



An audit of COVID-19 death reporting in counties Cork and Kerry, Ireland, winter 2021–2022

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Abstract

Background In Ireland, a ‘COVID-19 death’ is defined as any death in which the decedent was COVID-19 positive and had no clear alternative cause of death unrelated to COVID-19, a definition based on World Health Organization guidance.

Aims The objectives of this audit were to determine the proportion of COVID-19 deaths notified in the Cork/Kerry region of Ireland during winter 2021–2022 which adhered to this national definition, and to determine whether COVID-19 was deemed to be the primary cause of death, or a contributory or incidental factor.

Methods A review of all deaths in individuals who were COVID-19 positive at the time of death notified to the Department of Public Health for Cork and Kerry between 22 November 2021 and 31 January 2022 was conducted to determine whether each death adhered to the national COVID-19 death definition. The clinical opinion on cause of death was obtained by contacting decedents’ clinicians.

Results Sixty deaths in individuals who were COVID-19 positive at the time of death were notified to the Department in the study period. Of deaths notified as being due to COVID-19, COVID-19 was deemed the primary cause of death, a contributory factor or an incidental factor in 72.7%, 21.8%, and 5.5% of cases, respectively. Most (93.3%) notified deaths adhered to the national COVID-19 death definition.

Conclusions The COVID-19 death definition in Ireland may require revision so it can distinguish between deaths caused by COVID-19 and those in which COVID-19 played a less direct role. The current COVID-19 mortality reporting system may also need updating to capture more clinical nuance.

Keywords COVID-19 · Health intelligence · Infectious diseases · Mortality surveillance · SARS-CoV-2

Background

Since the beginning of the coronavirus disease 2019 (COVID-19) pandemic in December 2019, COVID-19 has led to millions of deaths worldwide [1]. COVID-19 mortality statistics have been used to measure the success of public health interventions to curb transmission of COVID-19 in many countries [2]. Additionally, they have played an integral role in shaping policies and public health decision-making in the response to the pandemic [2].

Due to the need for comparability of COVID-19 mortality data internationally, the World Health Organization

(WHO) published its definition for deaths due to COVID-19 in April 2020 [3, 4]. The WHO’s guidance on COVID-19 death certification has been implemented to varying degrees across the world, and many countries have adopted differing approaches to defining a COVID-19 death [5–7]. For example, definitions of a COVID-19 death in many countries are based on clinical diagnosis of the cause of death, as recommended by the WHO, while in others, the definition of a COVID-19 death is reliant on a positive laboratory test, and not on clinical diagnosis [5]. Additionally, some countries include suspected COVID-19 cases in their COVID-19 death rates, whereas others do not [8]. There are a number of reasons, however, why it is difficult to compare COVID-19 mortality statistics between countries, not least because of varying definitions being used [5, 8]. Varying testing strategies, divergent approaches to death certification, mixed quality of death certificates, inadequate death notification

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systems, inefficient or non-existent civil registration and vital statistics systems, and differing levels of training for mortality coders are just some of the obstacles to achieving comparable COVID-19 mortality statistics [5, 7–10].

The definition of a COVID-19 death to be used in Ireland was developed by the Health Protection Surveillance Centre (HPSC), Ireland's national infectious disease surveillance body, and closely aligned with that of the WHO [11]. It defined a COVID-19 death as the following:

“For surveillance purposes, COVID-19 deaths include deaths in all possible, probable and confirmed COVID-19 cases (as per the COVID-19 case definition) and all should be notified, unless there is a clear alternative cause of death that cannot be related to COVID-19 infection (e.g. trauma). There should be no period of complete recovery from COVID-19 between the illness and death...” [11].

To date, this definition of a COVID-19 death has remained in use in Ireland throughout the pandemic. However, COVID-19 may play a role in death in a variety of ways. Firstly, COVID-19 may be the primary cause of death. While COVID-19 infection itself is uncommonly the immediate cause of death, COVID-19 often leads to an event which is the immediate cause of death [12]. For example, individuals may die as a result of the complications from COVID-19 infection, such as septic shock, multi-organ failure, acute respiratory distress syndrome (ARDS), or venous or arterial thromboembolic events [12, 13]. Secondly, COVID-19 may contribute to the mechanism of death by exacerbating certain other pre-existing conditions to the extent that an individual's death from these other conditions may be accelerated [14]. Finally, COVID-19 may be diagnosed incidentally around the time of death, playing a limited or no role in the process of dying [15].

