-19 without a time limit applied was 42,072 deaths. Applying a time limit of 60 days or COVID-19 on the death registration results in in a total of 40,404 deaths being reported; a reduction of 1668 (4%). Applying a 28-day time limit results in 36,695 deaths being reported; a reduction of 5377 (12.8%).

[1] This reflects data reported to PHE as of 17:00 11 August 2020, which was processed for use for announcements on 12 August 2020.

Figure 1 and 2 show the change in deaths under the different measures It is important to note that the deaths that are excluded under the new measures disproportionately affect more recent weeks and does not significantly affect the overall epidemic curve and trends in death.

Figure 1. Cumulative deaths by date of report using current methodology (no time limit) and the new measures: time limit of ≤28 days and time limite of ≤60 days or mention of COVID-19 on the death certificate, as 11 August 2020



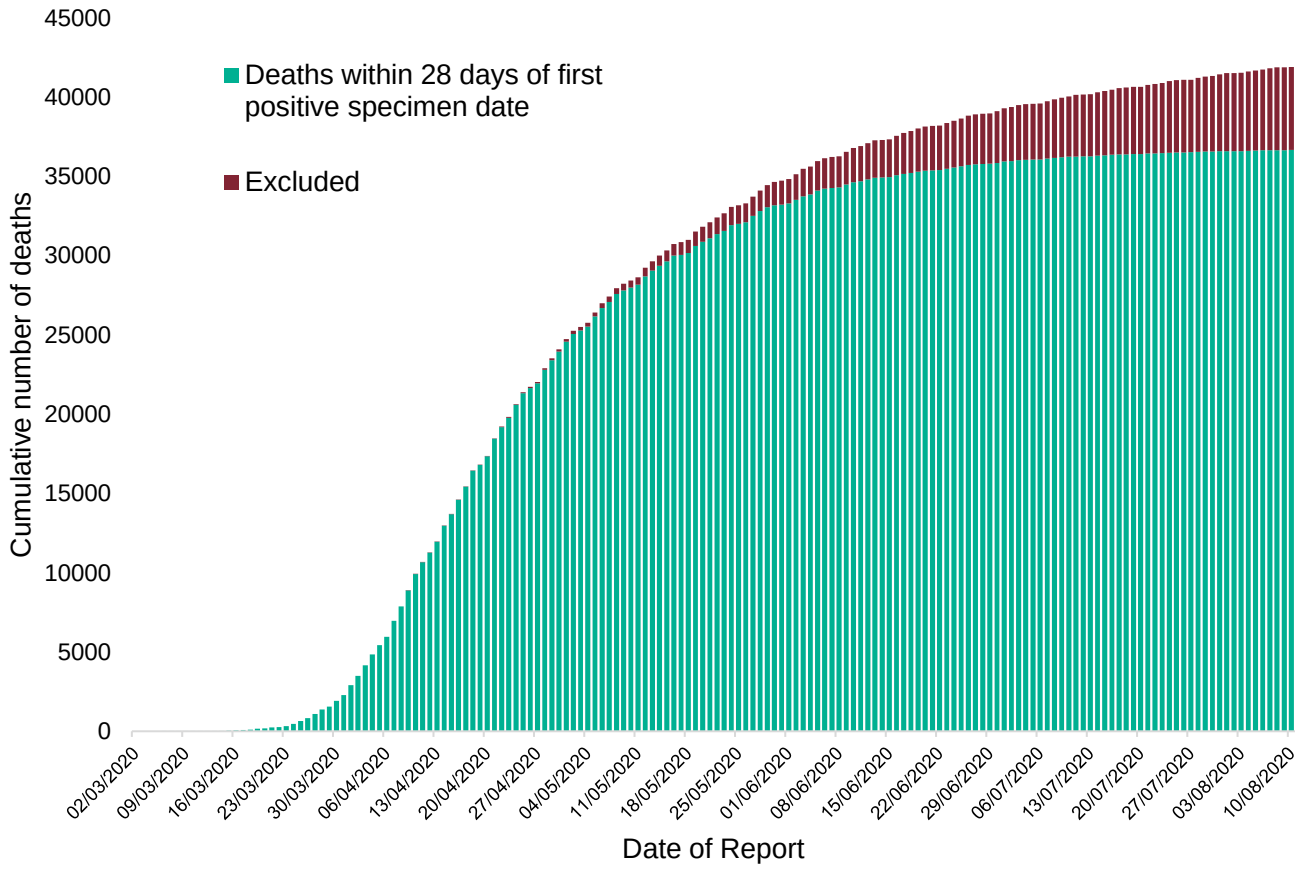
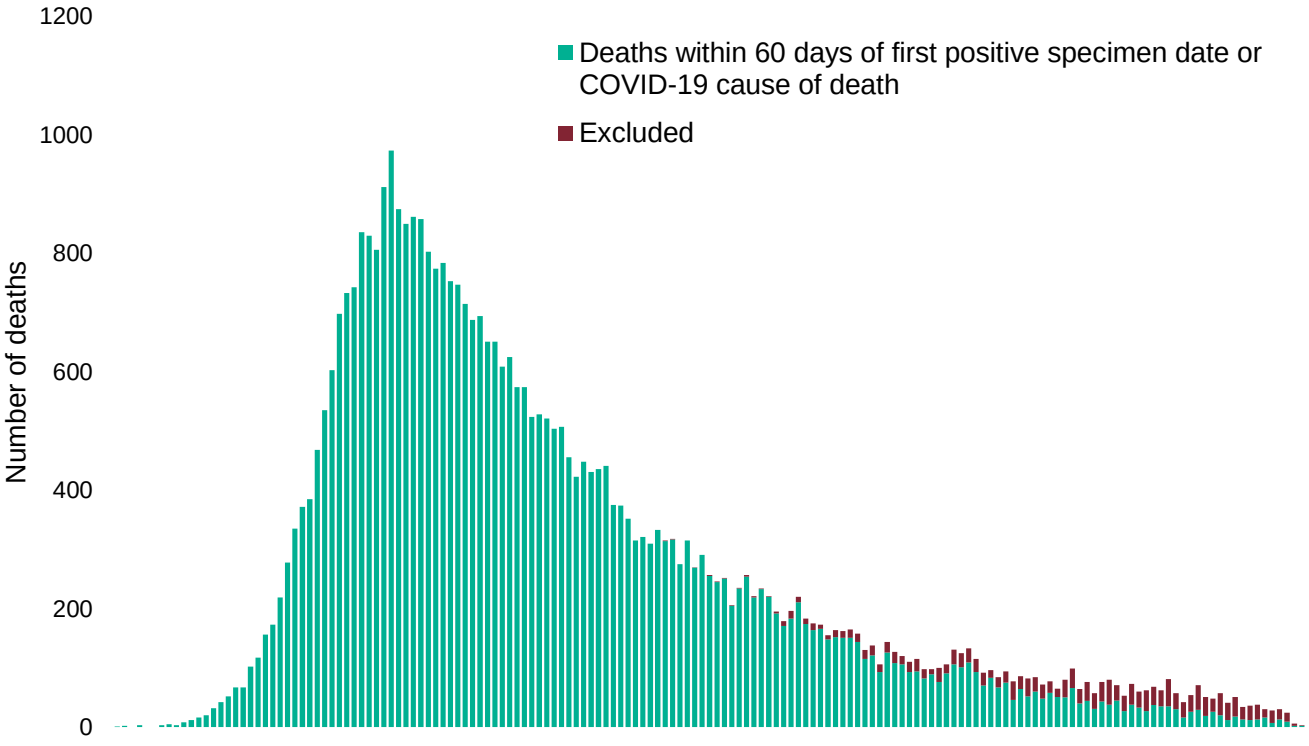
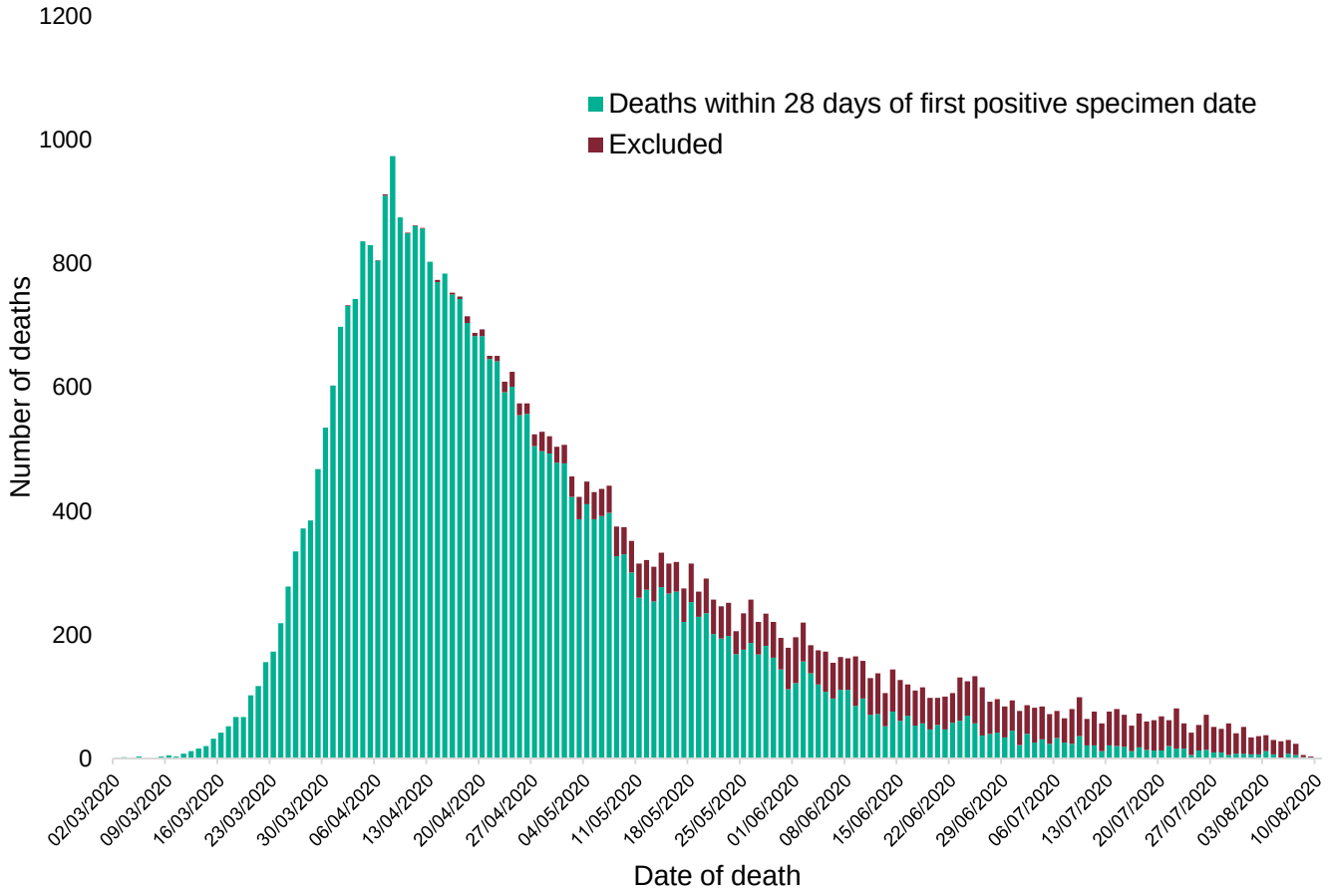


