Editorial

Deaths in healthcare workers due to COVID-19: the need for robust data and analysis

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Keywords: COVID-19; healthcare workers; infection; mortality

Conflicts of interest; none.

The novel coronavirus SARS-CoV-2 has rapidly spread across the world from its origin in Wuhan, China in late 2019. The resultant disease (COVID-19) has placed an enormous burden on healthcare systems because of the high transmission rates, prevalence of severe disease and mortality [1]. The risk of viral transmission to healthcare workers has been a concern since the start of the outbreak and the first person to raise concerns about the illness to the international community was Dr Li Wen-Liang, an ophthalmologist in Wuhan who sadly died of the disease that he likely contracted whilst at work [2].

COVID-19 has been described as the biggest national crisis since the Second World War [3]. In the UK, as of 7 May, more than 200,000 people have been confirmed with the disease with more than 30,000 deaths [4]. Government strategies and population responses have led to a 'flattening of the epidemic curve', which means the overall number of cases is not reduced but spread over a longer time period. COVID-19 will be with us for many months or even years. Whilst the death of healthcare workers has had a high media profile, no central registry of deaths exists.

We recently published an analysis of reported deaths from COVID-19 among health and social care workers [5]. We identified 119 deaths from publicly visible reports: 106 were confirmed (based on three media reports and one social media report) and analysed. In the vast majority of cases we were able to establish that the individuals had been working before death and the degree to which their job was patient-facing. However, it was not possible to determine whether healthcare workers became infected at work or elsewhere.

One element of focus was ethnicity, as it had become clear that black, Asian and minority ethnic (BAME) doctors were overrepresented in early deaths [6]. In total, 63% of health and social care workers who died were of BAME background, three-fold more than the proportion in the NHS workforce. Most were first-generation migrants, born outside the UK. While there is growing evidence that COVID-19 disproportionately affects BAME individuals in the UK [7,8] and elsewhere [9,10], these findings specific to health and social care workers are stark [8].

The overall mortality rate amongst health and social care workers was similar to the general population [5]. However, the vast majority of COVID-associated mortality is in patients older than working-age (> 70% of deaths are in those aged > 75 y [11]) and amongst men (57% male [11]), whereas NHS employees will

be younger and 77% are female [12]. Using national statistics [11-15], we compared COVID-19 related mortality rates in England and Wales between NHS employees and the age- and sex-matched populations not employed by the NHS. Although in most groups there was no evidence of excess mortality, among women aged 16-44 y the mortality rate for NHS employees is estimated to be approximately twice that for those not employed in the NHS [16]. This is a fragile statistic based on a small number of excess deaths. As this group makes up 35% of the NHS workforce, it is an important, if provisional, finding. We believe it warrants further investigation. Our methods relied on media publication of deaths and it is therefore not possible to estimate how many deaths we may have missed. Despite this, ours is still the most complete analysis of healthcare workers to have died from COVID-19.

In January, when evidence for human to human transmission of SARS-CoV-2 emerged, concern regarding transmission from infected individuals to healthcare workers was inevitable. Early reports raised concerns that healthcare workers were at increased risk of infection and that when infection occurred, that this would be more severe [1, 17].

An early, single-centre, retrospective analysis from Zhongnan Hospital, Wuhan, of 138 patients with COVID-19 pneumonia showed that 41% of infections were thought to be hospital-acquired [18]. Approximately 70% of these patients were healthcare workers, with one individual requiring intensive care, but there were no deaths. The study showed that infected hospital staff worked mostly on general wards (77.5%) followed by the emergency department (17.5%) and critical care (5%) [18]. There were further cases of clinicians becoming infected, and Tongji Hospital, also in Wuhan, reported that two anaesthetists acquired COVID-19 in early December and this was likely to have occurred whilst at work [19]. On or around 23 January 2020, a self-protection mandate was introduced across China imposing strict transmission-based precautions, including graded use of personal protective equipment (PPE) according to extent of patient contact [19]. Since the mandate was introduced no anaesthetists were infected in Tongji Hospital [19].

A study of more than 72,000 patients with COVID-19 by the Chinese Centre for Disease Control and Prevention showed that by early February around 3000 healthcare workers had become infected, accounting for 3.8% of all cases of COVID-19 [1]. There were five deaths in this cohort giving a case fatality ratio of 0.3% [1]; this is approximately one-sixth of the overall case fatality rate (2.3%) in the study, half of

which occurred in patients aged 20-59 y (0.6%). From early January and through February 2020, the proportion of confirmed cases in healthcare workers graded severe or critical decreased from 45% to 8.7% [1]. Four of the five deaths occurred before the self-protection mandate. The rate of COVID-19 diagnoses in the general population began to fall in the second week of February and healthcare worker infections fell dramatically after the end of January, plausibly related to the changes in protective practices [19].

In Europe, healthcare workers have accounted for a substantial proportion of all COVID-19 cases. In Italy healthcare workers accounted for 8% of cases in early March [20] rising to 10.5% in late April [21]. More than half were from Lombardia, northern Italy [22] and included: nursing and midwifery staff (43.2%); paramedic staff (9.9%); hospital doctors (19%); and general practitioners (0.8%) [22]. In Spain, an estimated 26% of confirmed COVID-19 infections were in healthcare workers [23]. A report of screened hospital staff from Holland identified 6.4% to be COVID-19 positive (Kluytmans-van den Bergh M, et al. unpublished data, https://www.medrxiv.org/content/10.1101/2020.03.23.20041913v1.full.pdf).

