



CASE STUDY

LAO PDR

THE LAO PEOPLE'S DEMOCRATIC REPUBLIC OPTIMIZING VACCINE DISTRIBUTION AND SUPPLY CYCLES

Abstract:

This case study from the Lao People's Democratic Republic (Lao PDR) presents how the country implemented a COVID-19 vaccine supply and redistribution strategy based on local requirements and vaccine utilization. By using triangulated data on vaccination uptake, vaccine stock and COVID-19 epidemiological data to inform vaccine distribution and supply cycles, the country was able to optimise the use of vaccine stocks in the face of variable levels of vaccine uptake.

COVID-19 Vaccine
DELIVERY PARTNERSHIP



Global challenges in COVID-19 vaccination

The deployment of COVID-19 vaccines was complex, including the management of vaccine supplies. Many of the complexities in the early phases of the pandemic were also experienced by Lao PDR and are detailed in this case study. Most countries had multiple vaccine products with varying handling requirements and vaccination schedules. In the initial phases of vaccine deployment, vaccine supply was limited, arriving at erratic intervals with minimal warning and varying product characteristics. A few vaccine products needed storage and transportation at ultra-cold temperatures (-70°C) and several had very short shelf-lives of six months or less. Furthermore, as new data on vaccine stability and effectiveness became available, storage requirements and shelf-life changed, and vaccination schedules were modified. All these factors created logistical challenges. Robust vaccine stock data across levels was essential to ensure that vaccination sites had the right products at the right time in the right amounts and that vaccine wastage was minimized.

Background & context

Lao PDR reported the first confirmed COVID-19 case in March 2020. As of May 2023, a total of 218, 227 confirmed cases and 671 deaths had been reported¹. Lao PDR launched its COVID-19 vaccination programme in March 2021 using vaccines obtained through the COVAX Facility and from multiple countries through bilateral agreements or donations.

Several factors contributed to Lao PDR's successful vaccination response, including lessons from responding to the SARS outbreak in 2003 and the H1N1 pandemic in 2009-2010. The country benefitted from strong coordination led by the central and provincial level governments across government sectors and departments and placed the highest priority on the COVID-19 vaccine rollout. This case study focuses on the country's successful vaccine supply management approach.

1 WHO, COVID-19 Situation Report for Lao PDR, 31 May 2023.

Lao PDR'S dynamic vaccine supply and distribution management

Lao PDR leveraged its existing District Health Information Software 2 (DHIS2) to report the number of COVID-19 vaccine doses administered and estimate vaccination coverage. Aggregate and patient information was collected in a COVID-19 Vaccine Registry (CVR) which was linked electronically to DHIS2 as a **DHIS2-CVR module**.

The existing national electronic logistics management information system, referred to as **mSupply**, was leveraged for COVID-19 vaccine stock management. Stock orders, movements, and balances were input and managed through mSupply and could be tracked by vaccine product and lot numbers. Microsoft Excel sheets were used at the district level while in some health centres, batch cards were still used to monitor vaccine stock and expiry dates.

Vaccine stock data from mSupply guided decision-making and timely troubleshooting in the highly complex and rapidly changing COVID-19 vaccine landscape. For example, decisions on vaccine allocations (both routine and ad hoc) were made using available data on stock balances, vaccine consumption rates, subnational vaccine uptake rates, and locations at risk for COVID-19 case surges (e.g., border provinces were prioritized). To allow for **optimal distribution**, vaccine products that were received in **smaller quantities** were distributed between fewer provinces. Vaccines with Ultra Cold Chain (UCC) requirements were initially restricted for use in the capital city, Vientiane, the only location with UCC freezers during the early stages of vaccine deployment. These data also informed anticipated delivery costs and the vaccine handling training needs of health workers in each province.

Having a robust vaccine management system was critical for tracking **multiple COVID-19 vaccine products**. Like many other countries, Lao PDR's reliance on donations from multiple sources required a system that could manage products with varied handling requirements and shelf lives. Given the limited supply in the initial phase of vaccine rollout, provinces did not receive vaccine allocations at a regular frequency, which led to challenges in managing supplies and communicating availability to the public.

