The Economics of Inequities in Global COVID-19 Vaccine Procurement

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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INTRODUCTION:

Vaccines were praised as the ultimate weapon in the fight against COVID-19. Developed in record time, they were designed to protect individuals around the world from severe illness, hospitalization, and death. However, rather than being an accessible solution, vaccine procurement exposed deep-rooted inequities that allowed wealthier nations to vaccinate their populations far earlier than developing countries. While the rapid, 10-month development of the COVID vaccine was a historic scientific achievement, the economic barriers to procurement left billions without access to these life-saving vaccines, particularly in lower-income countries (Kalinke et al., 2022).

Lower-income countries (LICs) include nations with a gross national income (GNI) per capita of \$1,025 or less. In comparison, lower-middle-income countries (LMICs) have a GNI per capita between \$1,026 and \$3,995 and high-income countries (HICs) have a GNI of \$12,376 or more (World Bank & Our World in Data, 2024). These financial disparities are vital drivers of unequal access to healthcare resources, like vaccines. Figure 1 shows these income groups based on The World Bank, where dark purple represents LICs and dark green represents HICs (World Bank & Our World in Data, 2024). Figure 2, in contrast, shows the recent number of people who have received at least one COVID-19 vaccine dose relative to their country's population, where yellow represents a lower vaccination rate and dark green represents a higher one (Our World in Data, 2024).



📕 Low income 📕 Lower-middle income 📕 Upper-middle income 📕 High income 🔟 No data

Figure 1. World Bank income groups (2023) (World Bank & Our World in Data, 2024)



Figure 2. Share of people who received at least one dose of COVID-19 vaccine as of August 12, 2024 (Our World in Data, 2024)

Figures 1 and 2 show that HICs tended to have much higher vaccination rates than LICs; for example, almost 85% of Australia's (HIC) population received their first vaccine, while only 17% of the Democratic Republic of the Congo's (LIC) population received theirs (Our World in Data, 2024). In fact, by November 2023, 79.86% of people living in HICs had been vaccinated with at least one dose, while only 32.82% of those in LICs had (Data Futures Exchange, 2021). Although in May 2023, the pandemic was ended by a declaration from the World Health Organization (WHO), the low vaccination rates amongst LICs to this day exposed many global health inequities. Vaccinating the global population to achieve herd immunity was considered the key to ending the pandemic (Erfani et al., 2021), but economic barriers faced by LICs prevented this global feat.

This paper examines how economic structures shaped public health outcomes, specifically focusing on global access of COVID-19 vaccines. Vaccine access during the COVID-19 pandemic was shaped by an interconnected network of economic actors that systematically deepened existing inequities, limiting the ability of LICs to procure and distribute doses. To support this argument, I will first explore existing literature to outline the actors and mechanisms contributing to vaccine access throughout the pandemic. Then, the analysis will shift the lens from what these actors did during the pandemic to how they interacted with one another. Finally, I will look at the limitations of this paper and possible solutions, looking to develop strategies to reconfigure these economic systems for future global crises.

LITERATURE REVIEW:

During the COVID-19 pandemic, many HICs engaged in vaccine nationalism; a phrase used to describe the hoarding of vaccines by countries with access to them, usually at the expense of the poorest countries (Upton, 2024; Chimpango, 2021). Many HICs negotiated large advance orders of the vaccine in the initial stages of development in return for funding in the research and production of pharmaceutical companies (Md Khairi et al., 2022; Chimpango, 2021). This was accomplished through Advance Purchase Agreements (APAs), in which the HICs committed to purchasing specific quantities of vaccines from companies upfront, and Advance Market Commitments (AMCs), in which HICs created a guaranteed market by agreeing to buy vaccines from any company if successfully developed and licensed (Thornton et al., 2022). These agreements helped manufacturing companies obtain funding, created demand for the vaccine, and allowed HICs to attain high vaccination rates early on in the pandemic. With greater buying power and faster regulatory processes, HICs secured APAs and AMCs ahead of

other countries, delaying access for LICs. This early advantage contributed to vaccine scarcity, driving up prices and further hindering the ability of LICs to purchase doses.