Ing et al. analysed a total of 198 COVID-19-associated deaths amongst doctors worldwide that were reported before 5 April 2020, using a Google internet search (Ing EB, et al. unpublished data, https://www.medrxiv.org/content/10.1101/2020.04.05.20054494v1). The cohort had a median age of 66 y, 90% were male and 40% of deaths occurred in Italy. Emergency medicine and general practitioners accounted for approximately 40% of deaths, whilst the proportions of individuals involved in specialties with high exposure to aerosol generating procedures was low: dentists (5%); ear nose and throat surgeons (4%); ophthalmologists (4%); and anaesthetists (3%). A separate Italian online directory (which likely included some retired doctors who were not working) recorded on 29 April 2020, 153 COVID-19-related deaths amongst doctors and dentists: three (2%) were anaesthetists [24]. A Russian 'in memoriam' page of healthcare professionals who have died during the pandemic lists 91 healthcare staff, five (5%) of whom are anaesthetists [25].

Healthcare workers involved in airway management, which generally involves multiple aerosol generating procedures, are presumed to be at high risk of acquired infection [26]. Particular procedures carry a greater risk of transmission, with tracheal intubation and its associated manoeuvres being in the highest category. In an area of very limited evidence, tracheal intubation is most highly, most consistently and

with least heterogeneity, associated with healthcare worker infection [26]. While passing a tracheal tube into a paralysed apnoeic patient is unlikely of itself to be an aerosol generating procedure, the combination of interventions that make up the procedure of tracheal intubation is high-risk. UK consensus guidelines for airway management of the patients with COVID-19 include recommendations regarding PPE during tracheal intubation to minimise the risk of viral transmission [27]. Airborne-precaution PPE continues to be recommended [28].

Meng et al. presented the Wuhan experience of caring for the critically unwell patients needing intensive care, which included an estimated 2500 tracheal intubations [19]. The authors emphasised the importance of preparedness, protocols and PPE during airway management to reduce the risk of viral transmission and noted that most healthcare-related infections in Wuhan occurred before such precautions were instituted [19]. A report of 202 emergency tracheal intubations in patients with COVID-19 in Wuhan reported no infections in members of the intubating team [29]. All staff involved wore airborne-precaution PPE, airway management was prompt with successful tracheal intubation on first attempt in 89.1% of cases. Of note, in both these studies protection was not focused solely on PPE and in addition to wider infection control measures, precautions included oral, nasal and aural disinfection, clinician isolation and infection surveillance for tracheal intubation teams [19,29].

Another notable finding from our analysis was that amongst the 106 staff deaths, none were anaesthetists, intensive care doctors or nurses or physiotherapists. This, taken together with the evidence presented above regarding infection related to tracheal intubation, is largely reassuring for those involved in airway management of the critically ill patient with COVID-19. It is supportive of the suggestion that those working most closely with the airway in the critically ill may have been systematically prepared at protecting themselves against nosocomial transmission since the start of the UK outbreak. Widespread knowledge sharing across the largely interlinked critical care and anaesthesia specialties [30] has led to a thorough understanding of viral dynamics and implementation of organisational and operational strategies (e.g. airway management) [27] required to reduce nosocomial transmission. Further data are required to assess rates of infection and severe illness, but the mortality data offers some reassurance that meticulous use of transmission-based precautions and appropriate PPE provides protection against nosocomial infection. Outside the UK, a lack of appropriate PPE is often described to have contributed to deaths in anaesthetists as a result of COVID-19 (Ing et al. unpublished data) [24,25]. An international

study led by the Difficult Airway Society (intubateCOVID, https://intubatecovid.org/ (accessed 05/05/2020)), will provide further information on this topic in the future.

In summary, healthcare workers are at risk of contracting COVID-19 through their occupational exposure. Our dataset of healthcare worker deaths sadly continues to grow, with nearly 200 deaths highlighted of which 157 were confirmed as of 3 May 2020. This comprises 48 nurses, 35 support workers, 26 other healthcare professionals, 25 doctors and 23 non-clinical staff; 96% of doctors, 75% of nurses and 59% overall are from BAME groups. The data remain incomplete due to the collating of cases from media reports. The NHS has yet to confirm publicly that it will be asking hospital Trusts to report staff deaths from COVID-19. As such, the extent of the problem in the UK is unknown and requires further analysis based on more reliable data. We know neither the incidence nor clinical outcomes (including disease severity and mortality) amongst healthcare workers, as no central registry exists at the present time. This may soon change as the Government has announced it will start collecting information on ethnicity and occupation in COVID-19 associated deaths [31]. We believe there is an urgent need for systematic collection, analysis and publication of such data. There is evidence that BAME groups are over-represented in mortality from COVID-19 amongst NHS staff and the potential for young females to be at increased risk merits further investigation. What data are available are relatively reassuring regarding infection and mortality risk amongst those involved in anaesthesia and critical care medicine. Whether a change in infection control measures outside high-risk areas is merited is also worthy of consideration. It has never been more important for the NHS to understand how best to safeguard and sustain their workforce. The current and future NHS workforce needs to feel safe and confident that they will be protected at work. We believe there is an urgent need for systematic collection, analysis and publication of data relating to health and social care work-related infection and deaths in the UK.

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