The increase in vaccine supply and availability of new data brought changing guidance on storage requirements (e.g. Pfizer shifted from UCC to the regular cold chain for a limited period) and vaccine expiry dates (e.g., shelf life extensions). Hence, it was essential to develop and/or update guidance to ensure an understanding of the product handling requirements.

Another important aspect of vaccine distribution was to **minimise the number of different vaccine products at the same session** and to ensure the different vaccination sites received allocations based on available quantities of doses of each product, the recommended vaccination schedule (see Figure 1 below), cold chain requirements and shelf life.

Vaccine supply management also needed to account for the varied vial sizes (number of doses per vial) between products and that evolved, e.g., the single-dose vial presentation of the Sinopharm vaccine was replaced with a 2-dose presentation, whereas the AstraZeneca vaccine came in 8- and 10-dose vial presentations.








Dose	LAO FDD EUA WHO EUL					LAO FDD EUA	
	Sinopharm	Sinovac	AstraZeneca	Pfizer	J&J	Sputnik V	Sputnik light
Dose 1							
Dose 2 options	Sinopharm 3 - 4 weeks interval	Sinovac 3 - 4 weeks interval	AstraZeneca 8 - 12 weeks interval	Pfizer 3 - 4 weeks interval AstraZeneca 3-4 weeks interval (in case of limited supply)		Sputnik V (dose 2 formula) 3 Months interval	
Booster or dose 3 options	Sinopharm AstraZeneca Pfizer J&J 3 Months Interval after the 2nd dose	Sinopharm AstraZeneca Pfizer J&J 3 Months Interval after the 2nd dose	AstraZeneca Pfizer J&J 3 Months Interval after the 2nd dose	Pfizer AstraZeneca J&J 3 Months Interval after the 2nd dose	J&J Pfizer AstraZeneca 2 month interval after J&J dose 1	Sputnik V AstraZeneca Pfizer 3 Months Interval after the 2nd dose	Sputnik Light AstraZeneca Pfizer 3 months after 1st and 2nd dose.
2nd booster or dose 4	Sinopharm AstraZeneca Pfizer J&J 3 Months Interval after the 3rd dose	Sinopharm AstraZeneca Pfizer J&J 3 Months Interval after the 3rd dose	AstraZeneca Pfizer J&J 3 Months Interval after the 3rd dose	Pfizer AstraZeneca J&J 3 Months Interval after the 3rd dose	J&J Pfizer AstraZeneca 2 months interval after J&J 2nd dose	Sputnik V AstraZeneca Pfizer 2 Months Interval after the 3rd dose	Sputnik Light AstraZeneca Pfizer 3 months after 1st and 2nd dose.

Figure 1: Lao PDR COVID-19 vaccination schedule, Ministry of Health

While the overarching message was that “the best COVID-19 vaccine is the one available to you”, when making distribution plans, the Government needed to ensure the availability of **the right vaccine, in the right amounts to the right locations.**

Four key principles were taken into consideration when deciding the distribution plan:

Balance, equity and risk: priority to the highest-risk populations (health workers, elderly, people with underlying health conditions), hard-to-reach areas, or areas with low vaccine coverage

Epidemiology: risk of COVID-19 case surges

Capacity: cold chain availability and ability to utilise stock with limited wastages

Demand: community demand, especially given preferences for specific vaccine products

In practice, these principles supported central-level decision-making on key aspects of supply planning. For example, to reduce the need to track defaulters for a second dose, the 1-dose J&J vaccine was prioritised in outreach sessions conducted in geographically remote areas; and when allocation of the Pfizer vaccine was expanded to provinces outside the capital city, the transportation time was used to determine which provinces should receive frozen or thawed vaccine.

