

Comparison of 2 COVID-19 mortality measures used in the pandemic response in England

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Main messages

Two main statistics have been used to count coronavirus (COVID-19) deaths in England: death registrations involving COVID-19 (reported by the ONS) and deaths within 28 days of a positive SARS-COV-2 test (reported by the UKHSA). The 28-day measure is a timely measure of COVID-19 deaths to inform public health response, but less precise than death registrations which consider the cause of death.

When compared, the 2 measures closely tracked one another (85 to 90% correlation) between May 2020 and December 2021. The UKHSA measure under-reported deaths at the very start of the pandemic prior to the scale up of community testing (March to April 2020). From January 2022, a marked uncoupling was observed corresponding with the emergence of the Omicron variant and widespread population immunity.

While both measures remain useful, they serve different purposes. Death registrations are a reference for overall death toll from COVID-19 (along with excess mortality estimates) and the 28-day death measure is most useful as a rapid indicator of death following COVID-19 infection, with peak utility when a new variant emerges or during a new wave which requires timely monitoring of severity for public health purposes.

Monitoring COVID-19 deaths has been vital to track the impact of the pandemic and inform the public health response. Over the course of the pandemic, a conversation has emerged about the best method for counting COVID-19 deaths and the merit of counting deaths 'with' COVID-19 versus 'from' COVID-19.

Routine mortality statistics for England and Wales are produced by the Office for National Statistics (ONS) and comprise data from death registrations including cause of death (1). These statistics are published weekly and since March 2020 have included a separate breakdown of deaths involving COVID-19. ONS distinguishes between deaths 'involving' COVID-19, where COVID-19 was mentioned as a cause of death on the death certificate, and deaths 'due to' COVID-19 where COVID-19 was designated as the underlying cause of death (2). This statistic provides a measure of deaths where clinical judgment has been used to assess whether a death is related to COVID-19. For this reason, death certificates are the reference metric for cause-specific mortality. Reporting lag presented a challenge for use during the pandemic. Death registrations are published with an approximate 11-day reporting delay from when the death is registered (3). However, while most deaths are registered within 7 days, delays between when a death occurs and is registered means some deaths can take over a month to be registered (7% of deaths registered in 2020 took over a month to be registered) (4). An ONS assessment of the quality of death certification during the pandemic noted that death registrations involving COVID-19 were of good quality, and the delay of death registration decreased to 4 days during the pandemic (5).

In response to the need for daily death figures to inform real-time decision making and modelling, NHS England began reporting daily deaths in hospitals on 5 March 2020. On 29 April 2020, Public Health England (PHE, succeeded by the UK Health Security Agency in October 2021) took over this reporting with a method that counted deaths in any setting. PHE began publishing daily numbers of people who died following a positive for SARS-CoV-2 test in England (also referred to as 'deaths with COVID-19') (6). Deaths were collated daily from multiple sources, using both active and passive reporting systems, and linked to positive SARS-CoV-2 tests, to provide a comprehensive measure with an average 3-day reporting delay. The ONS and UKHSA published joint explanations of these measures to ensure public transparency (7). The UKHSA measure was refined over time, and in August 2020, a 28-day interval was applied to deaths following a positive SARS-CoV-2 test (8), and in February 2022 the definition was updated to include deaths following re-infection (9). Both the UKHSA 28-day COVID-19 death measure and the ONS death registration measure are published on the GOV.UK COVID-19 Dashboard (10).

With 2 measures in the public domain, it is important to monitor how closely the rapid 28-day death measure approximates deaths with COVID-19 on the death registration to ensure face validity of the 28-day measure as a proxy for COVID-19 deaths. Reviewing deaths between 1 March 2020 and 30 September 2022, we present an assessment of how these 2 measures have related during this period, comparing the deaths that were reported under the 28-day death measure linked to their subsequent death registration.

Between 1 March 2020 to 30 September 2022, 83.7% (139,966/167,197) of deaths within 28-days of a positive COVID-19 test also had COVID-19 mentioned on the death certificate ([Figure 1](#)). There were 2 notable periods where the 2 measures diverged: one early in the pandemic during March and April 2020, and one later in the pandemic from January 2022 onwards ([Figure 2](#)).

During March and April 2020, the number of deaths with COVID-19 mentioned on the death certificate (9,342) exceeded the number reported within 28-day of a positive SARS-CoV-2 test (1,048). This was a consequence of limited testing capacity at the start of the pandemic, when most people who died from COVID-19 were not tested prior to their death, particularly in care homes and in the community. Following the rapid expansion of community testing after April 2020 ([11](#)), the 2 measures converged, and the proportion of reported 28-day deaths that also had COVID-19 on the death certificate consistently exceeded 90%. The correlation between the ONS and UKHSA measures was particularly high during the Alpha and Delta waves when deaths were high ([Figure 1](#)).

