Prioritising SARS-CoV-2 vaccination – challenges in choosing between the elderly and frontline healthcare staff

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In the Joint Committee on Vaccination and Immunisation (JCVI) list of priority groups for SARS-CoV-2 vaccination, frontline healthcare staff are included in the second priority group [1]. The first group comprises the approximately 410,000 residents of care homes [2] and the similar numbers of carers who look after them. Frontline healthcare staff and patients aged >80 years comprise the second group: there are approximately 1.7 million [3,4] NHS healthcare staff and 3.4 million [5] individuals aged >80.

There is both uncertainty and high emotion associated with approaches to managing group 2. There are reports of 75% of available vaccine being used to vaccinate the over 80s, with 20% for care homes and 5% to vaccinate healthcare staff [6]. We are also aware of a wide variety of different approaches to prioritisation among healthcare staff including: prioritising purely on age, or ethnicity, based on COVID-age, starting with those working in intensive care units (ICU), or conversely starting with those working in healthcare reception roles.

Three questions therefore arise

1. *How to prioritise between those aged over 80 and front-line healthcare staff?*
2. *What does 'front-line' mean when referring to healthcare staff?*
3. *Which front-line healthcare staff to vaccinate first, particularly if most are going to have to wait until most of 3 milllion over 80-year olds are vaccinated?*

These questions may be harder to answer than they appear but asking them may help define the issues. Without a structure there is likely to be wild variation in practice [7] (which we are already aware of) and concerns over lack of equity [8].

How to prioritise between those over 80 and frontline healthcare staff?
Patients over the age of 80 are notably less likely to become infected with SARS-Cov-2 than younger patients. The REACT-3 study [9] estimated individuals aged >75, compared to those aged <45, had less than half the risk of becoming infected, but had a mortality risk >300-fold higher. Conversely, there is extensive evidence [10] that frontline healthcare staff in the first wave were approximately 3- to 4-fold (and in some studies up to 7-fold [11]) more likely than the general population to become infected, but if infected likely had a lower mortality, most likely due to underlying better health [12].

The Office for National Statistics (ONS) has published data on COVID-19 mortality by occupation [13] up to 25th May 2020 in England and Wales. Combining this

data with workforce data from NHS digital [4] enables calculation of the relative risk of death associated with COVID-19 for different professional roles. Figure 1 shows that healthcare staff, during the first surge, had an approximately 41% (95% confidence interval 26-71%) increased risk of death from COVID-19 compared to others of similar age. This excess risk of death is lower than the excess risk of infection (see below), most likely because healthcare staff have better average health [12] than the general population. Within healthcare there are undoubtedly both high and low risk roles: those in non-patient facing roles have a lower risk of harm than the general population, and the excess mortality amongst those in patient facing roles will exceed the reported overall 41% increase.