The country’s ability to use COVID-19 and historical routine immunization data was enabled by the strong coordination between the Mother and Child Health Centre (MCHC), subnational leads, other government departments, and development partners. Coordination with the Ministry of Education and Sport was critical for the rollout of vaccinations for adolescents, to identify the target populations and provide

support for school-based vaccinations. In addition, Emergency Operation Centers (EOCs) that functioned at all levels were activated and served as information hubs and coordination facilities. Supply data were part of key indicators reviewed in the weekly meetings between the central level and the provinces. These indicators included COVID-19 vaccination uptake rates, allocation and distribution of vaccines, stock updates, vaccine expiry dates, supply chain and logistics issues, vaccine demand, and finance. To enable improved data visualisation, an additional stock dashboard was developed in Google Data Studio (Figure 2), which displayed data on stock received and distributed by the central level, donations per country, stock distributed by province, stock on hand and upcoming vaccine dose expiries at the provincial and central levels. The dashboard data were used in weekly meetings for responsive decisions in a rapidly evolving situation.

Current stock on hand per province and vaccine								
Province code	Province	AstraZeneca	Johnson & Johnson	Pfizer (Adult)	Pfizer (Child)	Sinopharm	Sinovac	Total
LA01	Vientiane Capital	0	0	18,570	14,800	14,156	11,920	55,446
LA02	Phongsali	0	0	14,490	0	0	0	14,490
LA03	Louangnamtha	0	0	0	800	106,190	19,500	126,490
LA04	Oudomxai	0	0	0	19,300	14,000	0	33,300
LA05	Bokeo	0	0	0	0	53,200	22,600	75,800
LA06	Louangphabang	0	0	40,640	28,630	18,140	70,380	157,790
LA07	Houaphan	0	0	7,020	7,316	13,435	1,194	28,965

Figure 2: Example of data presented as part of Lao PDR COVID-19 Vaccines Stock Dashboard, Ministry of Health

IMPACT

By December 2021, 50% of the total population had completed the primary series of vaccination. By July 2022, the complete primary series coverage increased to 72% among the total population (81% first dose coverage); 74% in the population aged 60 years and over; 68% in those aged between 12-17 years; 62% in those aged 6-11 years. Among the total population, 25% had received a booster dose².

The COVID-19 vaccine management experience has raised appreciation of the importance of stock data visibility and has accelerated the use of mSupply for vaccine management across all districts. Stock data is now seen as a key data indicator, whereas the focus previously was exclusively on vaccination uptake data. Routine vaccine stock data is now reviewed as part of monthly coordination meetings. There has also been an increased openness to using third-party logistics services and outsourcing to deliver vaccine supplies when in-house government capacity is limited.

Health worker capacity in vaccine stock forecasting, management and monitoring was strengthened after the refresher training that was provided as part of the COVID-19 vaccination training. The resources, training, supportive supervision and materials developed as part of the COVID-19 vaccine rollout and the use of the eLMIS/mSupply system, especially at the district and province levels, increase the capacity for managing routine vaccines.

² Report on the COVID-19 vaccine post-introduction evaluation in Lao PDR, 15 October 2022.

BENEFITS

The availability of DHIS2 vaccine administration and mSupply stock data helped Lao PDR's COVID-19 vaccination rollout in the following ways:

- Enabled allocation and distribution decisions to be made (right vaccine to the right place), for example:
 - I. Prioritized provinces with low coverage in priority use groups.
 - II. Prioritized locations that used outreach services as their primary service delivery mode and supplied them with one-dose J&J vaccine.
 - III. Allocated more doses to provinces at risk of a COVID-19 case surge.
- Ensured stock was reserved sub-nationally for second doses, by following coverage and stock levels of the different vaccine products.
- Provided the ability to monitor vaccination dropout rates and to identify provinces, districts and health centres that were struggling with follow-up.
- Identified provinces for targeted supportive supervisory visits based on low vaccine utilization rates.
- Enabled the triangulation of data to evaluate data quality (stock vs. administered doses).

