

Research Article

Evaluation of COVID-19 Vaccination Costs for Internally Displaced Persons in the Town of Dori, Dori Health District, 2021

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Abstract

Introduction: The coronavirus (COVID-19) pandemic affected the whole world from China, which declared it in December 2019. It has progressed rapidly and become an international public health emergency. Within the framework of the implementation of COVID-19 vaccination activities in the Sahel region of Burkina Faso, we have evaluated the economic costs detailed in this document.

Methodology: An evaluation from a societal perspective was adopted, covering the period from August to October 2021. The types of costs studied was Capital costs, costs specific to vaccinated people and recurring costs. The data was entered and analysed using Word and Excel.

Results: Ministry documents indicate that the first doses of vaccine have been supplied by the COVAX system. A deployment plan has been drawn up, which fully includes displaced populations in its forecasts. Vaccine acquisition costs predominated at over 60%, and the average cost of vaccination was 8,130 FCFA or 15 USD per person.

Conclusion: Vaccination in areas facing security crises is necessary to protect fragile populations, and requires greater resources and greater involvement from partners.

Introduction

Healthcare systems were shaken by the outbreak of the SARS-CoV-2 pandemic [1], which began at the end of 2019 in Wuhan, Republic of China [2]. This pandemic very quickly affected almost every country in the world, and was declared a public health emergency of international concern by the World Health Organization (WHO) so that appropriate measures could be taken. Burkina Faso announced its first cases in March 2020 [3]. Despite the various guidelines proposed by WHO [4] and various health sector governance institutions, several countries have taken drastic measures, including confining entire countries and closing borders. As a result, the disease has seriously disrupted the functioning of the entire world, with a heavy human toll in less than a quarter [2,5]. These consequences have not spared the African continent, which is extremely dependent on the export of raw materials and consumes many imported products [6]. In addition to the proposed measures concerning distancing, hygiene

reinforcement (...), efforts to ensure the continuity of Reproductive, Maternal, Neonatal, Infant, and Adolescent Health (RMNIAH) services and vaccination [7], the major pharmaceutical companies prioritized the development of vaccines against this new pandemic, which continued to spread despite the drastic measures taken on all five continents. They were supported by financial resources made available by several developed countries [8] and backed by emergency procedures authorized by various agencies such as the US Food and Drugs Agency (FDA) [9]. In less than a year, pharmaceutical giants such as Pfizer and Moderna have succeeded in developing a number of candidate vaccines which, because of their modus operandi, will take a long time to become accessible to countries with the least adapted health logistics, such as developing countries. The establishment of the COVAX mechanism by WHO and its partners will pave the way for vaccine deployment in developing countries [10,11]. This mechanism has led several countries to develop vaccine deployment plans, and to begin mobilizing resources to cover their populations with COVID-19 vaccines. Burkina Faso has developed its deployment plan, which aims to cover the entire population in a difficult security and humanitarian context, hence the need for this study to assess the economic impact of this vaccination in order to evaluate the possibilities of equitable access to this vaccination [12-14]. The aim of this study was to evaluate the costs of COVID-19 vaccination campaign for IDPs during the first six months of 2021 in the commune of Dori (Dori health district) in the Sahel region of Burkina Faso [15].

Methodology

Type of evaluation

This is an economic evaluation of the costs of including IDPs in

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Covid-19 vaccination, with data collected over the period August to October 2021. For the time horizon, we took into account the entire period of preparation, organization, implementation and evaluation, from the organization of the first planning meeting to the submission of the final report on the campaign implementation [16-18].

A societal perspective has been adopted. It includes all costs, from the point of view of both the government and households.

Scope of the study

The study was conducted in Dori health district (Figure 1) [19]. This is one of the four districts of the Sahel health region, and corresponds to the boundaries of Séno province. It hosts the regional capital. It has six (06) departments corresponding to six (06) municipalities, including one urban (Dori) and five (05) rural (Bani, Falangountou, Gorgadji, Sampelga, and Seytenga). There are 202 administrative villages, 08 sectors and 323 farming hamlets. It is bordered to the north by Gorom-Gorom district, to the south by Manni and Tougouri districts, to the west by Djibo health district and to the east by Sebba health district and the Republic of Niger. It covers an area of 6,997 km². In 2021, its population is estimated at 408,320 inhabitants, with a density of 58 inhabitants per Km² [18].