The first COVID-19 vaccine dose was administered in December of 2020. As of February 2021, the three largest vaccine producers had APAs amounting to \$11.92 billion to produce 700 million doses, in just the United States (Thornton et al., 2022). By March 2021, 9.09% of the total population of HICs were vaccinated, while only 0.33% of LIC and LMIC populations were (Cho et al., 2024).

Initiatives for global vaccination, especially in LICs, were created during the pandemic. For instance, the WHO and partners created the Access to COVID-19 Tools (ACT) Accelerator to speed up the development of, production of, and access to COVID-19 tests, treatments, and vaccines (World Health Organization, 2020). Under the ACT-Accelerator framework, the COVID-19 Vaccines Global Access (COVAX) was created to support the development of vaccines for use in all countries through organized distribution on the international level (Md Khairi et al., 2022; World Health Organization, 2020). COVAX was founded in April 2020 by the Coalition for Epidemic Preparedness Innovations (CEPI), Gavi, WHO, and the United Nations Children's Fund (UNICEF) (World Health Organization, 2020; Pushkaran et al., 2024). During the COVID-19 pandemic, COVAX aimed to procure and distribute 2 billion doses of vaccines by the end of 2021, enough for 20% of the population in all 190 participating countries (Pushkaran et al., 2024). Among these, 92 LICs and LMICs were eligible for the COVAX AMC-a financing mechanism designed to subsidize vaccine access. COVAX AMC relied on funding from wealthier nations, global organizations, and private donors, who contributed money to secure APAs with manufacturers (Pushkaran et al., 2023).

The COVAX alliance ended in 2023, having shipped only 1.89 billion doses of its promised 2 billion–not all of those were necessarily administered (Upton, 2024). The program fell short of its goals for several reasons. For one, COVAX AMC relied on donations that arrived slowly and depended on specific suppliers–some of which imposed export restrictions during the pandemic (Pushkaran et al., 2023). Secondly, when LICs received doses, many lacked the infrastructure and health-system readiness for adequate storage and administration. The vaccines required a strict temperature range between -90 and -60°C, requiring specialized cold-chain equipment like ultra-low freezers and refrigerated transport. Administering the vaccines created another challenge, as many LICs struggled with staffing shortages and healthcare capacity (Upton, 2024; Pushkaran et al., 2024; Md Khairi et al., 2022; Centers for Disease Control and Prevention, 2024).

Other initiatives, including the African Vaccination Acquisition Task Team (AVATT), were established. AVATT was founded to increase regional self-sufficiency and required participating African Union (AU) member states-including 8 LICs and 44 LMICs-to contribute funds to secure vaccines directly through COVAX and APAs (Van De Pas et al., 2022; Chimpango, 2021). AVATT was important in helping the AU secure doses but struggled with insufficient funding, supply delays, and complex negotiations with manufacturers (Chimpango, 2021). The World Bank's Pandemic Emergency Financing Facility (PEF) was another mechanism. It aimed to provide financial aid to LICs by distributing funds based on criteria during disease outbreaks. These criteria included meeting certain thresholds for death counts, cross-border spread, and disease growth rates (Boyce et al., 2023). However, the terms of PEF were too restrictive during the COVID-19 pandemic and faced the same delays as COVAX and AVATT, limiting its usefulness (Boyce et al., 2023). Relying on initiatives like AVATT, COVAX,

and PEF created vulnerability, dependency, and possibly further indebtment within LICs (Van De Pas et al., 2022).

