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## Building resilient health-care supply chains to manage pandemics in low- and middle-income countries

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## **Building resilient healthcare supply chains to manage pandemics like COVID-19 in low and middle income countries**

### **Introduction**

Representatives of the pharmaceutical industry projected that by January 2022 enough COVID-19 vaccines will have been produced to inoculate every adult in the world.<sup>1</sup> However, after 5.46 million deaths globally, access to this life saving public good has arguably been too slow, and critically, remains uneven today, with the continent of Africa severely lagging behind in the number of doses administered.<sup>2</sup> This forecast also discludes booster administration, the vaccination of children and wastage. While there are multiple barriers contributing to this gap, including hoarding in the developed world and hesitancy issues, it is evident that production capacity and supply chain robustness remain critical determinants of vaccine availability.<sup>3</sup> The pandemic has also put unprecedented stress on the supply of other essential health commodities including personal protective equipment (PPE), diagnostics, and therapeutics,<sup>4,5</sup> impacting the response to COVID-19 and disrupting essential healthcare services particularly for child immunization, family planning, mental health disorders and cancer.<sup>6</sup>

It is predicted that SARS-CoV-2 may become an endemic virus in the future. We are already witnessing repeat surges in COVID-19 cases with new variants of concern such as Omicron, which is going to be especially detrimental in low-and-middle-income countries (LMICs), where poor access to effective therapeutics and vaccines remains poor, including the potential need for booster jabs. Moreover, COVID-19 will be trickier to manage if or when surges coincide with other regional or global disasters, such as other infectious disease outbreaks, flooding or forest

fires. To prepare for these future challenges, the root causes of production, supply chain and adjacent issues that are still delaying access to vital pandemic tools must be addressed urgently.

### **What went wrong?**

The pandemic has exposed countries' heavy reliance on hyper globalized supply chains. The geographic concentration of active pharmaceutical ingredients and finished manufacturing of PPE, therapeutics, and vaccines has resulted in dependence on a few countries, choking global supply amidst surges in demand.<sup>3,5</sup> Even products manufactured locally rely on material inputs from countries like China and India.<sup>7</sup> Intellectual property restrictions have meant few vaccine manufacturers, many of which are located in high-income countries (HICs).<sup>3</sup> Outbreaks have shut down and slowed manufacturing. Rapid changes in cargo operations, air/port closures, and lockdowns made the transport of goods more expensive and uncertain.<sup>7</sup> Excess vaccine purchases and export restrictions on COVID-19 related commodities by certain countries triggered shortages and skewed access.<sup>4</sup> More importantly, there has been no coordinated, global strategy to defeat the pandemic despite repeated calls from the World Health Organization, resulting in inadequate sharing of essential global public goods.

### **What went well?**

Some LMICs prepared, adapted, and rapidly responded to the supply chain issues brought on by the pandemic. Forecasting a rise in demand for medical oxygen right at the start of the pandemic, the government taskforce in the Indian state of Kerala increased existing production, approved new plants, diverted industrial oxygen cylinders for medical use, and expanded hospital beds with oxygen capacity.<sup>8</sup> Kerala managed surplus oxygen supply during the second wave triggered by the delta variant while other states struggled with acute shortages leading to preventable

deaths. In western Kenya, decentralized warehouses were set up in peripheral health facilities driving a push-based supply strategy wherein the requirement of essential medicines was monitored based on electronic records and then delivered to patients at community-based drop-off points and their homes through collaboration with local authorities.<sup>9</sup> Public-private partnerships in Uganda and Nigeria have resulted in the production of low-cost ventilators by motor companies, highlighting an innovative approach of diversifying the supply chain for this critical commodity.<sup>10</sup> Nigeria has developed a low-cost and rapid COVID-19 diagnostic test which can be mass produced in the country, thereby reducing costs and reliance on international supply.<sup>11</sup>

### **What is needed to build resilient healthcare supply chains in LMIC settings?**

#### *International treaty for pandemic preparedness and response*

Intellectual property (IP) restrictions on COVID-19 vaccines are proving to be a major barrier in expanding regional manufacturing and utilizing unused capacity in several LMICs.<sup>3</sup> In December 2021, the World Health Assembly adopted the decision to start working on an international instrument for pandemic prevention, preparedness and response.<sup>12</sup> Such an instrument could potentially address the current IP regulations blocking the manufacturing of vaccines, therapeutics and diagnostics through emergency waivers and licenses which will enable regional hubs, engage a higher number of manufacturers and more doses. This international treaty could include provisions to tackle export bans on essential medical products through diversifying supply chains and also ensure knowledge sharing and technology transfer.