Death from COVID-19 is a complex process usually characterised by a cascade of events, rather than a single event, which makes understanding COVID-19 mortality statistics challenging. Disentangling the role of COVID-19 in COVID-19 mortality statistics, however, is crucial to understand the true impact of COVID-19 on population health. Policy decisions continue to be informed by COVID-19 mortality statistics in Ireland and internationally, underscoring the need for accurate mortality statistics [16].

Deciphering the role of COVID-19 in COVID-19 mortality statistics is particularly important at this time, as new variants emerge. The Omicron variant is significantly more transmissible than previous variants that have become dominant globally, but it is associated with less severe disease [17]. This, combined with the very high vaccine uptake in the Irish adult population, which has conferred additional protection against severe disease from COVID-19, indicates that high rates of infection and transmission are likely to persist in Ireland in the short term, but fewer people may experience severe disease, hospitalisation, and death due to

COVID-19 [18–20]. The definition of a COVID-19 death, therefore, may require updating to reflect COVID-19's changing clinical course.

Aims

The aim of this audit is to assess the accuracy of COVID-19 deaths reported from the Cork/Kerry region of Ireland during winter 2021–2022 and to determine whether they are consistent with the treating clinicians' opinion on cause of death.

The objectives of this audit are the following:

1. To describe the individuals who were notified as having died with a COVID-19 diagnosis in the Cork/Kerry region between November 2021 and January 2022.
2. To determine whether the deaths of individuals who died with a COVID-19 diagnosis and were notified to the Department of Public Health for Cork and Kerry during the winter of 2021–2022 adhered to the national definition of a COVID-19 death.
3. To determine, for all deaths in individuals who were COVID-19 positive at the time of death which were notified to the Department of Public Health, the opinion of the treating clinician as to whether COVID-19 was the primary cause of death, a contributory factor, or an incidental factor in their death.

Methods

In this prospective audit, all deaths in individuals who were COVID-19 positive at or around the time of death which were notified to the Department of Public Health for Cork and Kerry (hereafter referred to as the Department) between 22 November 2021 and 31 January 2022 were included.

When a COVID-19 death occurs in Ireland, the death is notified by the relevant individual or service (typically clinicians, coroners, or the HPSC) to the regional Department of Public Health. The regional Department of Public Health records the death on the Computerised Infectious Disease Reporting (CIDR) system, Ireland's national information system to manage the surveillance and control of infectious diseases [21, 22]. COVID-19 deaths which meet the national definition are recorded on the CIDR system as 'died due to COVID-19' and those which do not (e.g. a COVID-19 positive decedent who died due to a clear, unrelated cause, such as trauma or suicide) are recorded as 'did not die due to COVID-19'. The deaths recorded as COVID-19 deaths on the CIDR system are ultimately reported at the national and international level and published by the HPSC.

Deaths are most commonly notified to the Department of Public Health by the HPSC. This process involves the following steps: deaths are registered with the General Register Office (GRO) by a qualified informant, who is typically a family member of the decedent; the GRO sends lists of all registered deaths to the HPSC; the HPSC identifies any death where COVID-19 is mentioned on the death certificate; and if a death is not already recorded on the CIDR system, the HPSC sends the details of the death to the decedent's regional Department of Public Health.

For the purpose of this audit, demographic and clinical data about the decedent were collated for each death notified to the Department. A standardised data collection tool was developed in Excel and data fields included age, sex, COVID-19 symptoms, date of positive COVID-19 test, hospital and intensive care unit (ICU) admission and date of death. These data were collected from a number of sources, specifically the CIDR system, the Health Service Executive (HSE) COVID Care Tracker, the national database to manage cases of COVID-19 in Ireland, HSE CoVax, the national COVID-19 vaccine management system, and local hospital patient management systems [22–24].

