

# The Peruvian COVID-19 Immunization Program: lessons learned from a policy evaluation

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## Article

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## Abstract

Peru started its COVID-19 Immunization Program after recording the highest mortality worldwide during the first wave of the pandemic and halfway through its second wave. However, it became one of the fastest developing countries to cover 80% of its adult population with two COVID-19 vaccine doses. Overall, from the beginning of the Program in February 2021 up to March 2022, Peru delivered 66.2 million vaccine doses in a country with 32.8 million inhabitants. To do so, Peru successfully implemented a COVID-19 Immunization Program using an intersectoral and multidisciplinary approach. In addition, and more importantly, the Program included the participation of traditional and nontraditional health leaders. Peru's experience from previous immunization campaigns played a crucial role in its success. This experience allowed Peru to tackle challenges such as having over 80 original languages, a segmented and fragmented health system, and a vast territory with remote communities across coastal, highland, and jungle regions. This manuscript reports the findings of the policy evaluation of the Peru COVID-19 Immunization Program and collects the critical lessons learned during the Program's first year of implementation.

## Introduction

Peru's started its COVID-19 Immunization Program halfway through its second wave and soon after suffered one of the deadliest first COVID-19 waves worldwide.<sup>1</sup> Like most low- and middle-income countries, Peru faced vaccine access inequity by competing with high-income countries and accepting draconian contracts with outrageous conditions.<sup>2</sup> Furthermore, to start its Program, Peru needed to surpass several significant challenges, including political turmoil that forced two presidents to resign in one week<sup>3</sup> and a vaccine scandal known as Vacuna-gate.<sup>4</sup> Regardless, Peru implemented a successful COVID-19 Immunization Program using an intersectoral and multidisciplinary strategy. In addition, and more importantly, the Program included the participation of traditional and nontraditional health leaders. This manuscript reviews the history, challenges, and milestones of the first year of the COVID-19 Immunization Program in Peru while collecting its most essential lessons from a public health perspective. This revision might help plan future immunization campaigns in Peru and other low-middle-income countries.

## Results

### COVID-19 vaccines as the most needed lifesaving strategy for Peru

Peru entered the race for COVID-19 vaccines in September 2020, soon after suffering one of the deadliest first COVID-19 waves worldwide.<sup>1</sup> However, despite being one of the first Latin-American countries to enter the race of acquiring the first Pfizer doses, political turmoil delayed vaccine arrival until February 7th, 2021. The first COVID-19 vaccines arriving in Peru were purchased by the Chinese company Sinopharm and were meant to prioritize front-line workers, including healthcare workers and first responders.<sup>5</sup> However, these vaccines were distributed in the middle of the Sinopharm vaccine-trial scandal in which researchers violated trial regulations by vaccinating politicians and their family members.<sup>6</sup> This event alone might have contributed to the reduction of Peruvians supporting vaccinations, which decreased from 75% in August 2020 to 59% in February 2021 (<https://www.ipsos.com/es-pe/covid-19-y-vacunas-febrero-2021>). Nevertheless, as the Peruvian Ministry of Foreign Affairs reported, Peru managed to run a successful vaccination program after obtaining deals for 85.2 million vaccine doses. These deals included 38 million Sinopharm doses, 20 million Pfizer doses, 13.2 million COVAX Facility doses, and 14 million AstraZeneca doses.

