

Vaccine inequity generates dangerous mutants and prolongs COVID - 19 pandemic “No one is safe until everyone is safe”

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The COVID-19 pandemic is the greatest challenge facing mankind, which has caused immense human suffering and enormous economic losses all over the world. Safe and effective vaccines to meet this challenge is considered the most promising approach for curbing the pandemic.

The novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus causing coronavirus disease 2019 (COVID-19), has spread rapidly throughout the world since the outbreak of viral pneumonia in December 2019 in Wuhan, China.¹

On March 11, 2020, the World Health Organization (WHO) formally declared COVID-19 a pandemic. This has given a real boost for researchers at dozens of giant pharmaceutical and biotechnology companies and universities to develop effective vaccines that can protect people from infection with the emerging novel coronavirus and save humanity from the pandemic.²

In an unprecedented record period that did not exceed one year, scientists were able to develop several safe and effective vaccines tested on tens of thousands of volunteers around the world. The global regulators have given the green light to a number of these vaccines for emergency use authorization to prevent the novel coronavirus SARS-CoV-2 infection. They included two mRNA vaccines - Pfizer - BioNTechs (BNT162b2), and Mod-

erna (mRNA-1273), three adenovirus-based vaccines - AstraZeneca (ChAdOx1), Sputnik V (Gam-Covid-Vax), and Johnson and Johnson (Ad26.COVS.2.S), and three inactivated virus vaccines - Sinopharm (BBIBP-CorV), Sinovac (CoronaVac) and Covaxin (BBV152). These vaccines have saved countless people from serious illness and death, but they do not completely stop the spread of the virus.³

In December 2020, the largest vaccination campaign in history had begun in a global effort to stop the COVID-19 pandemic. By the end of September 2021, there were more than 6.5 billion administered doses worldwide. However, the distribution of the vaccines was not equitable and fair.⁴

On August 12, 2021, The Lancet medical journal published an editorial calling for equitable distribution of COVID - 19 vaccines. The journal stated that by August 9, 2021, only 12.6 million of the 4.46 billion doses administered globally were in low-income countries, whereas 3.65 billion have been administered in high-income and upper-middle-income countries.⁵

According to the Global Dashboard for Vaccine Equity, as of August 6, 2021, just 3.72 per cent of people (or 1 in 27) in low-income countries have been vaccinated with at least one dose, compared to 60.93 per cent (or 1 in 2) in high-income countries.⁶ The vaccination rate of people who have received at least one vaccine dose in the UK and USA was around 70.92 per

- Safe and effective vaccines is the most promising approach
- Covid 19 vaccination is the largest vaccination campaign in the history
- Antibodies are not the only measure of effectiveness of the vaccine
- No urgent need for booster doses to fully vaccinated individuals

cent and 65.2 per cent, respectively. However, just 0.09 per cent and 1.15 per cent of the population have received one dose in the Democratic Republic of the Congo and Papua New Guinea, respectively.⁷

Vaccine roll-out among low and high-income countries remains uneven, with some countries having secured vaccines for more than 100% of their population, while there are countries that have vaccinated less than 5% of their population.⁸

UN Secretary-General António Guterres has said that COVID-19 vaccines must be available to everyone, everywhere. "Vaccinationalism is self-defeating and would delay a global recovery".⁹ Recently (October 7 2021), speaking at an event with the WHO to launch a new global vaccination strategy, he said that the inequitable distribution of vaccines was dangerous because it could give rise to new variants and lead to more deaths. He appeals for 8 billion \$ to allow for vaccinating 40 per cent of the world by the end of 2021. He added that vaccine inequity is "not only immoral but also stupid" because it will give rise to new variants and more deaths.¹⁰

The WHO Director-General, Dr Tedros Adhanom Ghebreyesus, has called global vaccine equity "the challenge of our time" and said that "we are failing."¹¹

Unequal distribution of vaccines between rich and poor countries leaves millions of people vulnerable to the deadly virus and allows even more dangerous variants to emerge and spread across the globe.

The WHO has set a global target of 70 per cent of the population of all countries to be vaccinated by mid-2022, but to reach this goal, more equitable access to vaccines will be needed.⁷

COVAX, an international collaborative body led by the WHO and Global Alliance for Vaccines and Immunization (GAVI), aims to accelerate the development and manufacture of COVID-19 vaccines and guarantee fair and equitable access for every country in the world. Its goal is to provide at least 2 billion doses of WHO-approved vaccines to participating countries by the end of 2021, where 92 of the poorest countries in the world will receive about 20 per cent of their needs. So far, COVAX has made some progress, but it is still not sufficient to fill the huge gap in vaccine distribution between high and low-income countries.^{12,13}

While millions of people around the world are yet to receive their first dose of the vaccine, many high-income countries have already offered booster doses of COVID-19 vaccines to their citizens, which could divert much-needed doses away from low-income countries.