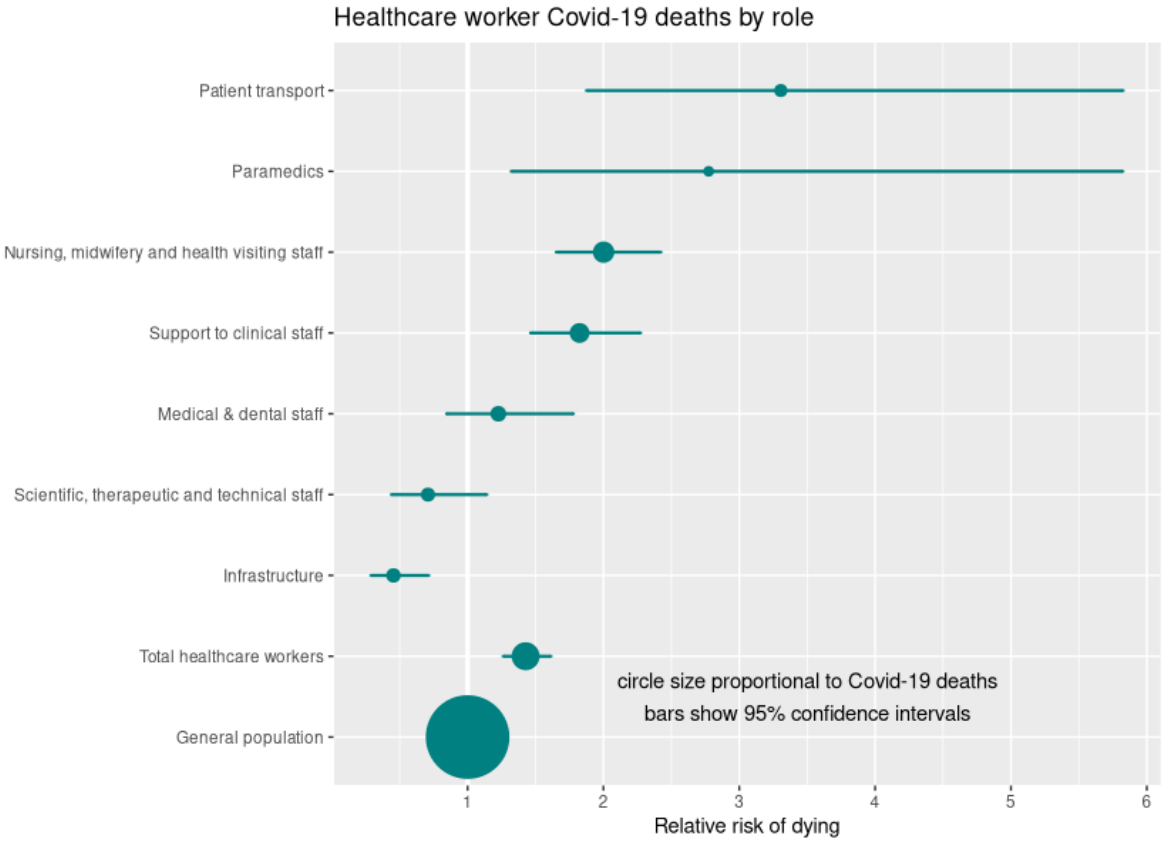

Figure 1: Deaths from Covid-19 by role, relative to general population of working age

Vaccinating those aged over 80 will save lives and it is estimated that it requires approximately 160 vaccinations [14] to save one life in this group. This is highly effective medicine. Vaccination of healthcare staff serves different priorities. First it will reduce harm due to healthcare staff sickness, as although COVID-19 may not cause the death of many in their middle years, it causes an illness typically requiring several weeks away from work and in some cases is followed by chronic illness. It will reduce the risk of in hospital transmission [15] (much of which occurs before symptoms develop [16]) from healthcare staff to other staff, or patients, the latter of whom have a high mortality if infected. In two studies of higher risk surgical [17] and medical [18] patients, in-hospital infection with

SARS-CoV-2 was associated with a mortality of more than 1 in 5. Preventing healthcare staff infection will also preserve services: staff absences are above 10% in many locations [19] and in some the rate is notably higher. Reduced staff availability due to illness, self-isolation and shielding is critical to maintaining services, particularly those such as emergency departments and ICUs where specific skillsets are needed.

There are other practical reasons to prioritise healthcare staff: they are at increased risk because of their employment and cannot modify their behaviour to avoid risk of infection. Indeed, during the pandemic while infection rates and hospital admission rates of others have fallen, they have remained stable or increased amongst healthcare workers [9,20] Conversely the over 80s could, by shielding for a few weeks longer, enable widespread immunisation of frontline healthcare staff, to protect those staff but also to preserve the very services that many, including the elderly, will need in the coming weeks and months. Importantly, most risk data relates to infection during the first surge, and the second surge has been associated with a greater number of hospital outbreaks. To compound the problem the new variants of SARS-Cov-2 [21] which will soon be dominant throughout the UK are notably more transmissible – this will increase the risk to healthcare staff, directly during patient contact and indirectly because there are likely to be many more patients and close proximity interactions. It will also considerably increase the stress on the NHS in general.

An important consideration is that employers have a legal right to protect their employees from harm or ‘detriment’ [22] and vaccination should be seen in this context. Deaths associated with occupational COVID-19 exposure require reporting to the Health and Safety Executive [23] under the 2013 reporting of injuries, diseases and dangerous occurrences regulations – RIDDOR.

Finally, there is a moral argument [24]. Healthcare staff have been exposed to increased harm to their physical health and mental wellbeing throughout this year, simply by turning up to work. Expecting them to continue to do this without early access to the vaccine is to some unrealistic and to others simply wrong. Of note in many other countries vaccination of healthcare workers is prioritised higher than in the UK, for example in the USA where the Center for Disease Control and Prevention [25] has allocated healthcare staff to the highest vaccine priority group.

How to define front-line healthcare staff and how to prioritise the healthcare workers?

The next two questions can be combined. Several hospital-based studies have explored which groups of healthcare staff are at risk of infection. The synthesis of this is [10]: front line and front door staff (and their household contacts [20]) are at increased risk but non-frontline staff are not, nurses are at greater risk than doctors, junior nurses and doctors are at higher risk than senior doctors and nurses, housekeeping and portering staff are in high risk groups, staff caring for patients with COVID-19 are at increased risk (except if working in ICU) and locations such as general medicine and medical wards are at higher risk than

surgery, anaesthesia and ICU. The main limitation of this analysis is that it includes only hospital-based care, excluding both general practice and staff involved in patient transport.