In addition to the collation of demographic and clinical data from a range of databases, contact was made with each decedent's clinician to ascertain the clinician's opinion on the cause of death. For each death notified to the Department, the treating clinician at the time of death was identified and contacted; these clinicians included general practitioners (GPs) and hospital doctors. The events leading to each death and the clinician's opinion on the cause of death were discussed. Specifically, the clinician's opinion on whether COVID-19 was the primary cause of death, or a contributory or coincidental factor in death was determined. This information was used to determine the accuracy of the COVID-19 death data which had been recorded on the national surveillance system, CIDR.

Categorical data were analysed using counts, percentages, and Pearson's Chi-square test, or Fisher's exact test, where appropriate. Continuous data were inspected using histograms. Where distributions approximated the normal distribution, analysis was performed using means and standard deviations. Where the distribution was not normal, data were analysed using medians and ranges. Data were collated in Microsoft Excel and analysed using SPSS Version 28.0.

Results

In total, there were 78 deaths notified to the Department between 22 November 2021 and 31 January 2022 inclusive. It was possible to ascertain the clinical opinion on cause of death in 60 (76.9%) deaths. The reasons why it was not possible to ascertain the clinical opinion on cause of death

in the remaining 18 deaths included failure to contact the relevant clinician despite multiple attempts ($n = 14$); the hospital team could not recall the circumstances surrounding the decedent's death ($n = 2$); and the cause of death was unknown to the clinician, e.g. due to death occurring suddenly at home without clinical input ($n = 2$).

Of the 60 decedents for whom it was possible to ascertain the clinical opinion on the cause of death, 50% ($n = 30$) were female, and the mean age at death was 74.4 years (SD 12.6 years and range 37–101 years) (Table 1). Of the 56 (93.3%) decedents for whom comorbidity data were available, all 56 decedents had underlying comorbidities, and the median number of underlying comorbidities was 3 (range 1–9). The most common comorbidities were chronic respiratory disease, coronary artery disease and diabetes. Of the 24 (40%) decedents for whom data on palliative care treatment were available, two were receiving palliative care prior to acquiring COVID-19.

Under half (45.0%) of all COVID-19 infections were acquired in the community, 23.3% were acquired in nursing homes, 11.7% were hospital-acquired, 3.4% were acquired in other defined settings (e.g. community hospitals), and 16.7% were acquired in unknown settings.

Table 1 Characteristics of COVID-19 positive individuals whose death was notified to the Department of Public Health for Cork and Kerry and for whom the clinical opinion on the cause of death was available ($n = 60$), 22 November 2021–31 January 2022

		<i>n</i>	%
Age	≤ 60 years	<5	6.7
	61–70 years	17	28.3
	71–80 years	19	31.7
	81–90 years	14	23.3
	> 90 years	6	10
Sex	Female	30	50
	Male	30	50
Comorbidities	Chronic respiratory disease	20	33.3
	Coronary artery disease	20	33.3
	Diabetes	14	23.3
	Chronic neurological condition	10	16.7
	Chronic kidney disease	9	15
	Cancer	8	13.3
	Obesity	8	13.3
	Other	44	73.3
	Unknown	<5	6.7
Vaccination status	Completed primary vaccination series and booster dose	15	25
	Completed primary vaccination series only	38	63.3
	Unvaccinated	6	10
	Unknown	<5	1.7

^aAcronym: COVID-19 coronavirus disease 2019

Symptoms consistent with COVID-19 were experienced by 88.3% ($n = 53$) of decedents. Sixty-three per cent ($n = 38$) of decedents were admitted to hospital at the time of infection and 28.3% ($n = 17$) were subsequently admitted to the ICU. In total, 91.7% ($n = 55$) of decedents were reviewed by a clinician in the community or in hospital in the week prior to death and 81.7% ($n = 49$) of decedents were reviewed by a clinician in the community or in hospital in the 24 hours prior to death.

The median number of days from positive COVID-19 test being performed to death was 17. In terms of the location where deaths occurred, the majority occurred in hospital (60.6%), a smaller proportion of deaths occurred in nursing homes or community hospitals (27.9%) and the remainder occurred in decedents' homes (11.5%).

