



How logical is the UK's vaccine priority ordering?

By Yifei Gong and Stuart McDonald

COVID-19 Actuaries Response Group – Learn. Share. Educate. Influence.

Summary

Nine groups in the UK have been prioritised to be vaccinated in the first phase. In this bulletin, we consider the logic of the priority order by examining the deaths to date in each group where COVID-19 was mentioned on the death certificate.

We find that the priority groups, which comprise less than half the UK population, make up 99% of the observed COVID deaths. The top two priority groups alone cover two-thirds of the deaths.

For each group, we estimate the number of vaccinations required to prevent one COVID death, finding that it increases rapidly as we move down the priority order. Our simple analysis lends strong support to the priority order determined, but should not be interpreted as suggesting that the lower risk groups do not need vaccination.

Introduction

The British medicines regulator, the MHRA, has approved the Pfizer-BioNTech vaccine, and the vaccination programme will start next week. Nine groups of at-risk people have been prioritised to have the vaccine in the first phase. It is expected that 800,000 doses, enough for 400,000 people, will arrive in the coming days.

We have categorised COVID deaths up to 20th November 2020 by each priority group. This allows us to see how many COVID deaths in 2020 might have been prevented or delayed if a vaccine had been available at the start of the pandemic. From this we estimate the vaccinations required to prevent one COVID death, which helps us understand the logic of the vaccination priority order.

Of course, we cannot assume that the pattern of future deaths would be similar to what was observed in the past. For example, care home deaths have been lower in the second wave than the first. Nonetheless, it is informative to consider how a viable vaccine might have mitigated deaths seen to date.

COVID death in this analysis is defined as the deaths with COVID-19 mentioned on the death certificate per ONS. This means that we miss some deaths from early in the pandemic which, [on balance of probabilities are now thought to be undiagnosed COVID deaths](#). It would increase the proportion of deaths in the first two groups if an adjustment was made to include these deaths.

For simplicity, we consider only the immediate risk of death. Groups who are not at significant risk of dying from COVID-19 will nonetheless wish to avoid contracting the disease and suffering the short- and longer-term consequences that arise. It is also important to note that there are good reasons to get vaccinated beyond reducing our own risk. We get vaccinated to protect others, by breaking chains of transmission, as much as to protect ourselves.

We use a simple analysis of death counts rather than an alternative such as Quality Adjusted Life Years (QALYs), which would place more value on younger lives. Whilst a QALY approach would have merit, a simple analysis seems appropriate here, given the relatively short time interval expected between the different priority groups becoming eligible for the vaccine.

Headline results

The table below shows the estimated COVIDs deaths in each group, cumulative percentage of total COVID deaths, approximate population of each group and the vaccinations required to prevent one COVID death.

Vaccination Group		COVID deaths	Cumulative % of total COVID deaths	Additional Population	Vaccinations to prevent one death
1	residents in a care home for older adults	22,800	36%	0.5m	20
	their carers	<100	36%	0.5m*	
2	everyone aged 80 and over	18,900	66%	3.0m	160
	frontline health and social care workers	900	68%	2.5m	
3	everyone aged 75 and over	6,300	78%	2.2m	350
4	everyone aged 70 and over	5,600	86%	3.3m	600
	clinically extremely vulnerable	1,000	88%	1.4m	
5	everyone aged 65 and over	3,100	93%	3.3m	1,000
6	age 16-64 with underlying health conditions; at higher risk	600	94%		
7	everyone aged 60 and over	2,000	97%	3.8m	2,000
8	everyone aged 55 and over	900	98%	4.4m	4,000
9	everyone aged 50 and over	500	99%	4.7m	8,000
10	All the rest	600	100%	37m	47,000
		63,200			

*Assume 1:1 ratio for carers

Group 1 – Residents in a care home for older adults and their carers

[ONS weekly deaths data](#) to 20 November shows 63,157 deaths registered with COVID-19 mentioned on the death certificate in England and Wales, of which 17,319 occurred in care homes. Based on earlier [ONS analysis](#), about three-quarters of care home resident deaths occurred within the care home and the rest in hospital. So we scale up to include deaths of care home residents which occurred in hospital. This gives us 22,800 total deaths of care home residents, around 36% of the deaths.

