AKE Insights

COVID-19 VACCINE

KEY POINTS

Lockdowns may have succeeded in preventing healthcare systems around the world from being overwhelmed, but only temporarily managed to suppress the virus in most countries. Almost all countries are experiencing second waves of the virus, and new restrictions have been introduced in Europe, the United States, and in a host of other countries. The continued spread of the virus prevents a normalisation of life, economic activity and travel.

Over the last few weeks there have been promising vaccine developments from three different groups - Pfizer/BioNTech, Moderna and the University of Oxford/AstraZeneca. Both China and Russia have previously approved COVID-19 vaccines, but both authorised their use before receiving the results of phase three trials. The vaccines open the possibility that COVID-19 could be contained by mid-2021.

There are huge production and distribution concerns which mean that the next stage in controlling COVID-19 will require substantial logistical competence. The difficulties include:

1. Producing sufficient doses
2. Storing the vaccines
3. Distributing the vaccine to remote areas
4. Ensuring that medical centres are large enough to rapidly vaccinate the population
5. Ensuring that enough of the population takes the vaccine

The logistics involved in distributing the vaccine is immense, and many governments lack the capacity and competence to do so rapidly and effectively. However, these challenges should not distract from the very real progress made in combatting COVID-19. It is likely that only a fraction of the population will be vaccinated in the coming months – but those first in line will be amongst those most vulnerable. At the very least the death rate associated with COVID-19 will continue to drop over the next months, although it could take considerably longer for life to fully normalise.

OVERVIEW

The world is moving closer to controlling the COVID-19 pandemic. Lockdowns may have succeeded in preventing healthcare systems around the world from being overwhelmed, but only temporarily managed to suppress the virus in most countries. Almost all countries are experiencing second waves of the virus, and new restrictions have been introduced in Europe, the United States (US) and a host of other countries. The continued spread of the virus prevents a normalisation of life, economic activity, and travel.

Thus, for most of the world, controlling the spread of COVID-19 requires a vaccine. Over the last few weeks there have been promising vaccine developments from three different groups - Pfizer/BioNTech, Moderna and the University of Oxford/AstraZeneca. The UK Medicines and Healthcare products Regulatory Agency has already approved the BioNTech and Pfizer COVID-19 vaccine, becoming the first country to approve this particular vaccine. Other countries are likely to follow in the coming weeks.

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However, developing the vaccines is only one step towards controlling the virus. There are huge production and distribution concerns, which means that the next stage in controlling COVID will require substantial logistical competence. The difficulties include:

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BACKGROUND TO THE VACCINES

The Pfizer/BioNTech and Moderna vaccines are mRNA vaccines. RNA vaccines are relatively new, and work by instructing our cells to create a 'spike protein' which triggers an immune response from our bodies. This response leads to the production of antibodies and should prevent infection as the real virus enters the body. No mRNA vaccine has ever before been approved by regulators. The Oxford/AstraZeneca vaccine involves injecting a modified chimpanzee virus, which includes a gene for the coronavirus spike protein. The modified virus is detected by the immune system, which then produces antibodies to attack COVID-19 in future. The Oxford/AstraZeneca approach has been used for dozens of major vaccines in the past, including tuberculosis (TB) and malaria.

The Pfizer/ BioNTech vaccine had an efficiency rate of 95 per cent according to stage three trials. In global phase three trials involving more than 43,000 people, 170 were observed to have contracted coronavirus, out of which 162 had been given a placebo. The Moderna vaccine trials show an efficacy rate of 94.5 per cent, and no participant who received the vaccine developed severe COVID-19.

The Oxford/AstraZeneca approach is controversial. Its stage three results showed that it had a 70 to 90 per cent efficacy rate, although the figures cannot be directly compared. However, there are questions about the quality of the trials. The average efficacy was 70 per cent, a number reached by pooling two different dosing protocols. The trials involved one set of participants receiving two identical doses a month apart, while the other group received a half-dose, and then a full dose. The efficacy for the first, larger group was 62 per cent. In the second subgroup, it was 90 per cent. The administration of the half group was only given to people aged 55 and below, and its sample size is small. Without further trials it is unlikely that the vaccine will be approved by regulators.

DISTRIBUTION OF THE VACCINES

Vaccine developers claim that they can make sufficient doses for more than one-third of the world's population by the end of 2021. The three vaccines created by the aforementioned developers could produce over 5 billion doses by the end of 2021, which could cover around 2.5 billion people globally. Around half of all the doses have been pre-ordered by the European Union (EU) and five other rich countries. Some developing countries may be able to get a large early supply - normally in cases where the country has a large local pharmaceutical industry and deals with local manufacturers, for example India, although those are exceptions. By some estimates it could take until 2024 or 2025 for much of the developing world to have access to the vaccine. The impact could be to worsen global health inequalities, continue to result in travel restrictions to some nations, and create further economic difficulties for developing countries.

However, sufficient production is only the start of the challenge. An important difference between the vaccines is storage. The Pfizer/BioNTech vaccine needs to be stored in ultra-cold temperatures of minus 70°C. There is limited infrastructure in place globally to store the vaccine at that temperature, and only major medical centres and research institutes currently tend to have the facilities to do so. The vaccine can be temporarily stored at higher temperatures however, and Pfizer has helped address the storage and distribution problem with small shipping containers which use dry ice to keep the vaccines cooled. However, dry ice is a by-product of gasoline manufacturing, and with lockdowns cutting demand for gasoline, dry ice supplies have also shrunk. Dry ice can also only be transported by ground, with restrictions on sea transport and air intense, potentially posing a challenge for rural areas.

Moderna's vaccine can be stored at minus 20°C, although even maintaining this temperature will be a challenge. While developed countries are likely to eventually develop storage facilities for these vaccines – with some countries already ahead of the curve - developing countries are likely to lag. The Oxford/AstraZeneca vaccine can be stored at normal refrigeration temperature, which is a large advantage over the other two.

In theory, the Oxford/AstraZeneca's vaccine should be the easiest to distribute, even if it is potentially the least effective and without further trials could struggle to get approval. Other developments, including attempts by Pfizer to create a powder version of the vaccine, could reduce refrigeration requirements – although these developments are unlikely until next year at the earliest.

Even when medical centres have access to the vaccine, it will be a challenge to rapidly immunise a large proportion of the population. There are limits to the number of medical professionals who can administer the vaccine, and all need to be trained on how to navigate the extreme storage requirements of the vaccines, including how to defrost, dilute and administer them. The result is that the number of people vaccinated will lag. The limits of vaccinations may then not be the availability of the vaccine, but instead the difficulties in physically vaccinating people.

A final challenge then is persuading the public to take the vaccine. A recent YouGov poll showed that only 42 per cent of US citizens are willing to take the vaccine, far below the 70 per cent required to develop herd immunity and contain the virus. The US may be an outlier, but other countries could still struggle to reach the mass required. Some of those refusing the vaccine are 'anti-vaxxers', but a greater proportion are those who believe that the development and approval process has been rushed. There also remains the strong possibility of mis- and dis-information regarding the vaccines from such groups which might further dissuade others.

OUTLOOK

The COVID-19 vaccine distribution challenge is therefore significant. The logistical capacity needed to distribute the vaccine is immense, and many governments lack the capacity and competence to do so rapidly and effectively. However, these challenges should not distract from the very real progress made to combat COVID-19. It is likely that only a fraction of the global population will be vaccinated in the coming months – but those first in line will be amongst those most vulnerable in developed countries. At the very least the death rate associated with COVID-19 in countries who have obtained does of the vaccine will continue to drop over the next months, although it could take considerably longer for life to fully normalise.