Fifty-five (92%) deaths were recorded on the CIDR system as deaths due to COVID-19 and 5 deaths (8%) were recorded as deaths not due to COVID-19 (Table 2). In total, 93.3% ($n = 56$) of deaths notified to the Department adhered to the national definition for a COVID-19 death and were either correctly classified as deaths due to COVID-19 ($n = 52$) or deaths not due to COVID-19 ($n = 4$); the remainder of notified deaths ($n = 4$) was incorrectly classified and not in accordance with the national COVID-19 death definition. Fifty-two deaths in which COVID-19 were either the primary cause of death or a contributory factor in death were correctly notified as deaths due to COVID-19 to the Department and recorded as such on CIDR. Four deaths in which COVID-19 was diagnosed incidentally were correctly notified to the Department as deaths not due to COVID-19 and recorded as such on the CIDR system. Three deaths in which COVID-19 was diagnosed incidentally were incorrectly notified to the Department as deaths due to COVID-19 and recorded as COVID-19 deaths on CIDR. One death in which COVID-19 was a contributory factor was notified incorrectly to the Department as a death not due to COVID-19 and recorded as such on CIDR.

Of the 55 deaths recorded on the CIDR system as being due to COVID-19, the clinical opinion in 72.7% ($n = 40$) was that COVID-19 was the primary cause of death; for 21.8% ($n = 12$) of deaths, the clinical opinion was that COVID-19 was a contributory factor in death (but not the primary

cause); and for 5.5% ($n = 3$), the clinical opinion was that COVID-19 was an incidental factor in death.

The median duration between time of death and death notification to the Department was 15.5 days (range 0–137); this duration varied by notification source. The median duration between death and death notification was 26.5 days (range 1–137 days) for deaths notified by the HPSC, 1 day (range 0–11 days) for deaths notified directly by the coroner, and 1 day (range 0–4) for deaths notified directly from other sources (e.g. nursing homes). The long median duration observed between death and death notification for the deaths notified by the HPSC was most likely due to the extensive reporting process described in the “Methods” section which is contingent on family registration of deaths to the GRO, among other factors.

Whole genome sequencing data were available for 8 decedents' polymerase chain reaction (PCR) swabs and these revealed that 4 (50%) infections were caused by the Delta variant and 4 (50%) infections were caused by the newly emerging Omicron variant at the time.

Discussion

This audit demonstrates that the majority of individuals who were notified as having died from COVID-19 to the Department of Public Health for Cork and Kerry between November 2021 and January 2022 were older individuals who had multiple comorbidities and who had received their primary vaccination course against COVID-19. A large majority of deaths notified to the Department as being due to COVID-19 and recorded as such on the national surveillance system, CIDR, adhered to the definition of a COVID-19 death that was in use in Ireland during the audit period.

As 27% of the deaths notified as being due to COVID-19 were deaths in which COVID-19 was a contributory or incidental factor, the findings of this audit suggest that the COVID-19 death definition in Ireland is broad and may capture all deaths in which COVID-19 played any role. Additionally, this audit demonstrates that the definition for a COVID-19 death in Ireland may be arguably ambiguous. Deaths in which COVID-19 was diagnosed incidentally

Table 2 The clinical opinion on cause of death and the classification of death on CIDR for deaths notified to the Department of Public Health for Cork and Kerry, November 2021–January 2022

Clinical opinion on whether COVID-19 was the cause of death			
Classification on CIDR system	COVID-19 was the primary cause n (%)	COVID-19 was a contributory factor n (%)	COVID-19 was an incidental factor n (%)
Recorded as death due to COVID-19	40 (72.7)	12 (21.8)	3 (5.5)
Recorded as death not due to COVID-19	0	1 (20)	4 (80)

^aAcronyms: CIDR Computerised Infectious Disease Reporting, COVID-19 coronavirus disease 2019

around the time of death were notified to the Department and recorded on CIDR almost evenly as deaths due to COVID-19 and deaths not due to COVID-19, suggesting that the definition may require revision to reduce any possibility of subjective interpretation. Moreover, these findings suggest that the national surveillance system, CIDR, has offered a restrictive, binary choice between recording a death as due to COVID-19 or not due to COVID-19 and has not captured the full clinical nuance of the role played by COVID-19 in death. Ideally, the CIDR system should be able to capture whether COVID-19 is a primary cause of, a contributory factor, or an incidental factor in death.

