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COVID-19 vaccine production and the technological gap in the Global South: The cases of Argentina and Brazil

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Abstract

This article examines the transformation of the global vaccine manufacturing landscape during the COVID-19 pandemic, highlighting the shift from concentrated production within a few Western transnational corporations to the rising prominence of emerging economies, particularly China and India. We propose a four-tier framework for categorizing vaccine production capacity: developed countries, emerging countries, stagnant middle-income countries, and low-income nations. Our analysis explores the global COVID-19 vaccine market and examines the diverse strategies employed by Argentina and Brazil—two nations that pursued domestic vaccine production while navigating intense global competition for market access.

Argentina's pharmaceutical sector, characterized by predominant privatization, pursued vaccine development through technology transfers from AstraZeneca, Sputnik V, and CanSino to local

private companies. Concurrently, Argentina launched the ARVAC Cecilia Grierson vaccine through a public-private partnership. In contrast, Brazil's approach relied heavily on public institutions, including Fiocruz and the Butantan Institute, combined with technology transfers from international partners such as AstraZeneca and Sinovac Biotech. Brazil is currently conducting clinical trials for its domestically developed SpiN-Tec vaccine, which offers significant logistical advantages.

Our analysis reveals that both countries faced substantial challenges in maintaining vaccine access and production capabilities. The persistent technological gap has resulted in continued dependence on foreign imports, undermining their capacity to compete effectively in the international vaccine market. Despite notable achievements in vaccine development and production, the experiences of Argentina and Brazil exemplify the structural difficulties faced by stagnant middle-income nations in achieving vaccine self-sufficiency and technological sovereignty in pharmaceutical manufacturing.

Introduction

The COVID-19 pandemic starkly illuminated global inequalities in vaccine access, particularly in the Global South, where countries confronted substantial challenges due to limited financial resources in science, technology, and innovation, reduced manufacturing capabilities, and heavy reliance on foreign production [1]. While developed and emerging countries rapidly rolled out vaccines, accounting for nearly 70% of all doses administered, lower-income nations received only 7%, highlighting profound disparities in global health [2] and demonstrating weaknesses in global health multilateralism [3].

Traditionally, vaccine manufacturing has been concentrated among a few Western transnational corporations that dominated the market [4,5]. However, the SARS-CoV-2 pandemic disrupted this landscape, enabling new players from the Global South, particularly China and India, to gain prominence [6]. Both nations developed a strategic approach to expanding their global market shares, a process that took decades to materialize. India emerged as a primary supplier for the United Nations Children's Fund's (UNICEF) Expanded Programme on Immunization (EPI) when Western transnational corporations shifted away from producing traditional vaccines in the 1980s, opting instead for more complex and profitable second- and third-generation vaccines [7]. In 2000, a partnership was formed between the Global Alliance for Vaccines and Immunization (GAVI) and the Indian government, with GAVI supporting India's Universal Immunization Programme (UIP) and Indian manufacturers becoming key suppliers. These suppliers contributed an estimated 53% of GAVI Alliance's procurement from emerging middle-income countries in 2008; however, this figure fell to 29% two years later. In the 2010s, China emerged as a competitor after its National Regulatory Authority (NRA) met World Health Organization (WHO) standards for a functional vaccine regulatory system [8]. Despite this competition, India, led by the Serum Institute of India, continued to dominate the offerings of WHO Prequalified (PQ) vaccines prior to the pandemic [9]. Currently, according to UNICEF's Immunization Market Dashboard, India's eight manufacturers supply 75 of the 137 WHO PQ-approved vaccines globally, produced by a total of 37 manufacturers (UNICEF, 2025). Despite this shift, the global vaccine market remains highly concentrated, with the top ten manufacturers capturing 90% of revenues from pandemic vaccines [6].

The global COVID-19 vaccine production landscape can be divided into four tiers: the first tier comprises developed countries with high vaccination rates, primarily focused on manufacturing mRNA vaccines (e.g., Pfizer and Moderna); the second tier includes emerging middle-income countries from the Global South that produced their own vaccines with slightly lower efficacy rates (e.g., CoronaVac/Sinopharm, Covishield, Sputnik V); the third tier consists of stagnant middle-income countries attempting to develop their own vaccines while competing with global vaccine suppliers; and the fourth tier represents low-income countries where access to COVID-19 vaccines has been limited.