Figure 2. Number of deaths by date of death using current methodology (no time limit) and the new measures: time limit of ≤28 days and time limite of ≤60 days or mention of COVID-19 on the death certificate, as 11 August 2020





5.5 How does the PHE data series compare to the ONS death registrations?

The PHE data series is used to count daily deaths in people with a confirmed COVID-19 test in England. ONS provides a weekly count of all deaths in England and Wales where COVID-19 is recorded on the death certificate (including deaths where COVID-19 was suspected based on symptoms and/or linked to an outbreak, and not limited to laboratory confirmed cases); these are reported on a 10-day lag due to registration delay. ONS death registrations which can be linked to laboratory confirmed COVID-19 tests are included in the PHE data series, but ONS death registrations without laboratory confirmation are not.

Table 2 compares the ratio of weekly deaths reported by the PHE data series under various measures to those published by ONS. The ratio, representing the magnitude of difference between the reported totals, is closest to 1.0 when comparing PHE deaths within 60 days or COVID-19 cause of death which. However, the ratio of the 28 days measure to ONS deaths is consistently less than 1.0 each week, indicating a less comprehensive measure but perhaps a more timely reflection of current trends.

Table 2: Comparison of reported weekly COVID-19 deaths from PHE and ONS data series, England (ONS data published to 28 July, PHE data published to 3 August)

	ONS deaths (by registration date)	**PHE current measure (by report date)**		**60 days + COVID-19 cause of death (by report date)**		**Within 28 days**	
	# of deaths	*# of deaths*	***Ratio***	*# of deaths*	***Ratio***	*# of deaths*	***Ratio***
Week 24 (6-12 June)	1,057	1,135	**1.07**	1,067	**1.01**	742	**0.70**
Week 25 (13-19 June)	744	917	**1.23**	787	**1.06**	472	**0.63**
Week 26 (20-26 June)	574	802	**1.4**	803	**1.40**	539	**0.94**
Week 27 (27 June -3 July)	497	679	**1.37**	531	**1.07**	280	**0.56**
Week 28 (4-10 July)	344	499	**1.45**	344	**1.00**	177	**0.51**
Week 29 (11-17 July)	284	574	**2.02**	369	**1.30**	195	**0.69**
Week 30 (18-24 July)	207	442	**2.02**	237	**1.14**	111	**0.54**

6. Frequently asked questions

1. **Where does the mortality data come from and who is included?**

These data are collected and combined from data sources: hospitals, local Health Protection Teams and automated laboratory systems. It means we can include deaths in anyone with a confirmed COVID-19 test which occur in any setting, including hospitals and care homes. Using multiple sources means it is less likely to underestimate deaths. Data are checked to ensure there is no duplicate counting of a death. This data series only includes people with a confirmed COVID-19 test (SARS-CoV-2 PCR); it does not include deaths in people who had suspected COVID-19 and were not tested by PCR. These deaths will be identified over time through ONS death registrations.

2. **Why was the time limit to 28 days changed now?**

This is a novel virus and our understanding of it is constantly developing. The period for which those infected are ill appears to be extremely variable, so a cautious approach at the beginning of the pandemic was appropriate. This is also recognised by the World Health Organization (WHO) who have not published any official time limitations. PHE has been tracking the length of time between infection and death throughout the epidemic, and there is now improved information to support the new definition.

3. **How many deaths have you counted so far that are not COVID-related?**

It is vital to make sure that deaths related to COVID-19 are accurately counted so the full burden of the disease can be better understood. A shorter time limit could have caused an underestimation in the number of deaths.

As of 3 August 2020, there were 41,598 deaths identified of which 39,810 (96%) died within 60 days of positive specimen date or had a COVID-19 on their death registration. Of the remainder, some may be related to COVID-19 as it will not include a number of deaths for whom death registration information was not available at the time of reporting.

4. **What are the implications of this change?**

The number of people counted as having died from COVID-19 will be lower as a result of this review, and the total fatalities will be updated retrospectively to reflect this. It is important to note that this does not significantly affect the trends that have been established. The number of fatalities continues to fall at a similar rate to that established by the previous methodology.