From January 2022, the 2 measures began to diverge. The proportion of reported 28-day deaths that had COVID-19 on the death certificate dropped sharply from 80 to 90% in mid-December 2021, to 55% in February 2022 and plateauing at 40 to 50% through to September 2022. This divergence corresponded with the swift emergence and dominance of the Omicron BA.1 variant which was associated with less severe illness and lower risk of death compared to the previous Delta variant ([12](#)). Moreover, by this point, high uptake of vaccination across all age-groups had been reached which strongly mediated the severity of COVID-19 disease in the population. A similar trend was observed in COVID-19 hospitalisation statistics at the same time. Among general admissions, the proportion of patients with COVID-19 for whom COVID-19 was the primary reason for admission declined from approximately 75% between June to mid-December 2021 to 35% by June 2022 ([13](#), [14](#), [15](#)).

We found no evidence to suggest that changes in testing policy and behaviour played a major role in this divergence. There were no changes in testing policy when the divergence first emerged: testing was widespread, with 1 to 3 million PCR or lateral flow tests reported daily between September 2021 and March 2022 ([16](#)). However, subsequent changes to testing policy included ending free community testing from 1 April 2022 and stopping asymptomatic screening of hospital patients and care home residents from 31 August 2022. One might expect the 2 measures to reconverge when fewer asymptomatic cases were being detected, yet this was not observed. In fact, the reduction in testing provision did not result in a reduction in the 28-day measure itself, suggesting that provision of symptomatic testing in hospital, care home settings and in those at high-risk meant ensures that most people who die from COVID-19 are diagnosed before death.

In recent months, the 28-day death measure has included a larger fraction of deaths unrelated to COVID-19. This was always the risk of defining a COVID-19 death without considering cause of death, and since the beginning of the pandemic the measure has counted a small number of so-called background deaths. For example, it has been pointed out that a person who tested positive and was “run over by a bus 2 weeks later” would be captured in this measure ([17](#)).

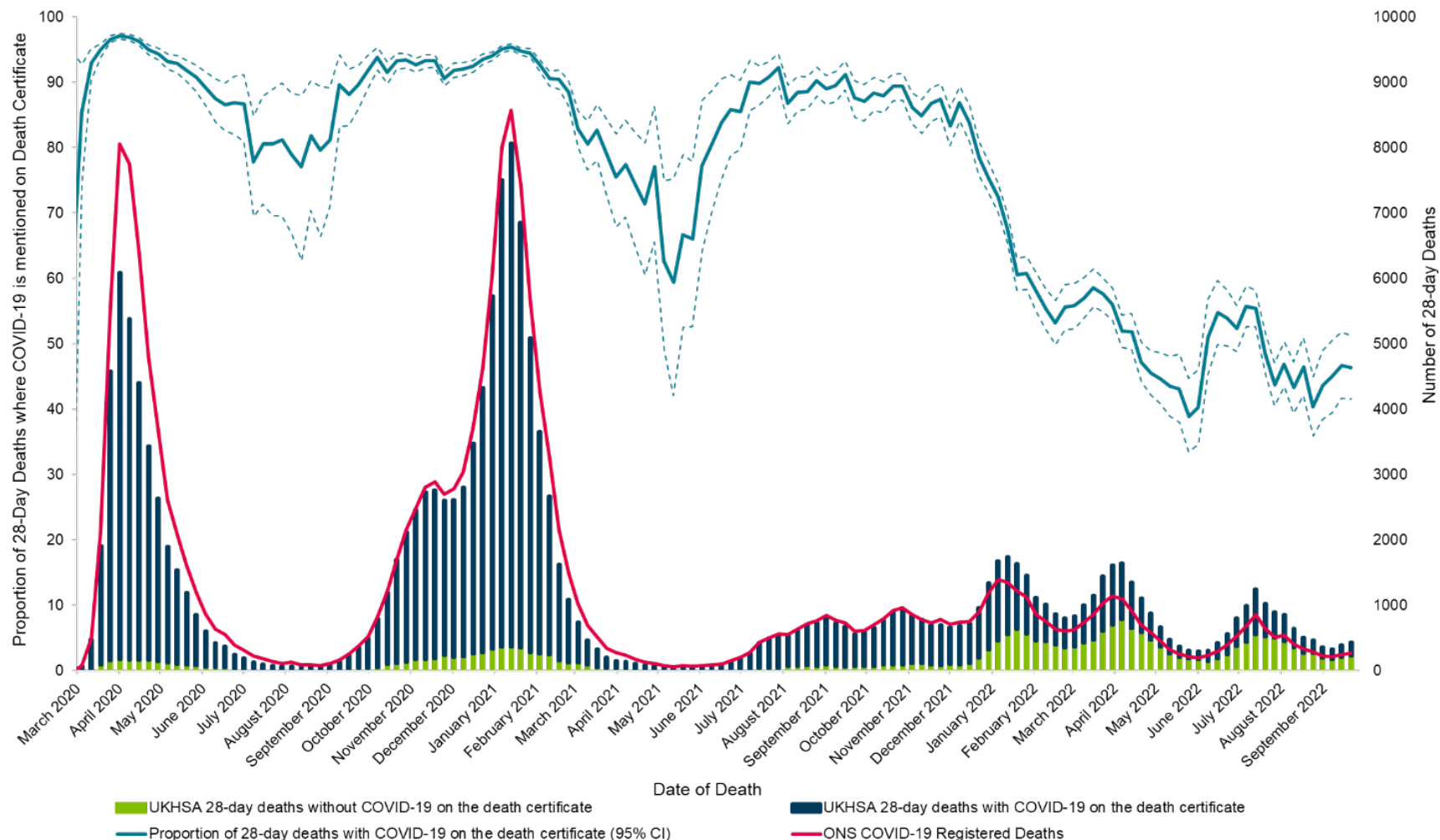
Reassuringly, this sort of miscounting is rare and by the end of September 2022, only 10 deaths reported under the 28-day measure had a transport accident listed as the underlying cause of death (ICD-10 code V01-V99) and 38 deaths had transport accident recorded anywhere on the death certificate (18). Statistically, these background deaths were a negligible contribution to the daily count when COVID-19 deaths were high, but during periods when COVID-19 deaths were low (such as summer of 2020 and spring 2021), these background deaths comprised a larger proportion of reported 28-day deaths (Figure 1).