The district has 33 health centers, including four which are still closed due to security issues; ten (10) health centers host IDPs. All functional health centers offer vaccination services, mainly as a fixed strategy in view of the security context.

The municipality of Dori comprises 8 sectors and 78 villages. Its population is estimated at 180,512 inhabitants (GCPH 2019). In terms of health, it hosts Dori Regional Hospital Center (CHR), two (02) medical centers and nine (09) health and Social Promotion Centers (CSPS).

According to CONASUR, the number of IDPs in the municipality of Dori stood at 52428 on August 31, 2021 (CONASUR, 31/08/2021). The target population to be vaccinated (aged 18 and over) represents 46%, or 24,117 inhabitants.

Study population

The study population is made up of staff from the Vaccination Prevention Department, the Sahel Regional Health Department, health district management teams and peripheral health facilities. The population of the town of Dori concerned by this vaccination is Internally Displaced Persons (IDPs) aged over 18 from IDP sites in the municipality of Dori. The partner institutions of the Sahel regional health department took part in the study.

Identification of resources and activities

Vaccination resources and activities were identified according to the different levels of our health system: the central level represented by the Vaccine Prevention Division (DPV), the intermediate level represented by the Regional Health Directorate of the Sahel (DRS/Sahel) and the peripheral level represented by the district management team (ECD/Dori) and the health and Social Promotion Centers (CSPS) in the town of Dori.

Cost estimation methods

We followed the following steps to estimate costs:

- Identification of the resources required for vaccination;
- Quantification of these resources
- Valuation of these resources in monetary terms.

The prices used are replacement prices (current cost of the input).

Data collection

Data collection was carried out at central, regional and district levels under the coordination of the Sahel Regional Health Director by trained investigators. The following techniques and tools were used:

Techniques:

- Literature review
- Semi-directive interview
- Data collection tools

Data were collected using a questionnaire, a semi-structured interview grid and a literature review grid.

Collected data

The following data were collected from a variety of sources (Table 3), and focused on different variables identified in relation to the evaluation objectives.

Types of costs studied

Capital costs (non-recurring): Non-recurring or capital costs apply to resources that last longer than one year, such as cold chain equipment and vehicles. Capital goods and services used for immunization include initial investments, such as introduction costs (microplanning, initial training and social mobilization/elaboration of IEC materials) as well as additional cold chain equipment, necessary vehicles and incinerators.

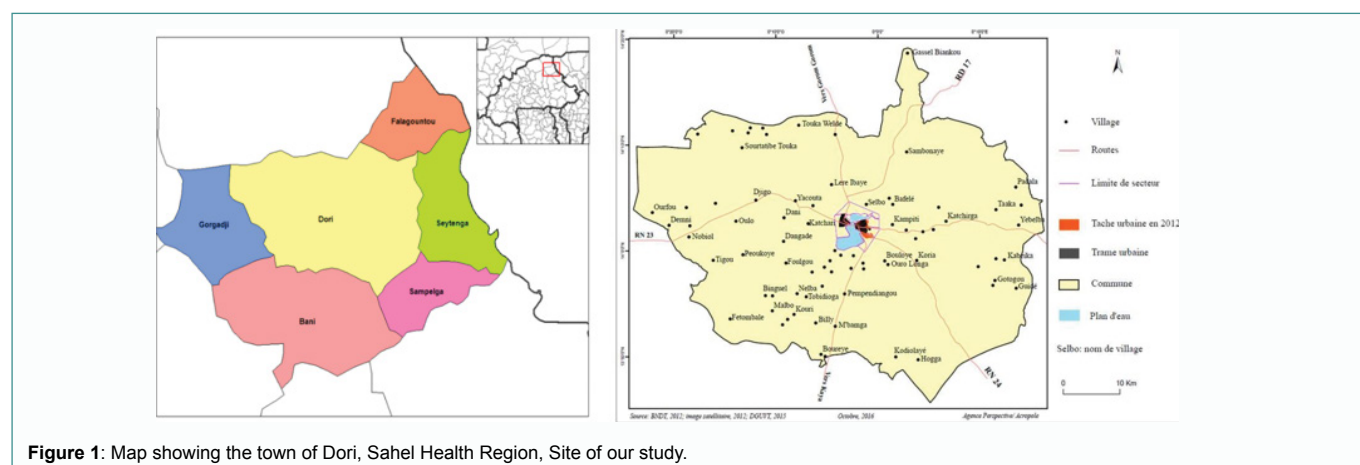


Figure 1: Map showing the town of Dori, Sahel Health Region, Site of our study.