The COVID-19 pandemic was not the first instance of global inequities in vaccine access. During the 2009 H1N1 influenza pandemic, HICs secured early access to most vaccines through APAs, while LICs were left waiting for donated surplus (Thornton et al., 2022). Countries that relied on donations received vaccines at least four months later than APA-holding countries, as HICs delayed sharing until it was clear that only a single dose per person was needed (Turner, 2015). Although the WHO attempted to facilitate donations, many LICs faced financial stress, limited healthcare capacity, and cold-chain infrastructure challenges. The delays had serious consequences: By the time vaccines reached LICs, much of the world was in a post-pandemic state, but an estimated 7,000 preventable deaths occurred in these under-resourced regions (Turner, 2015). Similar trends emerged in other outbreaks as well, including the H5N1 influenza in the early 2000s and the Zika virus in 2015-2016 (Thornton et al., 2022). Recognizing these historical patterns demonstrates that the COVID-19 vaccine response was not an isolated failure, but the sign of a flawed system.

Current literature isolates individual factors (i.e., bilateral agreements, cold-chain infrastructure, funding programs) as the major contributors to vaccine inequities without exploring how these ideas interact within an extensive system of human and non-human actors. This has limited the understanding of the complex dynamics within global vaccine procurement. To address these gaps, I use Actor-Network Theory (ANT) to analyze the interactions between human and non-human actors involved in the economics of vaccines (Crawford, 2005). In this framework, human actors include governments, pharmaceutical companies, funding sponsors, and global health organizations; non-human actors include legal agreements (APAs and AMCs),

funding programs, and vaccine technologies and infrastructure. ANT will help explain how these economic actors form an interdependent network where power is distributed among them.

Generalized Symmetry and Distributed Agency, two tenets of ANT, help explain how various actors contributed to vaccine inequity in this COVID-19 case study. Generalized Symmetry uses the same investigative frame for each actor to ensure that each is considered equally (Crawford, 2005). Distributed Agency acknowledges that no single actor acted alone or intentionally; instead, every individual actor is assumed powerless when they are without interactions with other actors (Hald & Spring, 2023). The ANT approach will reveal the network of barriers that led to vaccine inequities in LICs, offering a comprehensive understanding of the global vaccine distribution system.

METHODS:

This paper uses a case study analysis of the COVID-19 pandemic to examine the distribution of rapidly developed vaccines, focusing on the economic network that dictated access to vaccines in LICs. The case study spans from the early stages of development and procurement in 2020 to what is regarded as the end of the pandemic in May 2023. The research uses secondary sources, including academic journal articles analyzing bilateral agreements, vaccine distribution, financing mechanisms, and economic barriers; reports from data analytics organizations tracking vaccine allocation and economics; and global health organization reports on funding structures and vaccine distribution.

ANALYSIS:

The human side of the vaccine distribution system was in place long before the COVID-19 pandemic began. Established relationships between HICs and pharmaceutical companies are reflected in the geographical distribution of manufacturing plants (Figure 3),

which are mainly located in HICs (Shehadi, 2021). When the pandemic began, these relationships allowed HICs to secure APAs and AMCs. These legal agreements not only secured an early vaccine supply for HICs but also shaped the production priorities of these pharmaceutical companies and the global demand for vaccines. Thus, when COVAX emerged as a global distribution initiative, it faced significant supply constraints and delays, as manufacturers were limited in their allocation of vaccines to LICs. Meanwhile, donors were attempting to reduce inequities by financing COVAX. Funding alone, however, could not solve the delays caused by bilateral agreements. Funding was also uneven, with HICs allocating resources to multiple mechanisms–including procurement for themselves–while also expected to make up the majority of contributions to COVAX and PEF (Pushkaran et al., 2023). Global health organizations, including the WHO and CEPI, played a central role in coordinating these initiatives but failed to recognize the barriers in place by non-human actors, including the availability of manufacturing capacity and regulatory approval (Chimpango, 2021; Erfani et al., 2021; Pushkaran et al., 2023).