### The Vacuna-gate and its impact on Peru relief efforts to mitigate the pandemic consequences

After becoming the pandemic's epicenter with one of the deadliest COVID-19 second waves worldwide, Peru became the study site of five vaccine clinical trials. These trials included investigating vaccine candidates from Sinopharm (inactivated virus, Vero Cells), Sinopharm (inactivated virus, Covilo), Janssen (recombinant, ad26.COV2.S), Oxford/AstraZeneca (viral vector, Vaxzevria), and Curevac (mRNA, CVnCOV). One of these trials became a significant threat to the immunization process in Peru because of the political scandal called Vacuna-gate.<sup>4</sup> The scandal became publicized when news media reported that the trial researchers inoculated 487 people outside the Sinopharm vaccine trial protocol.<sup>7</sup> Those vaccinated included former President Martin Vizcarra and his wife, former ministers of health and foreign affairs, vice-ministers, negotiators, high-profile lobbyists, and a representative of the Catholic Church. The list also included authorities, researchers, and the researcher's family members from the two universities that conducted the trial (Universidad Peruana Cayetano Heredia and Universidad Nacional Mayor de San Marcos). In an initial inquest, the study researchers used 3200 vaccine doses to inoculate people outside the study protocol. Furthermore, Sinopharm specifically requested that trial researchers deliver 1200 doses to

the Chinese Embassy in Peru, which used them to inoculate prominent Chinese citizens living in Peru and embassy personnel.<sup>8</sup> Investigators also found that trial researchers violated several ethical principles in clinical research, including those stated in the Declaration of Helsinki<sup>9</sup>. For example, the researchers applied an untested third dose to over 40 people, including medical students, without informed consent or approved study protocol.<sup>10</sup> Such scandal sparked public protests and increasing distrust about the efficacy of COVID-19 vaccines among the Peruvian population.<sup>7</sup>

In response, the National Institute of Health reviewed its procedures to authorize clinical trials for COVID-19 vaccines.<sup>11</sup> Additionally, the Peruvian medical college initiated an ethical process for the physicians involved in the scandal. Contradictory, one year later, the Peruvian medical college decided to pardon every physician involved in the scandal, assuming that researchers vaccinated all of them according to protocol. While the Peruvian Vacuna-gate is an example of corruption and egregious use of power, there are several lessons to learn from this experience. First, health professionals must study Vacuna-gate as a case study for their ethical courses to prevent similar events in the future. Second, countries must proactively regulate and promote good research practices and update their regulations if necessary. Third, a global crisis like a pandemic requires a coordinated global response that allows countries to act in the best interest without compromising their ethics and values.<sup>7</sup> Overall, this scandal strongly impacted Peruvians' public perception of the efficacy and safety of the COVID-19 vaccines, particularly against the Sinopharm vaccine.<sup>6</sup> This situation threatened the Program's progress to a critical point in August 2021, when Peru prepared to use Sinopharm vaccines in the first massive immunization weekend led by President Castillo's government. MINSA (Peru's Ministry of Health) measured public resistance against the Sinopharm vaccine to assess the situation, estimating it to be around 20% in Lima. Independent studies reported similar rates among Peruvian adults<sup>12</sup> and even higher vaccine resistance among elderly Peruvians.<sup>13</sup> MINSA responded with a strong communication campaign with culturally adjusted content and public communication using the country's main original languages. This effort paid off, allowing MINSA to administer over 750 000 vaccine doses in the most extensive vaccine marathon in one single weekend until that date.

## Peru's COVID-19 Immunization Program

Peru started its COVID-19 Immunization Program by implementing a 3-phase strategy with free-of-charge vaccines and public regulations released by the Ministry of Health in October 2020. During Phase I, the target population was the first-line workers. This population included the healthcare personnel working in public and private health sectors, the Peruvian Red Cross, firefighters, armed forces, police, municipalities' security and cleaning personnel, and health-related careers students. In Phase II, Peru included the high-risk population, meaning all adults over 60 years, adults with comorbidities, native or indigenous people, incarcerated people, and prison staff. Finally, during Phase III, Peru aimed to protect the rest of the adult population between 18 and 59 years old. MINSA authorities set the goal of achieving a 50% coverage of the target population with two doses by December 2021. However, in August 2021, in preparation for a third COVID-19 wave and soon after President Pedro Castillo replaced President Francisco Sagasti, MINSA updated this goal to achieve 80% coverage of the adult population by December 2021. In November 2021, the Peruvian government made vaccinations mandatory for companies with more than ten workers. Also, the government began offering a third vaccine dose to every adult 18 years old or over who received the second dose at least five months before. In December, the government ordered the mandatory use of immunization certificates to enter businesses and indoor spaces, pushing thousands of Peruvians to get vaccinated.