CHALLENGES

- Because many vaccines were donated from a variety of sources, it was difficult to comprehensively plan vaccine deployment when the quantity, type, and timing of vaccine supply was unknown, with some shipments arriving with little-to-no notice, and others being severely delayed from the original shipment date.
- When vaccines were distributed to the lower levels, districts and health centres often had very little time to prepare for using them and little choice over which vaccine they received.
- The difficult supply and distribution situation complicated management and coordination and risked undermining vaccination schedules and related guidance, including the use of a homologous primary series giving people the same product as the first and second doses.
- Real-time supply data at lower levels (district and health facility) was limited. The National Immunization Programme will need to scale up the integrated use of mSupply for vaccine stock management across all districts.
- Some provinces were unable to forecast needs and vaccine distribution was therefore not based on utilization, but rather on some fixed amount provided to them proportionate to their population.
- There remained challenges in vaccine distribution from the district level to health centres resulting a lack of timely access for some important and high-risk groups.
- Although cold chain augmentation was undertaken before the COVID-19 vaccine introduction, some dated cold chain equipment (CCE) remained due for replacement.
- A significant challenge was the disposal of expired vaccines and closed vial wastage due to vaccine expirations witnessed in several provinces.

Opportunities beyond the COVID-19 vaccine response

- A post-vaccine introduction evaluation in late 2022 applauded the good coordination across health system levels, the dynamic approach to vaccine distribution planning, the ability to use new data systems, and the use of data triangulation for supply allocation.
- An integration assessment conducted in 2022 measured the country's capacity and resources to meet the demands, challenges, and opportunities for the integration of COVID-19 vaccination with routine services in the short and long term. The findings are critical in identifying financial and programmatic gaps (including supply chain management) and mapping resource availability to inform national-level planning for opportunities and mechanisms of integration at both national and sub-national levels, especially in the upcoming GAVI transition. Cold chain and logistics management for COVID-19 vaccines worked well once the central vaccine storage capacity had been strengthened.
- The country enhanced vaccine distribution and supply cycles, managed a multitude of vaccines with varying characteristics and shelf lives, and delivered them to all health centres, including remote facilities.
- The reliance on multiple vaccine donations, which may have led the Government to accept vaccines that may not have been the 'first choice' for the country should guide future decisions on acceptance of vaccine products.

Lessons

- Regular **communication and coordination** between national and subnational levels, as well as between government and supporting partners are key to the success of the COVID-19 vaccine rollout.
- Planning is critical but must be **flexible to change** due to the highly dynamic situation of the pandemic and constraints in vaccine supply.
- **Advance notification of vaccine supply** should be given to provinces, districts, and health centres so that vaccine stores can prepare for vaccine arrival and storage.
- Data collection and real-time reporting are key to flexible planning. There is a need to keep **data collection and entry as simple** as possible to reduce the workload, provide **feedback on performance to selected provinces**, identify potential problems down to the facility level, troubleshoot with specific vaccination teams and monitor progress.
- The forecasting capability of lower health service levels can be improved to avoid shortages and stock-outs.
- Retraining of health workers should include methodologies and processes of vaccine needs forecasting approaches.
- The use of the electronic mSupply system will need to be further improved to help ensure proper and effective management of vaccine stock in real-time at the service delivery level.

- Further updates to the electronic systems should include easy-to-use dashboards for health workers to review localized reports on vaccination coverage, defaulters, and available vaccine stocks. The latter would also assist in the more accurate forecasting of vaccination supply needs.

Additional resources

If interested in further information, You may contact:

Anithasree Athiyaman, Clinton Health Access Initiative (CHAI)

aathiyaman@clintonhealthaccess.org

or Nyambat Batmunkh, Team Lead IVD WHO Lao PDR

batmunkhn@who.int

Acknowledgements

WHO, UNICEF and CHAI would like to extend its gratitude and appreciation to Ministry of Health counterparts and health partners in Lao PDR who continue to make significant progress in improving access to COVID-19 vaccinations and other PHC services. CHAI-supported work highlighted in this case study was made possible through funding from the Bill & Melinda Gates Foundation.

COVID-19 Vaccine

DELIVERY PARTNERSHIP