The estimation for the deaths of their carers is based on the proportion of carers in the UK workforce. We assumed a 1:1 staff ratio in care homes. It's clear though that this isn't a significant assumption and the number of deaths is small – the carers are vaccinated primarily to protect those in their care (this assumes that the vaccine reduces infectiousness, as well as preventing disease, which is expected but currently unproven).

Less than 2 million doses are required to vaccinate the whole Group 1 population, of which half cover all care home residents, preventing about 36% of COVID deaths to date.

Group 2 – All those 80 years of age and over and frontline health and social care workers

According to ONS, 38,406 COVID deaths were aged 80 plus. We estimate that around 19,500 of these were care home residents. Subtracting these leaves about 18,900 deaths of people aged over 80 years and not living in care homes; around 30% of the total COVID deaths.

We have estimated the deaths of frontline health and social care workers based on the proportion of frontline NHS and social care workers in the UK workforce, tripling the risk of exposure given their occupation (which gave a similar number to media reporting for these workers). The proportion of deaths is small (around 1%) – again, this group are vaccinated primarily to protect those in their care.

Vaccinating the Group 1 and Group 2 population, could have prevented about two-thirds of total COVID deaths we have seen to date.

Other Groups

For the remaining groups, our approach is similar. We use total number of deaths in each age group from the ONS data and then remove the deaths already included in previous groups.

- Group 3 – There are 8,611 deaths aged 75–80 based on ONS data. We estimate that around 2,300 were care home residents. This leaves around 6,300 deaths in Group 3; around 10% of the total.
- Group 4 – people aged 70 plus, and those who are clinically extremely vulnerable:
 - There are 5,953 deaths between age 70–74 years with around 340 estimated to be care home residents. This leaves around 5,600 deaths; around 9% of the total.
 - It is expected that the Clinically Extremely Vulnerable would experience a higher mortality rate, but a lower exposure, given that they are shielding. We assume that around 10% of non-care-home COVID deaths under age 70 were clinically extremely vulnerable, based on [Intensive Care data](#) (ICNARC). This is around 1,000 deaths, around 2% of the total.
- Group 5 – people aged 65 and over: After subtracting the deaths in previous groups, there are about 3,100 deaths, which accounts for 5% of the total COVID deaths.
- Group 6 – people aged 16–64 with underlying health conditions which put them at higher risk of serious disease and death from Covid-19: There is limited data to identify the population of this group nor the deaths. We have assumed these account for 10% of COVID deaths under age 64, which gives about 600 deaths, around 1% of the total.
- Group 7 – people aged 60 and over: After removing the COVID deaths of care homes residents, there are about 2,000 deaths, which accounts for 3% of the total.
- Group 8 – people aged 55 and over: After subtracting the deaths in previous groups, there are about 900 deaths, which is about 1% of the total.
- Group 9 – people aged 50 and over: After subtracting the deaths in previous groups, there are about 600 deaths, about 1% of the total.

In summary, the nine priority groups, which comprise less than half the UK population, are likely to cover about 99% of the total COVID deaths. The remaining population, who are below age 50, not part of a medically at-risk group and not working in health or social care, makes up more than half of the UK population, but only covers about 1% of the COVID deaths.

Vaccinations to prevent one death

To assess the logic of the vaccination priority order we consider the approximate number of vaccinations it would have taken within each group to prevent one direct COVID death of someone in that group. Again, we are taking no account here of increased population immunity.

For example, there are about 480,000 residents in care homes [based on ONS data](#), which suggests that around 20 vaccinations would have prevented one direct death of a care home resident. If we include staff in care homes, this increases the vaccinations required to prevent of direct death to 40, which is still significantly lower than 160, the vaccinations required for group two (80 plus, living in the community).

As presented in the table above, the number of vaccinations required increases rapidly as we move down the priority groups, with 1000s of vaccinations required to prevent each direct death in groups five to nine and nearly 50,000 vaccinations to prevent each direct death among the majority of the population not included in the priority groups.

Conclusion

Our simple analysis lends strong support to the priority order determined, but should not be interpreted as suggesting that the lower risk groups do not need vaccination.

5 December 2020