On December 31st, 2021, Peru successfully covered 80% of the target population of 18 years old and over immunized with two doses (Fig. 1A). Several factors explain why Peru achieved such an important goal. First, the Ministry of Health successfully implemented the strategy named "Vamos a Tu Encuentro" or "We Will Find You," which moved from organizing mass vaccination events or "Vacunatonos" toward house-to-house vaccination campaigns. This new strategy was particularly effective in reaching remote communities across the Andes and the Amazon basin and closing the vaccination gaps. Another crucial factor that allowed the Program to succeed was sustaining an effective execution of its budget. The Program maintained an Executed Budget (EB)/Modified Institutional Budget (MIB) ratio of over 0.95 at the national, regional, and Lima levels (Fig. 1B). This budget execution allowed the Program to increase the mean number of people vaccinated per day (Fig. 1C) and sustain a continuous growth of the cumulative doses (Fig. 1D) since September 2021. During these efforts, national authorities led a nationwide immunization program, "Thinking Regionally but Acting Locally," using the weekly epidemiological data reports provided by the "Strategic Intelligence Task Force." These reports allowed the Program to prioritize the districts with higher vaccination gaps (due to not having or having incomplete vaccine doses). In this new strategy, national authorities worked alongside regional and local authorities to counteract the anti-vaxxers' misinformation campaign with culturally appropriate communication content and community champions and leaders' active participation. Overall, from the beginning of the Program in February 2021 up to March 2022, Peru delivered 66.2 million vaccine doses in a country with 32.8 million inhabitants.

# The value of moving from a traditional Immunization Program toward an epidemiological data-driven immunization strategy

One main characteristic that distinguishes Peru's COVID-19 immunization program is that it uses the One Health approach with solid epidemiological data-driven decision-making. This strategy allowed the Program managers to take advantage of the vast experience of the Peruvian nurses as immunizations managers instead of "vaccinators." Consequently, the Program implemented a collaborative, multisectoral, and multidisciplinary strategy. Also, it allowed the Program to think nationally but act locally. Furthermore, the Program successfully mobilized human resources across all regions, provinces, and municipalities to multiply and reinforce their vaccinator brigades. Such an organization demanded to involve a significant effort to hire thousands of nurses, technicians, and physicians to constitute enough vaccinator brigades to cover Peru's vast territory. Such efforts demand creative solutions to the enormous challenge of implementing a national Immunization Program in a highly segmented and fragmented health system with a substantial human resource shortage.<sup>14</sup> Furthermore, the Program successfully hired and administered large numbers of human resources under turbulent socio-political scenarios (an interim president and constant government changes, including four ministries of health in the first year of the COVID-19 Immunization Program).

In such a challenging scenario, the Program needed full support from each Ministry of Health for budgeting, human resources, and recognition to achieve every Program milestone. Such support included a significant team effort with the General Direction of Communications, the General Office of Technologies and Information, and the Strategical Intelligence Working Group. Clearly and timely communicating the benefits of COVID-19 immunization and vaccination schedules, using regional and culturally appropriate content that highlighted the importance of completing the second dose and booster dose played a crucial role in combatting anti-vaxxers misinformation. In addition, the General Office of Technologies and Information played a critical role in developing the Program's website ("Pongo el Hombro") and the mobile application to implement vaccination certificates. Such a platform also allowed the population to know where to get vaccinated and facilitated the vaccination data entry. It also allowed the Program to publish daily updates on the Ministry of Health open-access platform ("REUNIS"). More importantly, the open data let the Program develop open access dashboards and facilitate monitoring of the Program tracers and daily reports. Another critical push for the Program was the creation of the Strategical Intelligence Task Force, which supported the decision-making behind accelerating the Program goals in preparation for the third COVID-19 wave. The task force meets daily and provides comprehensive epidemiological and data-driven reports about the SARS-CoV-2 transmission across the country.

