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The SARS-CoV-2 global pandemic is accompanied by an ever rising death toll attributed to Coronavirus Disease 2019 (COVID-19), and evidence of excess deaths in addition to those included in official daily COVID-19 mortality updates.¹ Despite these daily updates of publicly available data, even in the United Kingdom, questions have persisted surrounding the circumstances of deaths formally attributed to COVID-19, with some media commentators suggesting many deaths may have been misattributed to COVID-19 infection, and that SARS-CoV-2 positivity in these patients is merely incidental.^{2,3,4}

In the United Kingdom, the official COVID-19 daily mortality update provided by Public Health England includes all patients who died having tested positive for SARS-CoV-2 by polymerase chain reaction (PCR) from sputum or nasopharyngeal swab. However, it is not currently clear if these patients died as a direct consequence of COVID-19 infection.⁵

We hereby aimed to provide independent review of clinical features of patients who have died during hospitalisation with a positive PCR test for SARS-CoV-2 and relate these to the reported cause of death to clarify the proportion of patients who have died *due to* compared to *with* COVID-19 infection. This retrospective review of the electronic health records was approved through local process, **and as it was performed on the basis of monitoring of service provision, did not require local ethics approval.**

Between 23 March and 28 April 2020, a total of 162 patients with a positive SARS-CoV-2 PCR died in Leeds Teaching Hospitals NHS Trust. Of these, COVID-19 infection was documented as the direct cause of death in 150 (93%). Review of the records revealed 138 (92%) patients had pulmonary infiltrates on chest radiography, and 146 (97%) required oxygen therapy. Only **two** patients had neither of these findings, both of whom died from acute renal failure in the context of COVID-19 with serological evidence of systemic

inflammation. **Of the 12 (7%) patients who did not have COVID-19 reported as a direct cause of death, three were due to dementia, three due to other infections, two due to co-morbidities, one was due to malignancy and three due to acute illness (renal failure, stroke and bowel ischaemia).** The number of deaths each week throughout this period is presented in Figure 1.

This retrospective review of cause of death has demonstrated that the overwhelming majority of hospitalised patients with positive SARS-CoV-2 PCR died as a direct consequence of COVID-19 infection. **Numerous observational studies have reported outcomes and risk factors for mortality in COVID-19, however the accuracy of causes of death have seldom been reported. One study described autopsy findings from 26 patients with reported cause of death as COVID-19, and found confirmatory evidence in 92%⁶, consistent with our data.**

These findings should provide reassurance to both medical professionals and the general public that cause of death reporting in hospitalised patients following positive SARS-CoV-2 tests are providing an accurate representation of COVID-19 mortality in hospitalised patients.

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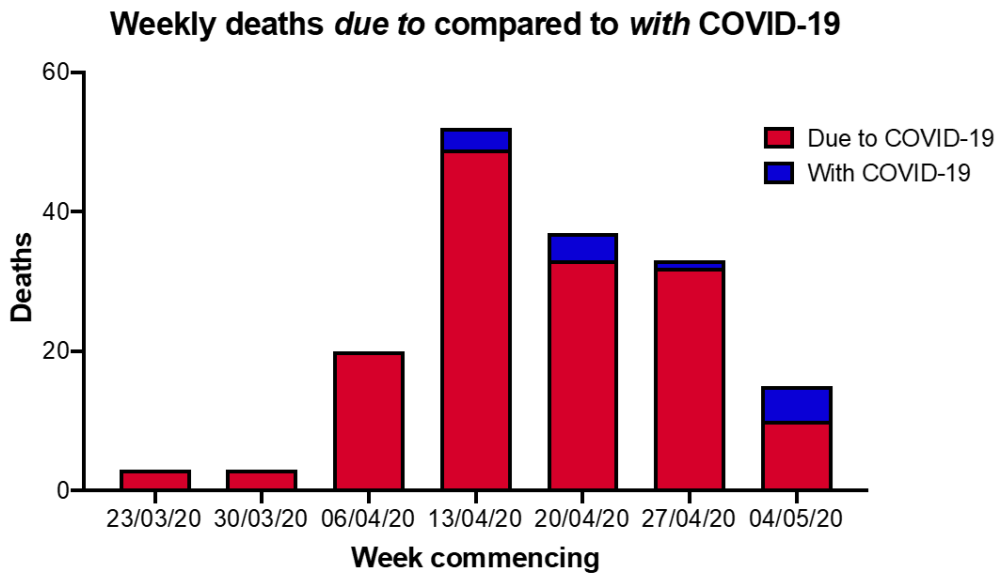


Fig 1. Weekly deaths ‘due to’ compared to ‘with’ COVID-19 in in Leeds Teaching Hospitals NHS Trust.