Through detailed case studies of Argentina and Brazil, this article analyzes the strategies employed in vaccine acquisition, technology transfers, competitive strategies for market access, and obstacles to developing domestic vaccine self-reliance in stagnant middle-income countries.

Argentina has a population of 46 million people and boasts one of the highest COVID-19 vaccination rates in Latin America at 91% [10]. The country adopted a highly diversified vaccination strategy, incorporating vaccines from both developed and emerging countries. Despite lacking public institutions with the capacity and scale of Brazil's, Argentina accelerated technology transfers from AstraZeneca, Sputnik V, and CanSino to local private companies that acquired downstream and fill-and-finish capabilities.

However, the involvement of both Argentine and transnational capital in these private companies meant that technology transfers did not necessarily lead to substantial local capacity building. In the case of AstraZeneca, the process was divided between Argentina and Mexico; Argentina produced the unpurified API and then sent it to Mexico, where the viral vector concentration, industrial formulation, fractionation, and packaging processes were completed. For Sputnik, the Argentine-owned Richmond laboratory agreed to implement the vaccine production process in two stages, initially importing adenovirus vectors for downstream processes, with the expectation of internalizing the entire process in the second stage. However, the upstream scaling process was never completed. Public research institutions and medium-sized private companies developed the ARVAC Cecilia Grierson vaccine, which was introduced in October 2023.

Meanwhile, Brazil has a population of 212 million people (4.6 times that of Argentina) and achieved an 87% vaccination rate. Brazil's vaccine production depended heavily on technology transfer agreements with international pharmaceutical companies such as AstraZeneca and Sinovac Biotech. These agreements enabled local production at public institutions like the Oswaldo Cruz Foundation (Fiocruz) and the Butantan Institute, including knowledge transfer for local production of active pharmaceutical ingredients (APIs). Brazil is currently conducting clinical trials for its own vaccine, SpiN-Tec, developed through a partnership between Fiocruz and the Federal University of Minas Gerais.

Section snippets

Global vaccine production and market shares

During the SARS-CoV-2 pandemic of 2020–2021, lower-income regions faced considerable disadvantages due to limited vaccine manufacturing capabilities and heavy reliance on foreign production. According to the World Health Organization [6], lower-income countries struggled to access essential vaccines and depended almost entirely on foreign supplies. While discussions about waiving intellectual property rights occurred at the WHO [11,12], middle and low-income nations continue to contend with a …

The case of Brazil

In Brazil, human vaccine production is primarily characterized by technology transfer agreements between transnational companies and public institutes. Over the past four decades, organizations such as Bio-Manguinhos at the Oswaldo Cruz Foundation (Fiocruz), the Butantan Institute, and the Ezequiel Dias Foundation (FUNED) have collaborated with five major transnational companies—Abbott, GSK, Merck, Pfizer, and Sanofi—to lead vaccine production [16]. Private actors play a minimal role, operating …

The case of Argentina

Argentina has followed a different trajectory from Brazil regarding vaccine production and public health policy. Beginning in the mid-1970s, Argentina adopted a broader neoliberal policy orientation, de-funding national labs and facilitating the introduction of vaccines from multinational pharmaceutical companies [7]. The National Administration of Drugs, Food and Medical Technology (ANMAT) was established in 1992 as a decentralized agency to regulate the registration of medicinal products and …

Discussion

This article makes three key contributions to understanding vaccine production in middle-income countries. First, it reveals how different models of public-private partnerships shape technological capabilities. Second, it demonstrates how political changes can undermine scientific achievements. Third, it provides critical insights for pandemic preparedness in countries with limited technological infrastructure.

By examining national vaccine development efforts in Argentina and Brazil, this …

CRediT authorship contribution statement

Maria J. Haro Sly: Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Conceptualization. **Lautaro Zubeldia:** Writing – original draft, Investigation, Conceptualization. …

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Maria J. Haro Sly reports a relationship with Argentina Ministry of Science Technology and Innovation that includes: employment. Lautaro Zubeldia reports a relationship with Argentina Ministry of Science Technology and Innovation that includes: employment. If there are other authors, they declare that they have no known competing financial interests or personal …

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