## Challenges with logistics, supply, and procurement of the vaccines

As Peru undertook the most extensive vaccination campaign in its history, the COVID-19 Immunization Program worked readily and effectively with each of the 25 regional health directorates and 1874 district mayors to deploy COVID-19 vaccines safely. The Program prepared a plan with a series of protocols, indicators, data platforms, websites, apps, reports, and tracers to do so. The preparation of this documentation demanded a significant effort from the Program leaders. Still, those were essential to keep the Program on track and allow flexibility to adjust to the number of vaccines arriving every week and cover Peru's vast territory. Peru's vaccination situation was particularly challenging due to the many rural and remote populations distributed across the coast, highland, and jungle regions (Fig. 2A-D). Such diverse territory demanded prioritizing vaccines that required specialized cold storage (-20 to -80 °C or -4 to 94 °F: Pfizer and Moderna) in urban areas and those that required standard cold chain (-4 °C or 39 °F: Sinopharm, AstraZeneca, Johnson & Johnson) in rural areas. Vaccines arrive in Peru weekly by air cargo and are immediately stored at the National Center for the Supply of Strategic Health Resources (CENARES) warehouses. From CENARES, the vaccines are defrosted and delivered to the regional warehouse every week following a tide schedule. This strategy covered the main urban areas well and helped Peru protect 13% of its target population by June 2021. However, the Program needed a big push to achieve the bold milestone of an 80% of the target population covered with two vaccine doses. To achieve this, the Program multiplied the number of vaccine doses from 0.3 million in February to over 7.4 million per month since September (Fig. 3A) by increasing. For instance, i) the number of vaccine brigades from 4200 in June to over 8000 since September (Fig. 3B); ii) the number of massive COVID-19 vaccination centers from 1616 in June to over 1981 since September (Fig. 3C); and, iii) by increasing the local COVID-19 vaccination centers from 280 in June to over 2200 since September (Fig. 3D). A key lesson from this experience was the enormous value of setting regional goals for each process step. The Program leaders set these goals daily and weekly, and every Friday was reviewed and celebrated at national virtual meetings or "Hopeful Fridays." These meetings help program managers keep milestones on track, check the strategic intelligence reports, and make the adjustments necessary to support the regions that need more support.

## Discussion

Overall, the impact of Peru's COVID-19 vaccination program was huge in terms of mortality reduction, particularly during the third wave and among the healthcare personnel.<sup>15,16</sup> By October 2021, and after a second devastating COVID-19 wave, Peru reported over 200,000 deaths due to COVID-19. Despite recording a third COVID-19 wave peak of new cases 5.08 times higher than its second wave, the peak mortality registered in the third wave was lower than 30% of the second wave's peak mortality. A significant fraction of the averted mortality is attributable to Peru facing its third wave, with over 80% of its adult population protected with two doses of the vaccine. Likewise, it is attributable to an overwhelming majority of Peru's population potentially having hybrid immunity by December 2021.<sup>17</sup> Hence, the overall mortality could have been much higher without the COVID-19 Immunization Program.

In implementing the most extensive immunization program in Peru's history, the country managed to surpass vaccine inequity and, more importantly, sustainably. For this purpose, national, regional, and local authorities worked together to close the immunization gaps and overcome vaccine misinformation and anti-vaxxers movements that seriously attempted to sabotage the Program.<sup>18</sup> The many challenges faced by Peru to succeed allowed for several critical lessons for future vaccination campaigns (Table 2). We hope these lessons help future vaccination campaigns in Peru and other low-middle-income countries.

## Methods

### Ethics

Our study only used public documents and open data curated by the Peruvian government. It publishes this data without identifiers and keeps it updated in the public domain of the Peruvian National Open Data Repository (REUNIS). For this reason, following good research practices, our study did not require approval from an ethical review board.

