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Why are vaccination rates lower in low and middle income countries, and what can we do about it?

Hasan Mahmud Reza and colleagues argue that access to vaccines enabled by predictable supply of vaccine doses and delivery to remote areas are critical for vaccine uptake in low and middle income countries

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Covid-19 vaccine distribution has brought global inequities in healthcare access into sharp relief. In the first six months of vaccine distribution, over 90% of all doses were given to residents of high and upper middle income nations. Many other countries are now catching up, but less than 21.5% of Africans were vaccinated 18 months after vaccine development.¹

There are competing narratives as to why vaccination rates in low and middle income countries are lagging behind. The governments of these countries and public health experts have argued that high income nations effectively hoarded covid-19 vaccines by pursuing direct purchasing agreements with vaccine manufacturers instead of buying through the Covid-19 Vaccines Global Access (Covax) initiative.²⁻⁴ The ensuing bidding wars, lack of effective global price regulations and barriers to local vaccine production, in their opinion, have hindered access to vaccines for low and middle income countries.⁵ By contrast, some drug company executives have claimed that high rates of vaccine hesitancy in low and middle income countries make allocation of greater vaccine stock to those countries inefficient, as doses would go unused, citing cases of unused vaccines reaching their expiration dates in Africa.⁶ Less frequently discussed are supply chain problems in low and middle income countries, which might be key limiting factors to widespread vaccination, especially in remote, rural areas.

These explanations are not mutually exclusive: both deficiencies in international supply and “last mile” infrastructure challenges to reach remote communities have hampered covid-19 vaccine distribution at different points during the pandemic.⁷ Further, a new vaccine must be socialised in any given population to overcome hesitancy, but governments might understandably be reluctant to engage in community mobilisation if the subsequent arrival of doses remains uncertain. The absence of predictable international vaccine supply deprives health systems of important opportunities to develop internal distribution networks and troubleshoot infrastructural challenges, and, we argue, has likely been an important driver of lagging vaccination rates against covid-19 in low and middle income countries.

International supply chain problems trigger a chain of events

Very few countries had the ability to produce large quantities of covid-19 vaccine internally when the vaccines were developed so initial access for all

countries hinged on just a few manufacturers. The surge in global demand created intense competition, and the ability to pay primarily determined which buyers were prioritised.⁴ Covax was set up to aid low and middle income countries with vaccine purchases, through both financial and bargaining assistance. Although Covax tackled the financial constraints to vaccine access, wealthier countries directly negotiating with drug companies were still prioritised for vaccine distribution, and the vaccine doses pledged to Covax beneficiary countries have yet to be completely fulfilled.⁴ At the same time, intellectual property waivers were not granted, limiting technology transfer and preventing low and middle income countries from producing covid-19 vaccines locally.⁵

The consequences of delayed vaccine delivery go beyond leaving the population vulnerable to infectious disease risks for longer. Without adequate supply of covid-19 vaccine doses (in most cases from international sources), the governments of low and middle income countries could not engage in the experimentation and “learning by doing” that is necessary to build internal distribution systems for new vaccines, some of which have specific cold storage requirements. Untested vaccine distribution systems within countries typically cannot efficiently deliver a sudden high volume influx of vaccines, especially on a rapid timeline. As a case in point, some rich countries donated vaccine doses close to their expiration dates that would be wasted domestically, but low and middle income countries found these batches difficult to administer in time. Several African countries received doses with short shelf lives, which ultimately had to be re-exported or destroyed.⁸

Bangladesh offers an informative example about the way in which delayed dosage arrival and growing uncertainty about vaccine availability hindered longer term access to vaccines. Bangladesh has an accomplished history of childhood immunisation and a nascent drug industry but only limited local production capacity with respect to covid-19 vaccines.⁹ Although Bangladesh procured some AstraZeneca vaccines relatively early in January 2021 from the Serum Institute of India, the government of India halted all vaccine exports to prioritise internal vaccinations, and most of the promised doses were never delivered.¹⁰ The institute was contracted to provide two billion doses to low and middle income countries under the Covax initiative with a proportionate share scheduled to go to Bangladesh,

