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## Closing the global vaccine equity gap: equitably distributed manufacturing

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Although the unprecedented speed of development of COVID-19 diagnostics, vaccines, and treatments has been lauded, one shortcoming that persists is vaccine inequity.<sup>1</sup> The global roll-out of vaccines has been uneven, progressing expeditiously in many high-income countries (HICs) and delayed in low-income countries (LICs).<sup>2</sup>

Early in the COVID-19 pandemic, vaccine production was insufficient to meet global demand. Many wealthy countries turned inwards, procuring vaccine doses through exclusive bilateral deals for their domestic populations (vaccine nationalism), and manufacturing countries, such as India, imposed temporary export bans.<sup>2,3</sup> These events catalysed the global vaccine inequity that is still evident today. During the past 19 months, there has been considerable increase in vaccine production globally with a projected output of 24 billion total doses by mid-2022.<sup>4</sup> Unfortunately, as of May 2, 2022, only 15.7% of eligible individuals

in LICs have received a single vaccine dose, largely due to constraints in both availability and absorptive capacity.<sup>5</sup> The focus has now shifted to increasing the distribution of doses to LICs that are purchased directly by respective governments or procured through multilateral initiatives, such as COVID-19 Vaccines Global Access (COVAX) and Access to COVID-19 Tools (ACT) Accelerator. However, these attempts, along with other approaches, such as COVID-19 vaccine dose sparing and time-limited intellectual property (IP) waivers, do not address an underlying structural driver of vaccine inequity: the insufficient number of vaccine manufacturers and the location of their factories predominantly in HICs.<sup>6</sup> In LICs there is a need for access to local capacity for manufactured vaccines that is uncoupled from donated doses or excess production capacity in HICs (vaccine sovereignty).<sup>3,7-9</sup>

The emergence of immunity-evading SARS-CoV-2 variants of concern or another pandemic caused by a new pathogen risks the possibility of repeating the cycle of vaccine nationalism and inequity. It took many months to reach the point of large-scale COVID-19 vaccine production, at considerable cost to human lives, health-system capacity, social stability, and economic productivity. In the future, vaccines must be made readily available to meet global health security needs in a fair and equitable way.<sup>1</sup>

Reports from advisory panels to the G20 and WHO have recommended the creation of a globally coordinated network of vaccine manufacturing facilities with robust distribution channels.<sup>10,11</sup> This vaccine manufacturing capacity should be modular with respect to underlying vaccine technology (eg, mRNA, viral-particle based, and protein subunit) and geographically diversified. Crucially, adequate financing mechanisms need to be established to sustain these facilities during non-pandemic periods. These financing mechanisms could take the form of long-term contracts and revenue guarantees, advance market commitments, and bond structures that are backed by HICs.<sup>12,13</sup> Furthermore, equitably distributed vaccine manufacturing capacity will yield additional benefits, such as vaccine production for



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other communicable diseases, increased investments in biomedical innovation, and public health infrastructure strengthening.

There are ongoing efforts at the regional and national level to enhance global vaccine manufacturing capacity. The African Union launched the Partnerships for African Vaccine Manufacturing, with the aim of increasing the share of vaccines manufactured in Africa from 1% in 2021 to 60% by 2040.<sup>14</sup> The Pan American Health Organization has similarly created a regional platform to advance the manufacturing of COVID-19 vaccines and other health technologies in the Americas.<sup>15</sup> WHO has established a hub and spoke model for mRNA technology transfer that is centred in Cape Town, South Africa (hub) with links to countries in Africa and Asia.<sup>16</sup> The primary goal is expansion of mRNA vaccine production capacity by making the necessary operating procedures, technology transfer, and specialised training available to local manufacturers.<sup>16</sup> Furthermore, several companies have made bilateral arrangements with individual LICs to increase vaccine manufacturing capacity.<sup>17-19</sup>

Although these efforts are promising, they are fragmented and insufficient to achieve the goal of equitably distributed and sustainable vaccine manufacturing capacity. This is largely because there is neither adequate strategic coordination to ensure current efforts are aligned towards a common goal or a systems-level approach to identify and address key barriers (eg, intraregional trade tariffs, insufficient long-term financing, and inadequate investments towards workforce training). Advancing equitably distributed vaccine manufacturing capacity is also a highly capital intensive (estimated at US\$1.5 billion for a single facility), complex, and long-term undertaking.<sup>20</sup> This scale of investment means that funds must be strategically deployed to maximise value and matching contributions from both public and private entities will be required. Additionally, close alignment with and adaptation to the local needs and policy goals (ie, priority population segments and target vaccination rates) of governments in LICs will be key. Steps will also need to be taken to create the necessary circumstances that derisk public-private investments to expand vaccine manufacturing capacity. Beyond building new manufacturing facilities, a broader set of considerations must

be addressed to ensure the long-term viability of vaccine manufacturing capacity, including regulatory harmonisation, last-mile delivery, workforce training, technology transfer, and vaccine platform updates as the underlying science advances.<sup>7</sup>

No single entity can address all of these issues. Instead, only the sustained and collaborative engagement of public and private sector entities will be able to identify and address operational challenges, disseminate best practices, and create the business models sufficiently able to derisk the large capital investments necessary. These efforts must be strategic and coordinated, because decisions made now will invariably influence the course of future pandemics and will be difficult to change in the midst of the next crisis.

Consequently, there is a need for an effort to facilitate and align this multisectoral community. Public and private sector participation should include national and regional leadership, regulatory agencies, pharmaceutical and biotechnology companies, multilateral bodies, and financing entities that will address five key areas. First, appropriate financing and business models are needed to incentivise and derisk investments and address demand certainty and competitive pricing for vaccines to ensure long-term sustainability of manufacturing facilities. Second, local workforce development and technology transfer needs to be prioritised. This effort will involve training the local talent pipeline, transfer of technical know-how, provision of necessary technology and platforms to support vaccine manufacturing, and incentivising the retention of newly trained local employees. Third, supply chain and logistics must be developed and maintained to encompass raw materials sourcing, specialised equipment for production, transportation (including last-mile delivery), and cold chain considerations. Fourth, regulatory harmonisation and legal and policy requirements must be in place to ensure a stable political environment and that relevant regulatory and trade frameworks, licensing, and product liability issues are addressed. Finally, strategic coordination is crucial and will need to include data infrastructure and efforts to align stakeholders across national, regional, and global levels, and ensure that there are clearly defined roles and responsibilities for all stakeholders.

The world cannot afford a protracted pandemic with ongoing damage to economic productivity and global health security. A collaborative public-private effort to direct and inform an equitably distributed vaccinated manufacturing capacity is a decisive step towards pandemic resilience. The World Economic Forum in collaboration with the US National Academy of Medicine and the Coalition for Epidemic Preparedness Innovations is spearheading such an effort: the Collaborative on Equitable Vaccine Manufacturing Capacity, which will be launched later in May, 2022. All stakeholders must act now to work collectively and collaboratively. Only through an aligned and systematic approach will it be possible to end the present COVID-19 pandemic, stave off future pandemics, and finally realise the shared vision of global vaccine equity.

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