A modelling study exploring excess mortality due to the COVID-19 pandemic globally observed that the number of deaths reported in Ireland during the first 2 years of the pandemic ($n = 5910$) was notably greater than the estimated excess deaths that occurred directly due to the pandemic during that time (1170, 95% confidence interval (CI) 84–2330) [25]. Similarly, in an analysis of excess all-cause mortality in Ireland during March–June 2020 conducted by the Health Information and Quality Authority (HIQA), the number of officially reported COVID-19 deaths during the study period exceeded the estimated excess mortality (1709 vs 1072) [26]. While there is a divergence in the findings of both studies in the extent to which the estimated excess mortality differs from the nationally reported COVID-19 deaths, both studies indicate that there is likely a gap between the number of excess deaths due to the pandemic and the number of COVID-19 deaths officially reported in Ireland. This gap may be at least partially explained by the use of a wide-ranging definition for COVID-19 deaths that has been in use.

Furthermore, as the Omicron variant, which is associated with increased transmission of infection but less severe disease, has become the dominant circulating variant globally, the proportion of deaths in which COVID-19 is a contributory factor, as opposed to being the primary cause of death, may be expected to rise [15]. This has occurred in the UK, where a growing proportion of decedents is dying 'with', as opposed to 'from', COVID-19 since the introduction of the Omicron variant in November 2021 [15]. Thus, updating the COVID-19 death definition may be needed to reflect this changing epidemiological pattern.

The limitations of different COVID-19 death definitions have been considered in other countries [5, 8, 10]. Due to the varied definitions of COVID-19 deaths being used to inform the nationally-reported COVID-19 statistics across the world, as well other factors, such as varying testing strategies, certification and coding practices, and death notification systems across countries, a growing number of commentators are advocating for the use of excess mortality data and multiple data sources, not just nationally reported headline figures, to understand the impact of the pandemic on population health, inform policies and strategies, and

compare COVID-19 mortality statistics between countries [5–8, 27].

This audit had a number of strengths. Firstly, for each death notified, extensive follow-up of the decedent occurred; the clinician treating the decedent at time of death, or a clinician who knew the circumstances surrounding the decedent's death, was contacted and asked in-depth questions about the decedent. Secondly, this was a prospective audit and deaths were followed up almost immediately after being notified to the Department. This ensured that the period between deaths occurring and contact being made by the Department with treating clinicians was minimised; this may have helped to curtail poor recall and recall bias among clinicians who were contacted. Lastly, this audit benefitted from the authors having access to multiple databases, including national and local databases, which facilitated data validation.

The limitations of this audit must be acknowledged. Firstly, the audit sample was small in size and may not have been representative of all those died with a positive COVID-19 diagnosis since the beginning of the pandemic. Secondly, 18 (23%) deaths notified to the Department during the audit period could not be followed up due to logistical barriers. These 18 decedents may have been systematically different to the decedents who were successfully followed up and this may have led to selection bias. Thirdly, the treating clinicians who were contacted about each decedent may have had varying perceptions as to what constitutes a death in which COVID-19 is the primary cause or a death in which COVID-19 is a contributory or incidental factor. This may have given rise to differential misclassification of cause of death, reducing the validity of the audit findings. Finally, the decedents' comorbidities were not captured systematically and may have led to underestimation of the prevalence of comorbidities among decedents.

Conclusions

The definition of a COVID-19 death which has been used in Ireland is broad, encompassing most deaths in which the decedent was positive for COVID-19 at or around the time of death; it may not capture the clinical nuance of the circumstances in which death occurred and, in some cases, may be ambiguous and open to interpretation. Furthermore, the recording of COVID-19 deaths on the national surveillance system, CIDR, has been binary, capturing whether decedents died unequivocally due to COVID-19 or not. As demonstrated in this audit, not all COVID-19 deaths meet these fixed criteria.

The national definition of a COVID-19 death that has been in use in Ireland was developed in the earliest phase of the pandemic in 2020. This definition may require revision and updating, as the clinical and epidemiological picture

of COVID-19 continues to evolve, the underlying clinical nuances of COVID-19 deaths warrant further consideration, and COVID-19 mortality statistics continue to play a crucial role in policy decisions during the ongoing pandemic.

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