but this promise also fell through when the US government imposed a temporary ban on exporting critical raw materials to the Serum Institute of India, severely disrupting its production capacity.¹¹ These developments created massive uncertainty in Bangladesh about the timing and quantity of any vaccine arrivals, potentially complicating vaccination programme planning. When a million doses of Pfizer vaccines arrived on 31 May 2021, the rollout was limited to only seven hospitals located in Dhaka city, partly because the logistics were not ready for nationwide rollout of a new vaccine with ultra-cold storage requirements.¹² The Bangladesh government announced plans to expand vaccine delivery facilities in 26 districts that had cold room facilities but efforts lagged for peripheral and remote regions.¹³ Many of the vaccination centres identified in the government's initial strategic plan remained non-functional.¹⁴ Nepal and Pakistan experienced similar obstacles.¹ The repeated promises of vaccine supply from high income countries to low and middle income countries largely remain unrealised with only 45% of the 1.1 billion promised doses donated through Covax as of 17 February 2022.¹⁵

When vaccines first arrived in Bangladesh in early 2021, demand seemed low outside the major metropolitan areas.¹⁶ Only 21.5% of the country's population was fully vaccinated almost a year after the first vaccine doses arrived in the country.¹⁷ Does this instead imply that vaccine hesitancy among rural populations is a crucial factor in covid-19 vaccination rates?

Access is a prerequisite for vaccination

Solis Arce et al analysed the drivers of covid-19 vaccine hesitancy using harmonised data collected from 15 survey samples covering 10 low and middle income countries.¹⁸ They found that covid-19 vaccine acceptance was higher in every sample from low and middle income countries (average 80%) than in those from Russia or the United States. Another systematic review found the lowest rates of hesitancy in low and middle income countries like Ecuador, Indonesia, Malaysia, and China—nearly half the hesitancy rates of Italy, US, Kuwait, Poland, and France.¹⁹ This hesitancy gap is consistent with attitudes towards vaccines predating the covid-19 pandemic: over 90% of South Asians and East Africans consider vaccines safe, compared with only 59% of Western Europeans.²⁰ Low and middle income countries are not all the same: there is substantial variation in vaccine acceptance rates between and within them.^{21–24} Studies in sub-Saharan Africa, for example, have found a higher degree of covid-19 vaccine acceptance among people with less education, whereas people in South Asia with less education are more hesitant.¹⁸

When it is expensive to get to vaccination centres, not many people can afford to attend, and this is observationally equivalent to—and often confused with—vaccine hesitancy.²⁵ Over 80% of respondents in rural Sierra Leone, for example, indicated their willingness to receive a covid-19 vaccine in representative phone surveys conducted from October 2020 to January 2021, but only 10% of the eligible population of the country had received the first dose and less than 3% had received a second as of 11 October 2021.¹⁸ Access difficulties are acute in communities situated far from a limited number of vaccination centres. In subsequent rounds of the same phone surveys, respondents in rural Sierra Leone reported that it takes an average of 85 minutes to travel to the nearest vaccination clinic by motorbike, which costs about \$6.5 each way.²⁶ In communities where most people survive on \$1.50 a day, this is prohibitively expensive. Previous research on delivery of child vaccines also points to the importance of accessibility for vaccination in low and middle income countries.^{27 28} A study published in 2010 tested the effect of conducting reliable

immunisation camps in remote villages in India and found that the presence of camps that villagers can easily access increased vaccination rates by 200%.²⁹

Populations in which access constraints make getting a jab highly inconvenient might look hesitant, and hesitancy and access are not mutually exclusive deterrents to vaccine uptake. Any programme to solve last mile delivery challenges and improve access to a novel intervention must be accompanied by carefully designed strategies to socialise the new technology and engage communities in information and uptake campaigns. Yet, conducting such campaigns can be politically costly for a government if the international delivery of vaccine doses remains uncertain and the government is unable to follow through with distribution.³⁰ Responding to last mile delivery challenges identified in Sierra Leone beyond the arrival of vaccine stock, for example, vaccination sites were decentralised, expanding from 72 to 724 across the country,³¹ and community mobilisation activities to raise vaccine awareness began at the grassroots level.³² With ample doses supplied across vaccination sites, the Sierra Leone government introduced a monthly five day “surge” vaccination campaign at peripheral health units in more rural locations as a way to decrease the cost of access,³³ and the country's vaccination rate showed discrete jumps after each surge campaign.³⁴