### Study design

We performed a policy evaluation of the Peruvian COVID-19 Immunization Program by conducting a mixed-method investigation in two stages: (i) desktop research and (ii) graphical analysis of the open data from the vaccine program. Our first analysis collected and reviewed relevant documentation published during the first year of the Peruvian COVID-19 Immunization Program. During this review, we focus on the Programs' policy, strategy, challenges, milestones, and diversity of approaches [see supplementary materials for details]. Additionally, we used the procurement, logistics, supply, and program evaluation as the subthemes of interest during our revision. During our graphical analysis, the leading Program indicators and milestones were assessed using the "ggplot2" package on R 3.6.1 (R Foundation for Statistical Computing, Vienna, Austria) and R Studio 1.2.5001 (Free Software Foundation, Inc., Boston, MA). In addition, we obtained the Program's coverage, budget execution, counts of COVID-19 vaccine doses distributed monthly, and cumulative and population estimates from open data curated from the government of Peru. We describe the metadata from each of our study data sources in Table 1. Vaccine counts were obtained from the COVID-19 Vaccination open data, updated daily at the Unique National Health Information Repository (REUNIS). Additionally, we got the annual estimated population for 2001 at a national level from the National Registry of Identification and Civil Status (RENIEC). And we got the 2001 budget execution report from the Monitoring of Budget Execution, Friendly Consultation COVID-19.

Table 1  
Metadata for the datasets used in the Research Article

Name	Provider	Year	Format	Variable	Source
Peruvian Population 2021	National Institute of Statistics and Informatics (INEI)	2021	CSV	Continuous	<a href="https://www.datosabiertos.gob.pe/dataset/poblaci%C3%B3n-peru">https://www.datosabiertos.gob.pe/dataset/poblaci%C3%B3n-peru</a>
COVID-19 Immunization	Ministry of Health (MINSA)	2022	CSV	Continuous	<a href="https://www.datosabiertos.gob.pe/dataset/vacunaci%C3%B3n-contra-covid-19-ministerio-de-salud-minsa">https://www.datosabiertos.gob.pe/dataset/vacunaci%C3%B3n-contra-covid-19-ministerio-de-salud-minsa</a>
Monitoring of Budget Execution: Friendly Consultation COVID-19	Ministry of Economy (MEF)	2022	CSV	Continuous	<a href="https://apps5.mineco.gob.pe/coronavirus/Navegador/default.aspx">https://apps5.mineco.gob.pe/coronavirus/Navegador/default.aspx</a>

Table 2  
Main challenges and lessons from Peru's COVID-19 vaccination program

Subtheme	Challenges	Lessons
Procurement	Vaccine inequity	Government leadership with a multidisciplinary, multisectoral task force was crucial for purchasing and procuring COVID-19 vaccines from multiple sources in a highly competitive market.
	Vaccines approval	A firm policy and rigorous decision-making based on evidence were critical to the approval of the vaccines during the COVID-19 pandemic in Peru. Such a process demanded diligent and rigorous health technology assessments from Peru regulatory agency DIGMEID and the National Institute of Health.
Logistics	Cold chain	The high diversity of Peru's territory demanded a very flexible protocol and a combination of cold chain technologies, particularly for reaching remote communities in coastal, highland, and jungle settings. Smart sensors, solar refrigerators, and other cold chain technologies with solar batteries worked well in rural areas. Still, Peru needs to move towards a remote system to control and secure the cold chain beyond vaccine storage.
	Vaccine storages	The segmented and fragmented health system in Peru demanded strong coordination in the vaccine distribution among each region's leading healthcare providers. National and regional storage played a vital role in the Program's logistics, but certainly Peru needs to invest, modernize, and expand its storage capacity to cover its territory more effectively.
Supply	Vaccines brigades	During the vaccination campaigns, human resources management and capacity development demanded a strong collaboration between the health and economy sectors, national and regional authorities, and central and regional administrations. Strong leadership and command from the Immunization Program with the constant support from the national leaders were vital for the Program's success.
	Vaccine hesitancy and anti-vaxxers misinformation	A broad and robust communication campaign with culturally adjusted content that attends the main original languages in the country is required to fight vaccine misinformation and reduce vaccine hesitancy.
Evaluation	Program leadership	Peru had a strong immunization background, which played a vital role in the Program's success. In addition, the many organizational challenges during the Program's expansion demanded strong leadership and communication between the national, regional, and local program managers. Their commitment and continuous support were critical to the growth and success of the Program.
	Recognition	Job recognition was essential in healthy organizations and was crucial to the Program's success. Every week, national leaders rewarded those local and regional leaders that achieved their weekly milestones, which were critical for the Program's success in the long term.