Figure 3. Map of COVID-19 vaccine facilities (Shehadi, 2021)

Non-human actors were, therefore, not just passive tools in the network; they actively shaped vaccine production and distribution. APAs and AMCs served as mechanisms that dictated supply and demand throughout the pandemic, determined who could access the vaccine, and provided the funds for vaccine technology to thrive. The rapid development of the COVID-19 vaccine was enabled by the guaranteed funding and demand provided by the agreements; however, the concentration of manufacturing plants within HICs restricted international collaboration (King, 2024). As HICs figured out how to manufacture these vaccines, LICs fell behind, lacking the manufacturing capacity and funds needed to produce vaccines domestically. Export restrictions on raw materials and vaccines by HICs created additional procurement challenges (Pushkaran et al., 2023). Alongside manufacturing plants, LICs also lacked the cold-chain infrastructure and storage capacity necessary for COVID-19 vaccines. Even when vaccines were available, LICs faced logistical challenges related to distribution and administration, further delaying vaccination efforts. Other funding mechanisms, including COVAX AMC, AVATT, and PEF, faced bureaucratic barriers that slowed procurement and deployment, ultimately encouraging vaccine nationalism and showing that even well-intentioned programs cannot function within a flawed system.

The interactions between human and non-human actors created a looping network that systematically marginalized LICs. The geographical concentration of manufacturing plants in HICs strengthened the relationship between pharmaceutical companies and HIC governments, allowing for early procurement advantages (King, 2024). As HICs secured APAs and AMCs, global demand surged. COVAX, unable to compete, struggled to procure doses and faced delays in vaccine access for LICs. When LICs finally gained access to doses, their healthcare infrastructure was unprepared to handle large-scale distribution. Many vaccine doses obtained in LICs through COVAX were thus close to expiring, resulting in LICs rejecting them (Das et al., 2022; Upton, 2024). This caused COVAX to preferentially allocate doses to countries with sufficient deployment infrastructure and transportation systems, undermining their goal of equitable distribution and prolonging certain LICs' dependence on external aid (Das et al., 2022).

The infrastructure gap became both a cause and consequence of exclusion from the vaccine. Because LICs continued to depend on HICs, manufacturers continued to work in HICs, restarting the loop.

A common argument against this standpoint justifies the inequitable decisions that national governments and pharmaceutical companies made during the pandemic. First, radical nationalist perspectives may argue that every country experienced political, social, and economic effects from the COVID-19 pandemic. Governments were under extreme pressure to fix these consequences by acquiring vaccines for their populations, thus acting ethically when they made bilateral agreements within HICs. This approach brings up questions of political morality and whether it is fair for HICs to return to normalcy before contributing to global vaccine distribution. However, national economic interests do not override the ethical duty of HICs to minimize global harm and death, especially when doing so requires a comparatively low cost to the countries' residents (Emanuel et al., 2021). Second, pharmaceutical companies were incentivized to prioritize HICs because they provided the fast and secure financial means to sustain vaccine production. Vaccine development is a high-risk, high-cost endeavor, requiring significant upfront investments in research and development, clinical trials, and manufacturing (Thornton et al., 2022). Without reliable funding sources, the rapid development of the COVID-19 vaccines would not have been possible. Therefore, the bilateral agreements ensured innovation, production, and profit for these companies. In addition to the economic benefits, pharmaceutical company employees were among the first to be vaccinated because they are mainly located within HICs (Emanuel et al., 2021). This perspective accurately reflects pharmaceutical, free-market economics that inherently favors profitable deals with HICs, leaving LICs disadvantaged. While LICs could have been competitive in this market, they lacked the financial and regulatory resources to secure timely deals, excluding them from the race. This perspective also does not account for the donations from COVID initiatives and private entities. COVAX tried to secure the same APAs as HICs, so there was a deliberate decision to prioritize HICs–a decision made by pharmaceutical companies that regularly claim a commitment to advancing public health. This choice reflected an imbalance in global power dynamics, neglected the ethical responsibility to ensure equitable access, and ignored the long-term consequences of leaving regions vulnerable, threatening global recovery.