In other words, even the most successful initiatives to counter vaccine hesitancy will fail to raise vaccination rates if actual doses are not available and accessible to the wider population. Thus, where access is a fundamental problem, policy responses must include predictable vaccine supply (perhaps generated by heightened local production capacity) alongside tested internal vaccine distribution infrastructures that can reach remote, rural areas of low and middle income countries.

Conclusions

Although there are competing narratives as to why covid-19 vaccination rates are lower in low and middle income countries, the cause is, of course, multifactorial. In our view, international supply chain complexities and absent local vaccine production complicated national planning efforts to bring covid-19 vaccine programmes to scale. Country experiences with covid-19 vaccination programmes have generated important insights that might help us craft better policies to control future pandemics. First, all countries have an important role in protecting global health. Financial contributions from high income nations towards pooled purchasing agreements like Covax will be insufficient if treatments, diagnostics, or vaccines are stockpiled to prioritise access for high income countries.

Although many low and middle income countries ultimately benefited from financial support, the early lack of physical product had adverse consequences for awareness-raising, community mobilisation, and overall pandemic response efforts.³⁵ Developing local production capacity in a broader set of low and middle income countries might have been a sensible investment, given the procurement challenges experienced. Africa, for example, currently has limited capacity for the production of vaccines and faced greater difficulties in procuring supplies relative to countries like India and Brazil that had well established local manufacturing facilities.³⁶ Rwanda and Senegal have announced partnerships with Pfizer to host Africa's first covid-19 vaccine plants,³⁶ and investing in manufacturing capability in low and middle income countries should not be neglected from future pandemic preparedness planning efforts.

Low and middle income countries also need to develop robust internal distribution systems for vaccines, especially for remote, rural populations, because deficiencies in supply and last mile delivery challenges can amplify each other. The governments of these countries need to engage in “learning by doing” to develop robust distribution infrastructures and need to grapple with logistical challenges to implement a far reaching vaccination campaign. One might argue, on the other hand, that in the case of the covid-19 pandemic, low and middle income countries had both substantial experience in mass immunisation campaigns for children²⁵ and a generous lead time between the onset of the pandemic and the availability of vaccine doses to plan and prepare for distribution to their populations. But administering covid-19 jabs to the entire adult population as quickly as possible is a fundamentally different logistical and administrative challenge than childhood vaccines administered at defined intervals during infancy.³⁷ Further, troubleshooting hypothetical challenges during planning staged will almost always need refining as context evolves and problems emerge during implementation, as both challenges and feasible solutions might not be anticipated.

Low and middle income countries that raised their vaccination coverage in early 2022 implemented creative approaches to enhance access, such as taking healthcare workers and vaccination doses to local communities, instead of trying to bring everyone to centrally located healthcare facilities, setting up temporary neighbourhood vaccination centres, or using mobile vaccination vans.³⁸ Finally, the acceptability of solutions might also need to be tested with communities.

The experience of low and middle income countries in the covid-19 pandemic shows that predictable vaccine supply is essential, not only for community mobilisation and awareness raising, but also to develop internal distribution capabilities and test solutions for the challenges that inevitably arise. When internal distribution systems are under-developed, vaccine hesitancy could become a scapegoat, distracting attention from the deeper access challenges that need to be tackled.

Key messages

- Vaccine hesitancy is not the only driver of low vaccination rates in low and middle income countries; External supply restrictions and internal distribution challenges to the last-mile are important contributors
- Low and middle income countries need to experiment with innovative approaches to ensure cost-effective delivery of vaccines to remote rural populations
- This requires a predictable physical vaccine supply from drug manufacturers and high income countries
- When low and middle income countries have identified efficient ways to reach rural areas, they can then be scaled up to their populations

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