Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

The global impact of disproportionate vaccination coverage on COVID-19 mortality

Published Online
June 23, 2022
https://doi.org/10.1016/
S1473-3099(22)00417-0

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Over the course of the first year of COVID-19 vaccination, between Dec 8, 2020, and Dec 8, 2021, 8·33 billion doses were administered among 4·36 billion people globally.[1] In their study in *The Lancet Infectious Diseases*, by fitting a mathematical model to excess mortality, Oliver J Watson and colleagues[2] estimated that in 185 countries and territories 31·4 million COVID-19-related deaths would have occurred during this timeframe in the absence of COVID-19 vaccination. They estimated that 19·8 million deaths were averted by COVID-19 vaccination. Consequently, the number of lives saved by COVID-19 vaccination markedly exceeded the death toll that has occurred. Nonetheless, even more lives could have been saved by improving the equitability of vaccination coverage worldwide. Specifically, an estimated 156 900 additional deaths would have been averted if the COVID-19 Vaccines Global Access (COVAX) Facility's vaccination target of 20% (for each Advance Market Commitment country) had been attained, and an estimated 599 300 additional deaths would have been averted if WHO's 2021 COVID-19 vaccination target of 40% (for each country) had been attained.[2] Meeting these targets, particularly in low-income countries, is challenged by myriad obstacles that require international support to overcome.

The primary barrier is the lack of access to vaccines due to a combination of restricted supply and funding in resource-constrained settings. Several high-income countries secured advanced purchasing agreements with vaccine manufacturers.[3,4] In the case of the USA, the number of vaccine doses purchased even before production was enough to fully vaccinate its entire population three times over.[4] By contrast, low-income countries were unable to pay the premium prices negotiated by high-income countries, delaying the delivery of vaccines.[3,4] In Burundi, for example, vaccine rollout was initiated 10 months later than in the USA.[1]

The inequitable distribution of vaccines has prolonged the pandemic, and exacerbated the probability and frequency of the emergence of variants of concern. Additionally, many of these novel variants evade host immunity, thereby eroding vaccine efficacy, as well as increasing transmissibility. Given the rapid global dissemination of these variants, the worldwide burden of morbidity and mortality due to COVID-19 is thereby affected. Provision of vaccine doses from high-income to lower-income countries is therefore not only moral but also pragmatic. The G7 countries have failed to meet their 2021 commitments for donation of vaccines, with the delivery of respective commitments to low-income countries and middle-income countries ranging from 31% by Japan to 8% by Canada.[3] Concerningly, contentious negotiations between political parties in the US Senate have resulted in the exclusion of financing for international COVID-19 vaccination, imperiling global vaccination aid programmes.[5]

Beyond the donation of vaccines to low-income countries, vaccine distribution infrastructure is fundamental to achieving vaccination coverage targets. For instance, more than 1·3 million donated doses were returned by the Democratic Republic of the Congo's Government and more than 114 000 doses expired because of an inability to maintain cold-chain storage and administration of vaccines.[6] Consequently, vaccination coverage of only 0·07% was achieved in the Democratic Republic of the Congo by December, 2021. The model created by Watson and colleagues[2] estimates that if the WHO vaccination target had been met, 32 070 additional lives could have been saved in the Democratic Republic of the Congo (country estimates are provided in the appendix of the Article).

Vaccine hesitancy is an increasingly pervasive challenge across the world. Within Nigeria, for example, vaccine misinformation has been widespread,[7] leading to vaccination coverage of only 1·82%. Watson and colleagues[2] estimate that if the WHO-targeted coverage of 40% had been achieved in Nigeria, 96 420 additional deaths could have been averted. Vaccine misinformation has also affected high-income countries, such as the USA, where public health responses to COVID-19 have become politically polarised.[8] Transparency during evidence-based vaccine approval processes is fundamental to trust. If vaccine refusal remains entrenched, mandates might become necessary to protect individuals, reduce SARS-CoV-2 transmission, and mitigate the emergence of more virulent variants.

Vaccination programmes have also been disrupted by violent conflict. For example, aid agencies have been unable to distribute COVID-19 vaccines, among other vaccines, in Houthi-controlled regions of Yemen.[9] Similarly, there has been cessation of vaccination in areas of Ukraine targeted by the Russian invasion.[10] Watson and colleagues[2] estimate that if the WHO targeted coverage of 40% had been achieved, 14 230 additional lives could have been saved in Yemen and 19 300 additional lives could have been saved in Ukraine.

The saving of more than 19 million lives by the unprecedented rapidity of development and roll-out of COVID-19 vaccines is an extraordinary global health feat. Nonetheless, millions of additional lives could have been saved by more equitable distribution of vaccines. The most effective approaches to promote vaccination coverage worldwide are multifaceted, requiring improvements in vaccine supply, cold-chain operations, and public confidence. High coverage in an individual country not only benefits that country but contributes to a worldwide reduction in SARS-CoV-2 transmission and emergence of novel variants. An enduring collective response is both pragmatic and ethically imperative.

We declare no competing interests.

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COVID-19 vaccinations for children

It is widely accepted that vaccination is key to bringing the COVID-19 pandemic under control by preventing severe disease. Due to the global disease distribution and diverse populations affected, multiple vaccine platforms are needed to overcome limitations in manufacture, logistics, and efficacy. Despite the global administration of up to 11·84 billion doses[1] of COVID-19 vaccine to healthy adults and people at increased risk of disease, vaccinations for children are an emerging consideration.

In *The Lancet Infectious Diseases*, Krishna Mohan Vadrevu and colleagues[2] provide initial safety and immunity data in children in India, who received a whole-virion adjuvanted inactivated SARS-CoV-2 vaccine (BBV152, Bharat Biotech International, Hyderabad, India). In Vadrevu and colleagues' study, participants were enrolled into one of three groups (ages ≥2 to 6 years, >6 to 12 years, and >12 to ≤18 years), and monitored for solicited and unsolicited adverse events after vaccination. The vaccine is authorised for use in adults by WHO, although not by the US, UK, or EU regulatory authorities.

To grant licensure, regulatory authorities must consider the potential risks and benefits of vaccination. In paediatric populations, both sides of this equation are not yet fully understood. Risks that must be considered include patients at additional risk of severe disease, long COVID, and the potential for children to contribute to disease transmission to other vulnerable groups such as older people, or to teachers and caregivers (which could, in turn, lead to super-spreader events).


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Published **Online** June 24, 2022 https://doi.org/10.1016/S1473-3099(22)00414-5

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