While death registrations consider clinical judgement of the cause of death, this may also introduce bias into how deaths are recorded. With reduced severity of disease and widespread vaccination, the contribution of COVID-19 to the events leading up to death has become less clear. This may result in subjective bias in the attribution of COVID-19 to the events leading up to death. This may be particularly true for community deaths that are less likely to be tested, a trend that has previously been seen in flu and pneumococcal disease where testing is less common (19). Likewise, heightened clinical awareness can influence death reporting, as was seen in 2005 when a spike in death reports involving Meticillin-resistant *Staphylococcus aureus* (MRSA) was observed following increased media coverage and a directive from the Chief Medical Officer on reporting MRSA deaths (20). It is possible that more recently, COVID-19 is less likely to be listed on the death certificate as clinical awareness fades and the contribution of SARS-CoV-2 infection to the cause of death is more complex. Underreporting may explain the waveform observed in 28-day deaths where COVID-19 was not listed on the certificate since January 2022 (Figure 1). Further research is needed to understand whether clinician awareness of COVID-19 influences reporting.

It remains a priority to monitor the burden of COVID-19 mortality going forward. By using consistent definitions, both death measures remain useful to observe trends over time. The 28-day death measure remains more timely, whereas death registrations where COVID-19 is listed as a cause of death is a better estimate of the overall burden of COVID-19 mortality. Another important measure of burden is excess mortality (18). While not a useful real-time metric to inform public health response due to reporting lag, excess mortality is a useful measure of the total impact of pandemic, greater than COVID-19 deaths alone, and can be used retrospectively to triangulate against the other measures.