In these studies, 'frontline' is not consistently defined, but the sense running through the studies is that individuals who come into physically close contact with COVID-19 patients for more than brief periods, particularly for direct delivery of care, are at increased risk. This is consistent with knowledge that risk of infection transmission is significantly impacted by both proximity and duration [26] of contact. Table 1 suggests patient facing staff on this basis account for approximately 1 million NHS staff.

The ONS's most recent publication on COVID-related mortality by occupation included deaths up to 25th May 2020 [13]. This timescale covers includes 78% of all the healthcare staff deaths [27] recorded up to 12th October 2020. Our analysis shows first (Figure 1), that only frontline (patient facing) healthcare roles are associated with an increase in mortality and those in non-patient facing roles have a lower mortality than the general population. Second, all frontline staff, irrespective of role, are at increased risk of death but the burden of risk that frontline nurses and clinical support staff experience is increased (Figure 2). Thirdly, those at the highest risk are ambulance and transport staff who are exposed to patients often at the start of their illness and in potentially poorly ventilated enclosed spaces both when visiting patients' homes and during transportation. A separate analysis has shown the relatively low risk of mortality amongst those working in anaesthesia and ICU roles and locations [10]. Of particular importance, the extent of the occupational increase in mortality risk (a 4-fold increase relative to the general population and a >7-fold variation between healthcare roles) far exceeds the impact of gender, ethnicity of comorbidities as individual factors which generally alter risk by less than 100% and rarely by more than 2-fold [28].

Table 1: Relative risk of dying from Covid-19, compared to general population of working age
(ONS data up to 25th May 2020, England and Wales, age 20-64 years)

Role	Deaths	Workforce	RR	Lower CI	Upper CI	P Value
Patient transport	12	28,724	3.31	1.88	5.82	<0.0001
Paramedics	7	19,947	2.77	1.32	5.82	0.007
Nursing, midwifery and health visiting staff	108	431,185	2.00	1.65	2.42	<0.0001
Support to clinical staff	81	353,467	1.82	1.46	2.27	<0.0001
Medical & dental staff	28	180,542	1.23	0.85	1.78	0.281

Scientific, therapeutic and technical staff	17	189,247	0.71	0.44	1.14	0.156
Infrastructure	19	328,700	0.45	0.29	0.71	0.001
Total healthcare staff	272	1,531,812	1.43	1.26	1.61	<0.0001
General population (excluding healthcare staff)	4761	3,760,5270	1.00			