Vaccine inequity during the COVID-19 pandemic was not the result of an isolated cause or deliberate intent but was the predictable outcome of a system that functioned as its structural relationships allowed. Shaped by market-based incentives and global power dynamics, this system rewards speed and profit, often at the expense of equitable and ethical resource distribution. While organizations and mechanisms attempted to correct these gaps, they were constrained by historical economic and political frameworks. From the location of manufacturing plants to the demands of cold-chain storage, these initiatives encountered systemic barriers at every step of the distribution process. As short-term, crisis-driven responses, they were not enough to address the deep structural inequities. Ultimately, the same system that enabled rapid vaccine development and allocation in HICs acted as the barrier to that access in LICs.

CONCLUSION:

At the heart of vaccine distribution, there lies a clash between profit and equity. The same economic forces behind HICs' quick acquisition of vaccines also created barriers for LICs. ANT reveals how power distribution across a network of actors shaped this outcome, as a failure of the entire system. If global health continues to operate in this way, inequities in future pandemics are sure to follow. Beyond the scope of this paper is the role of intellectual property (IP) rights in limiting LICs' ability to manufacture vaccines locally under the 1995 Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement. TRIPS was designed to facilitate international trade by restricting knowledge transfer, meaning medicinal products cannot be manufactured or marketed without the patent holder's permission (Chimpango, 2021; Erfani et al., 2021; World Trade Organization et al., 2023). During the COVID-19 pandemic, HICs did not give LICs the rights to their vaccine technologies, preventing LICs from manufacturing their own vaccines; thus, TRIPs contributed to LIC procurement difficulties (Duroseau et al., 2023; Chimpango, 2021). TRIPS was amended in June 2022 to allow developing countries to manufacture and export vaccines under the authorization of the World Trade Organization et al., 2023). This revision marks a step toward improving vaccine inequities.

Another potential measure toward future pandemic preparedness is the establishment of manufacturing hubs in LICs, including investments in staff and cold-chain technology. Using their experience from initiatives like COVAX, global health organizations could lead efforts to secure funding and resources now rather than scrambling for solutions during the next global health crisis. Developing these facilities in advance would ensure the necessary storage, transportation, and distribution capacity to handle large-scale vaccine rollouts. Furthermore, the recent TRIPS amendments will grant LICs the flexibility to manufacture vaccines, reducing dependence on exports and improving procurement capacity. Comparing Figures 2 and 3 proves that the location of manufacturing plants affects national vaccination rates, meaning it is critical to build up production capacity in LICs.

One more solution is to strengthen and redesign financing mechanisms to give LICs direct control over vaccine procurement instead of relying on donors with competing interests. This includes looking into the role of APAs and AMCs and potentially imposing restrictions or regulations on their use by HICs in emergencies. This would allow global initiatives and LICs to receive a proportional share of agreements and/or doses. Additionally, initiatives like COVAX, AVATT, and PEF require more funding and structural reforms to function effectively. These mechanisms must be more enforceable and adaptable during global health crises to ensure LICs have reliable access. Strengthening global legal frameworks also helps guarantee that funding commitments are upheld and vaccine distribution is fair and need-based.

Future work should explore the long-term impact of the TRIPS agreement, especially in relation to its place within the network of actors outlined by ANT. It is also important to evaluate the proposed solutions within their historical context to understand their effectiveness and outcomes in past global health crises. Further research is needed on how public-private partnerships, regional political alliances, and global supply chain weaknesses influence vaccine access and distribution.

The COVID-19 pandemic exposed inequities in global vaccine distribution, driven by a network of economic forces. If these systemic issues remain unaddressed, future crises will continue to leave the most vulnerable without protection. The lessons learned from this pandemic must serve as a foundation for a more equitable and resilient global health system.

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