5. **Does this mean that deaths have been over-reported up to now?**

The way deaths were counted was based on the best available evidence at each stage of the epidemic. A time limit could only be recommended once enough data were available to analyse the time between positive test result and death, cross checking against death registration

forms. Implementation of a shorter time limit would have resulted in a substantial underestimation of deaths. This inaccuracy is probably less consequential than that caused by the relatively small proportion of deaths estimated not to be related to COVID-19.

6. What was the initial justification for not including a time limit?

The World Health Organization (WHO) Regional Office for Europe have stated on 4 June 2020, "WHO has no defined time-limitation for COVID-19 related deaths. This should be a clinical decision." In April 2019, when the PHE reporting methodology was agreed with the Department of Health and Social Care, the decision was taken to report numbers of people who died with a positive test at any point, because the duration and sequelae of this new and emerging disease was not clearly understood, and any other approach risked underestimating COVID-19 deaths.

Over the last 3 months, PHE has actively reviewed the change in the time between reports of a positive specimen and death. In parallel, questions were raised on recovery figures for England, accelerating discussions on the methodologies used for assigning COVID-19 deaths in England, compared to other countries.

7. Why is this methodology no longer suitable?

PHE has monitored the time between positive test and death throughout the epidemic and planned to revise the definition to a time limit. In parallel, questions were raised on recovery figures for England, accelerating discussions on the methodologies used for assigning COVID-19 deaths in England, compared to other countries.

8. Does this methodology not mean that deaths will be undercounted from now on?

No. We are conscious that due to the unstable nature of the disease, applying a time limitation could potentially miss COVID-19 deaths, hence all cases with COVID-19- reported on their death registration will be included regardless of their time to death from the initial infection date.

9. Will this be the same methodology used in the devolved administrations? If not, why not?

PHE has been working with our colleagues in the devolved administrations (Northern Ireland, Scotland and Wales) to aim to achieve a unified approach for reporting and monitoring deaths consistently across the UK, and all countries will report the 28 day measure .

10. The number of deaths reported by PHE is already different to that of the ONS. To what extent will this exacerbate the discrepancy?

PHE counts deaths in persons with laboratory-confirmed infections using multiple sources of death to ensure deaths are reported promptly and to minimise any under-counting. ONS uses a different definition – those where the registered medical practitioner has mentioned COVID-19 on the death certificate. These registrations do not require cases to be confirmed by laboratory testing and can be made on clinical suspicion. While there is certainly overlap between the 2

data series, the difference in definitions means they do not definitively measure the same thing and the numbers will always vary. Table 2 in the main text indicates that the 60 day plus COVID-19 cause of death measure is the measure most comparable to the ONS death data series.

Annex 1: Details of data sources included in PHE data series

Data source	Description
NHS England line listing of deaths reported by NHS trusts in the COVID-19 Patient Notification System (CPNS)	This data contains information on deaths of patients who have died in hospitals in England and had tested positive for COVID-19 at the time of death Data are reported to NHS England by individual NHS Trusts via a web-based reporting system.
Health protection teams (HPTs) reporting deaths notified to them (primarily non-hospital settings)	These are deaths reported to Health Protection Teams as part of their outbreak management. These are primarily from non-hospital settings such as care homes but can also include other settings.
NHS Demographic Batch Service tracing of patients with a laboratory confirmed COVID-19 test	These are reports of deaths among individuals who have a laboratory confirmed diagnosis of COVID-19, as recorded in the SGSS dataset (national dataset extracted directly from laboratories). From 1 June this includes laboratory reports from both pillar 1 and pillar 2 testing i.Pillar 1: swab testing in NHS hospitals for those with a clinical need, and health and care workers ii.Pillar 2: swab testing for the wider population, as set out in government guidance. These data are submitted daily to the Demographic Batch Service (DBS) to check NHS patient records for reports that individuals who died in the previous 24 hours. These deaths are not limited to specific places of death.
Office for National Statistics (ONS) death registrations which can be linked to laboratory confirmed COVID-19 tests.	These are deaths where COVID-19 is mentioned on the death registration which could be linked to a laboratory confirmed COVID-19 test These deaths are not limited to specific places of death.