#### *Building local supply for essential goods without IP restrictions*

While such an international agreement is urgently needed, it will take time to garner the approval and consensus of member states, continuing the delayed supply of essential products to LMICs. To buy time, LMICs can start building sufficient access to essential equipment and medicines without intellectual property restrictions. Until access to vaccines are secured, tools such as PPE, testing kits and therapeutics that can protect and treat populations, can be locally produced by the government or through public-private partnerships. Throughout the pandemic, many African countries were reliant on costly imported PPE often subject to supply disruptions and limited procurement budgets. The speedy establishment of new PPE manufacturers during the pandemic, such as the Transgreen O-Care in Nigeria has demonstrated the ease at which these tools can be produced locally by private organizations with government support.

LMIC governments can also incentivize existing local medical product manufacturers through subsidies and other mechanisms to build in redundancy into the supply chain in the way of emergency stockpile, safety stocks, diversified suppliers (including non-traditional sources) and increasing manufacturing capacity. This excess may be used to facilitate trade negotiations as new treatments and vaccines emerge in advanced economies. Regional mechanisms such as the African Continental Free Trade Area (AfCFTA) agreement, should be better leveraged to ease existing trade barriers, such as export and import controls on essential medicines to improve access to critical supplies.

#### *Boosting regional life science and manufacturing capabilities*

In the mid- to long-term, HICs will have to work with LMICs to invest in building regional manufacturing hubs that can produce adequate supply of complex vaccines, biologics, antivirals, diagnostics, and medical devices to prepare for future COVID-19 surges or other infectious

disease outbreaks. In the least, such urgently needed partnerships offer the incentive of health security and smooth flow of trade and economy for HICs. BioNTech shared plans in May 2021 to build an “mRNA factory” that will supply the Southeast Asia region with vaccines beyond COVID-19. Additionally, there are at least twelve manufacturing facilities across Africa that are producing or are in agreement to produce the drug substance or final formulations of various COVID-19 vaccines.

However, these partnerships do not go far enough. These regional facilities should comprise multi-stage processing - from bulk production to fill-finish -, should include facilities that produce materials critical to production, such as single-use bioreactors, buffers, reagents and salts, and should be able to produce enough supply for its region. Further, for this to work effectively, this initiative will require large-scale investment, multi stakeholder collaboration, skills and capacity building, technology transfer, supply chain transparency, and potentially some IP waivers.

#### *Improving surveillance and forecasting systems*

In the long-term, investing in sub-national, national, and regional surveillance systems for infectious disease outbreaks, including genomic surveillance, will enable LMICs to better forecast and monitor new variants of SARS-CoV-2 and other pathogens, and issue timely and targeted responses to reduce the risk of spikes in demand for essential health goods. Advanced analytics can then be used to combine such epidemiological and stock-related data to forecast the demand for essential goods like PPE, diagnostics, therapeutics, and vaccines. Such predictive forecasting and the use of data science will ensure real monitoring and a proactive healthcare supply chain that anticipates any potential shifts in demand and consumption and ensures that

essential health goods are in stock whenever needed. Such systems will require large-scale investment, capacity and skills building, and cooperation between the public and private sector as well as HICs and LMICs, and transparency in the process.

## **Conclusion**

Significant financial commitments from HICs and global health donors as well as domestic investments along with improved governance will be critical for implementing the above recommendations. The proposed international treaty for pandemic prevention, preparedness and response shows promise for addressing global health governance issues. At the national level, multi-sectoral government teams at central, provincial and district levels will have to be strengthened, building in genuine incentives for transparency and accountability in supply chains to ensure equitable distribution and avoid any losses. Improved coordination between public, private, and community-based actors will be essential in ensuring the essential medical goods including vaccines reach the required users. Unfortunately, too many countries in the Global North are already discussing post-pandemic life without pledging to significant changes in global pandemic preparedness, one that prioritizes the needs of HICs and LMICs alike. Without this commitment the outcomes of the next infectious disease outbreak will be very familiar.

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