"We cannot accept countries that have already used most of the global supply of vaccines using even more of it, while the world's most vulnerable people remain unprotected", said WHO Director-General on August 4, 2021.¹⁴

So far, there is no agreement among scientists that a booster dose of COVID-19 vaccines is necessary for the entire population. Bernal et al. have demonstrated that only modest differences in vaccine effectiveness were noted with the delta variant compared with the alpha variant after receiving two vaccine doses. Both BNT162b2 (Pfizer-BioNTech) and ChAdOx1 nCoV-19 (AstraZeneca) vaccines were highly effective, especially at preventing severe disease, hospitalization, and death.¹⁵

A recent study published in The Lancet on October 4, 2021, confirms that Pfizer-BioNTech vaccine was 90 per cent effective against

hospital admissions up until around six months after full vaccination. Furthermore, the vaccine remained effective against all “variants of concern” of the virus, including delta variant, and among all age groups. However, effectiveness against infections declined to 47 per cent after five months.¹⁶

Following COVID-19 vaccination, SARS-CoV-2 antibody levels wane over time. However, the level required to elicit full protection is not yet known. It is worth noting that immune responses to COVID vaccines depend on more than one mechanism of protection, namely humoral and cellular immunity. Therefore, a low level of antibodies does not necessarily mean a loss of protection.

On September 1, 2021, the European Centre for Disease Prevention and Control (ECDC) said that “based on current evidence, there is no urgent need for the administration of booster doses of vaccines to fully vaccinated individuals in the general population”. The report also mentioned that additional doses should be considered for people with severely weakened immune systems as part of their primary vaccination.¹⁷

A more even distribution of the COVID-19 vaccines benefits everyone, as it reduces not only the risk of serious illness and death, but also the emergence of more dangerous mutants of the SARS-CoV -2.

All viruses, including SARS-CoV-2, are constantly changing through genetic mutations. Most changes do not cause concern; however, there is a concern that some variants may progress to becoming more infectious, causing more serious illness, or avoiding the protection offered by vaccines.¹⁸ The Centers for Disease Control and Prevention (CDC) and WHO have classified four variants as “Variants of Concern” (alpha, beta, gamma, and delta) that pose an increased risk to global public health.¹⁹

Uncontrolled high spread of the virus increases replication in the host cells and generates mutants, especially in countries where populations are not vaccinated. An example is what happened in India in late spring and early summer 2021, where a new variant, the Indian

variant, which later was renamed the delta variant originated, killing thousands of mostly unvaccinated people, and spreading later to other countries and becoming the dominant variant in the whole world.²⁰

The newly emerged delta variant in India was followed by a sharp increase in the number of reported COVID-19 cases and deaths in several countries worldwide. In the UK, a rapid increase in cases with delta variant has been reported associated with travel from India. On May 6, 2021, the UK designated lineage B.1.617.2 as a variant of concern.²¹

The delta variant (B.1.617.2) is more contagious than the other SARS-CoV-2 variants, spreading about 40% to 60% faster than the alpha variant, which was 50% more contagious than the original strain that appeared in China in late 2019. With less than one per cent of the currently circulating alpha, beta and gamma mutants, the delta mutant is virtually the dominant one around the world and has been monitored in more than 185 countries.²²

Common to the new variants of SARS-CoV-2 is that they have several mutations in the spike protein – the most important target of the COVID vaccines - that increase the ability of the virus to infect human cells and make the virus more resistant to antibodies produced following previous SARS-CoV-2 infection or vaccination.^{23,24} One of the most important mutations in the delta variant is P681R in the spike protein, which makes it easier for the virus to enter human cells.²⁵ In addition, new sub-variants of delta (delta plus) have already emerged. This development of new variants and sub-variants will continue if the spread of infection remains high.

The delta variant constitutes now more than 99 per cent of SARS-CoV-2 variants in the whole world. It has spread rapidly to other countries including well-vaccinated countries, like the UK, USA, and Germany, causing a surge in new cases of COVID-19, and hospitalization, affecting primarily younger age groups and those who are unvaccinated or those with low immune response to vaccination. The widespread of the delta variant in early summer

2021, shows that an outbreak of COVID-19 anywhere in the world could become an outbreak everywhere, which in turn prolongs the COVID-19 pandemic. This is a reminder of the UN and WHO's vaccination message "No one is safe until everyone is safe".

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Abbreviations list: Centres for Disease Control and Prevention (CDC), Coronavirus disease 2019 (COVID-19), European Centre for Disease Prevention and Control (ECDC), Global Alliance for Vaccines and Immunization (GAVI), Messenger Ribonucleic Acid (mRNA), Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), United Kingdom (UK), United Nations (UN), United State of America (USA), World Health Organization (WHO).

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