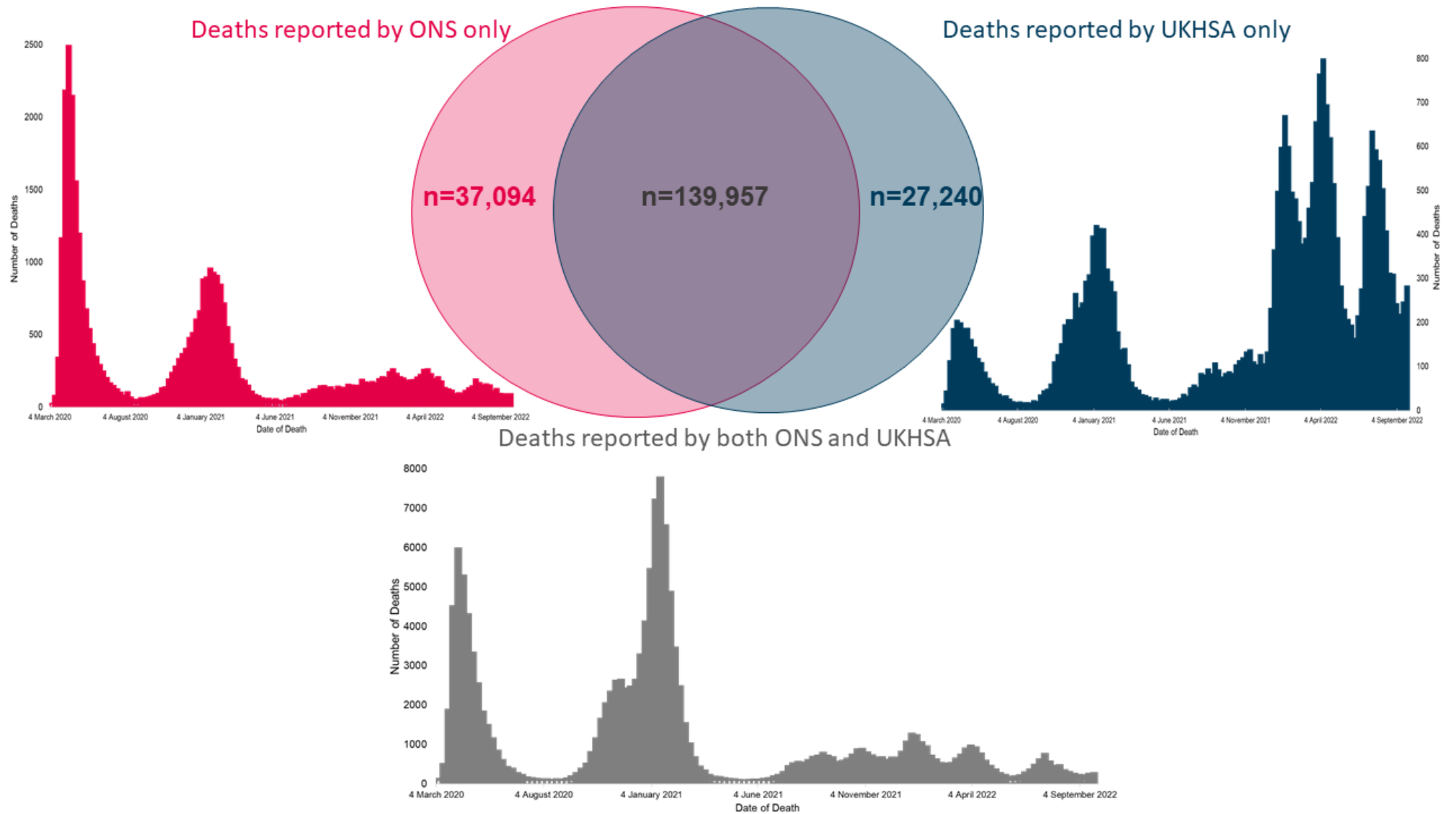
For any emerging infection, there will be initial uncertainty about how to measure mortality associated with it. Surveillance of deaths in persons with COVID-19 has adapted to meet the demands of public health officials for timely information, resulting in the 28-day measure currently used. As we reach a new phase of the pandemic, there is less need for a reporting system capable of providing rapid numbers and trends, and we can instead focus on death registrations or excess mortality estimates. However, it remains useful to maintain a rapid reporting system as it may prove valuable in future, for example in the event of a new variant with increased severity. Additionally, current studies are needed to better understand the contribution of COVID-19 in the sequence of events leading to death in the context of widespread immunity and a more specific population at risk of being severely impacted by COVID-19, namely the elderly and immunosuppressed (21).

Figure 1. Weekly COVID-19 deaths reported by ONS and UKHSA and proportion of 28-day deaths with COVID-19 mentioned on the death certificate, 1 March 2020 to 30 September 2022



* COVID-19 death certificates are defined where COVID-19 was mentioned anywhere on the death certificate, either as the underlying cause of death or as a contributory factor in the death, using the ICD-10 cause codes U071 and U072. The proportion is calculated as the weekly number of deaths reported in the 28-day measure where COVID-19 was mentioned on the death certificate, over the number of 28-day deaths where death certificate information is available (98.6% [164,802/167,197] of 28-day deaths had a death certificate available).

Figure 2. COVID-19 deaths reported by ONS (death certificates) and UKHSA (deaths within 28-days of a positive COVID-19 test), March 2020 to September 2022



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