## Source data

The data used in our study is open data curated by the Peruvian government and freely available using the references presented in Table 1. The budget execution report is owned by the Ministry of Economy and can be accessed from the Monitoring of Budget Execution, Friendly Consultation COVID-19. Data are available under the terms of the Creative Commons Zero "No rights reserved" data waiver (CC0 1.0 Public domain dedication).

## Data availability

The data that support the findings of this study is open data curated by the Peruvian government and freely available in:

- <https://www.datosabiertos.gob.pe/dataset/poblaci%C3%B3n-peru>
- <https://www.datosabiertos.gob.pe/dataset/vacunaci%C3%B3n-contra-covid-19-ministerio-de-salud-minsa>
- <https://apps5.mineco.gob.pe/coronavirus/Navegador/default.aspx>

## Declarations

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was vital for our success of the Program. We also acknowledge the member of the Strategical Intelligence Task Force and the Health Intelligence Working Group that supported the Program with epidemiological reports and insight.

### Authors contribution

Jimenez, Quispe, and Vargas were responsible for the conceptualization, data curation, formal analysis, investigation, methodology, software, validation, and visualization. Cevallos and Castro contributed to the data curation, investigation, methods, and study resources. Jimenez and Quispe were responsible for funding acquisition and resources. Additionally, Quispe administrated the project and supervised the research team. All authors contributed to the original draft preparation, review, and editing and agreed to be accountable for the work.

### Competing Interests

Bs. Jimenez was the executive director of the Immunization Directorate at MINSA and led the COVID-19 Immunization Program from March 12th, 2021, to February 25th, 2022. Dr. Cevallos was the Minister of Health at MINSA from July 29th, 2021, to February 9th, 2022. Dr. Castro was Advisor to the Minister of Health at MINSA from August 18th, 2021, until December 10th, 2021, when he was designated the Ministerial Chief of Staff at MINSA until February 22nd, 2022. Dr. Quispe was the lead scientific advisor to the Minister of Health at MINSA from August 13th, 2021, to February 10th, 2022. Jimenez, Cevallos, Castro, and Quispe declare no further conflict of interest.

### Disclaimer:

The findings and conclusions presented in this report are those of the authors and do not necessarily reflect the Peruvian Ministry of Health's official position.

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## Figures

### Figure 1

Key results indicators of the first year of the COVID-19 Immunization Program in Peru.

The figure shows the evolution of some of the critical result indicators during the first year of the COVID-19 Immunization Program in Peru and the monthly coverage of the adult population with two COVID-19 vaccines doses (percentage of the people 18 years old or over, protected with two vaccines doses) (Figure 1A). Also, it shows the level of the program budget executed by December 2021 (Figure 1B), the mean number of vaccine doses administered per day during each month in 2021 (Figure 1C), and the cumulative numbers of vaccine doses administered up to March 2022.

### Figure 2

Evolution of the COVID-19 weekly mortality rates\* during Peru's first, second, and third COVID-19 waves.

The figure shows pictures of the vaccine brigades implementing the house-to-house vaccination strategy named “Vamos a Tu Encuentro” or “We Will Find You,” across the Peruvian territory, including regions from the coast (Figure 2A), highlands (Figure 2B), and Amazon basin (Figures 2C and 2D).

### Figure 3

Primary process indicators of the COVID-19 Immunization Program in Peru in 2021.

The figure shows the evolution of the primary process indicators of the COVID-19 Immunization Program in Peru in 2021, including the monthly counts of vaccine doses applied (Figure 3A). Also, it shows the number of vaccine brigades that were hired monthly (Figure 3B), the number of mass vaccination centers (Figure 3C), and the number of local vaccination centers (Figure 3D) habilitated per month.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

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