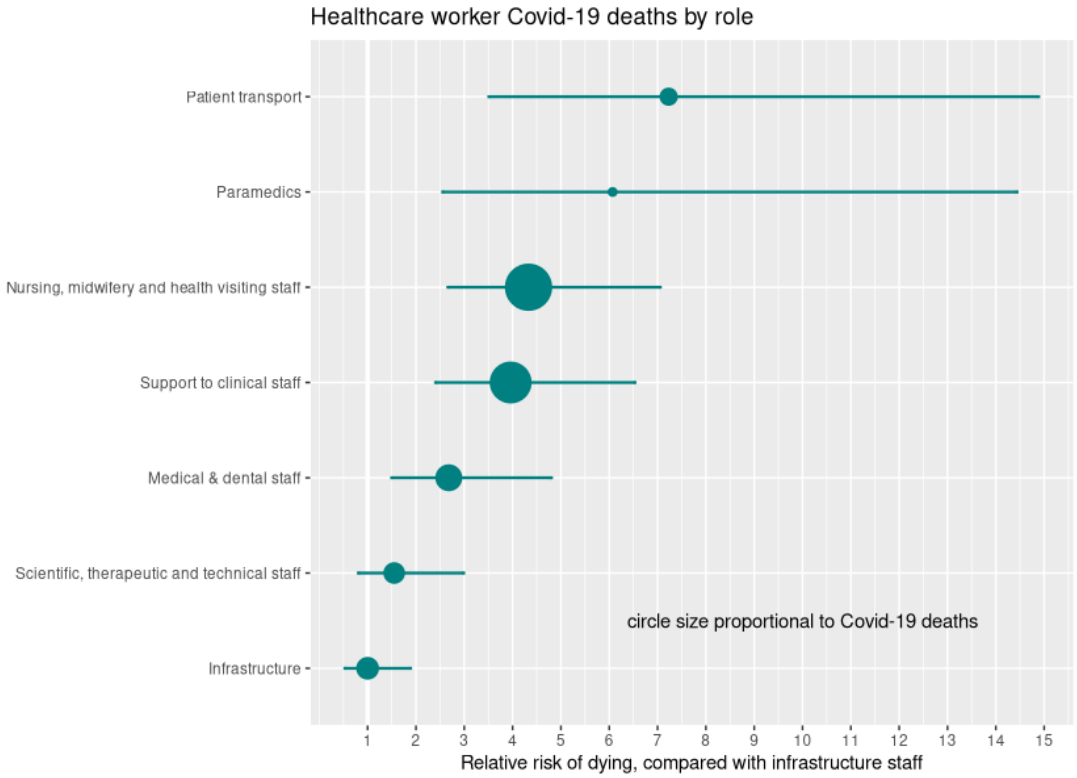

Figure 2. Risk of death, based on ONS and NHS digital data, amongst healthcare workers by role.

There are important limitations to this analysis. First, some important roles are not identified and these include housekeeping and portering staff. The ONS does not separately identify housekeeping staff who work in healthcare and hospital porters are include by the ONS as ‘infrastructure’ staff. Whereas serology studies identify these roles as being associated with increased risk of infection, we are not able to calculate relative risk of mortality. Second, the analysis considers only the individual’s role: a full analysis considering other risk factors would be of greater value, but the data are not available. Third, the data could usefully be updated to include more recent deaths: many of the staff who died were exposed before personal protective equipment guidance changed, which may impact risks.

We also maintain a database of deaths of healthcare staff that are in the public domain and have reported this previously [29-31]. Our database likely misses many deaths as they have not been reported in the media. There appears to be differential reporting with most medical staff deaths reported in the media but far fewer of the deaths of support care staff reported. Despite this, we note six portering staff among 255 deaths (2.4%) in our dataset and the ONS data reports nine. It is certainly plausible that portering staff (and housekeeping staff) are missed by the above analysis.

Again, in considering which healthcare workers to prioritise for vaccination there are other practical and moral factors to consider. There may be a practical imperative to prioritise those healthcare staff who are specifically needed to maintain services and who are particularly difficult to replace, for instance ICU staff may be prioritised above their risk level for this reason and we are currently entering a period of ICU capacity crisis. Morally it may also be right to prioritise those front-line staff whose have had the most constant exposure to COVID-19 and its attendant physical and psychological distress or those whose services have remained busiest throughout. This list likely includes general practice, emergency departments and respiratory, general medicine, geriatric wards and again ICU. However, there will be many other locations also calling out to be prioritised and judgements might become both complex and partisan.

Conclusions

The JCVI priority groups for vaccination are clear, but decision-making on the ground is far more complex. This includes deciding who to prioritise between those aged >80 and frontline healthcare workers. Frontline healthcare workers are at 3- to 4- fold increased risk of infection. In terms of risk this is equivalent to making all staff diabetic, giving them all chronic lung disease or increasing the age of each healthcare worker by around 10 years. There is a strong rationale for prioritising healthcare staff, and in the short term above the elderly. This rationale is amplified by the emergence of the new highly transmissible virus variant which is increasing stress on healthcare services.

Deciding which healthcare workers should be prioritised for vaccination first is complex. It is clear those who have patient facing roles should be prioritised, while those who do not, should not. Decisions about which frontline staff to vaccinate first are less clear. Prioritisation is only an issue while vaccine supplies remain limited, and urgently vaccinating all healthcare staff at risk best protects the workforce and the patients they care for. There is likely currently too much emphasis on an individuals' personal risk and insufficient consideration of occupational risk: both are important in overall risk [32]. The greatest reduction in healthcare staff deaths comes from prioritising ambulance staff, nurses and clinical support staff. However, within all staff groups personal risk factors such as age, sex, ethnicity and comorbidities should also guide prioritisation. Other staff groups might also be considered for prioritisation; for practical reasons – to maintain services; and for moral reasons – to protect those staff who have throughout this year and continue to put their wellbeing and safety at risk simply to attend work and care for others.

Conflicts.

We are both wanting to be vaccinated. One of us has high personal risk. One of us acquired COVID-19 at work. Only one only one of us has been vaccinated so far. An abridged previous version of this paper was published in the Health Service Journal on 31 December 2020. This left out the arguments for prioritising healthcare staff, as guidance had changed on the afternoon before to prioritise staff but discussing the rationale for this remains important. The full article adds important context to the discussion about vaccine priority.

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