The costs taken into account in our study were:

- Refrigerator
- Vaccine carrier
- Cold accumulators
- Building
- Motorcycle and car rentals

Recurring costs: Recurring costs apply to resources lasting less than a year [20]. In our study, these costs included:

- vaccine and vaccination consumables
- transport of vaccine and consumables
- laboratory inputs
- human resources
- training and coordination meetings
- supervision
- social mobilization and communication;
- safety
- vehicle and motorcycle maintenance
- vehicle rental

Costs specific to vaccinated people: These costs include travel costs to the vaccination site (fuel required), any payments for vaccination and the costs of lost productivity and/or opportunity due to time lost to vaccination.

Sampling:

Size of the sample: To determine the number of vaccinated people to be asked about costs, we used Schwartz's formula [21] below:

$$n = \left(\frac{z_{\alpha}^2 * p(1 - p)}{e^2} \right)$$

z_{α} = 11.96 for a risk α of 0.05.

e = absolute margin of error, set at 0.05.

P : the proportion of people vaccinated, estimated at 0.01.

To account for non-respondents, we have added 20%, giving a headcount of 20.

Date analysis données: The data were entered into Word and Excel and then analysed using these programs. A content analysis was done the speeches delivered to us.

Ethical considerations: The study protocol was submitted to the authorities of Burkina Faso Ministry of Health (Sahel Regional Health Directorate). The study obtained approval for data collection from the authorities of Burkina Faso Ministry of Health through a note from the Sahel Regional Health Director (note N° 2021-193/MS/RSHL/DRS dated August 18, 2021). Participation in this study was voluntary. Interviews were conducted in strict confidence. We ensured the confidentiality of our database by entering codes instead of people's first and last names. The data were password-protected. The use of the results of our work will be limited to the strict exploitation linked to

the objectives of our study.

Results

Vaccine types and strategy

Several types of vaccine are being considered by Burkina Faso for the first phase of its vaccination program, considered is this study. The Janssen vaccine (Johnson & Johnson) has been selected for the vaccination of IDPs. The vaccine is administered in a single dose. Vaccination at fixed sites in the form of a campaign for people present during the campaign. Those who did not receive doses will go to the training centers, where routine vaccination will continue. Ministry documents indicate that the first doses available will be supplied by the COVAX system (SII-AZ AZD1222 produced by Astrazeneca and vaccine supplied by the Republic of China). The deployment plan full integrates internally displaced populations in its forecasts, but the first-phase forecasts are inadequate in terms of health facility sites, and the absence of specific teams to reach localities with advanced strategies. This option seems beneficial according to the assessments (Table 1 and 2).

Table 1: Nature of data collection variables.

The campaign	Collected data
Social mobilization	Number of internally displaced people in the district, Implementation of social mobilization/communication activities.
Training	Training costs, transport costs, reproduction of tools,
Vaccination	Number of IDPs in the district, type of vaccination strategy used, type of vaccine used, quantity and unit price of vaccine, number of refrigerators and freezers, number of vehicles and unit prices, cost of transport, number of doses received by each IDP vaccinated, maintenance.
Supervision	Cost of transport, reproduction of tools
Monitoring	Demographic data, reproduction of tools, data management, campaign evaluation, communication costs, monitoring

Table 2: Questionnaires for collecting data on indirect costs.

N°/Persons	1	2	3	4	5	6	7	8	9	10
Vaccination site										
CSPS										
Age (year)										
Sex (M/F)										
Education level										
Main business										
Marital status										
Are you IDP (Yes/No)?										
What vaccines have you been given?										
Means of transport to the site										
Distance from home to vaccination site										
Estimated travel costs (CFA)										
Time lost (hours)										
Estimate time loss in money (CFA)										
Did you pay for the vaccination?										
If yes, how much?										
Did you experience any side effects after vaccination? If so, which ones?										
If yes, which ones?										
How long after injection did they appear?										

Size of IDP population to be vaccinated and people surveyed

According to a report by the National Emergency and Rehabilitation Council (Conseil National de Secours d'Urgence et de Rehabilitation (CONASUR)) [22], the number of IDPs in the commune of Dori stood at 52, 428 on August 31, 2021. The target population to be vaccinated (aged 18 and over) accounted for 46% of IDPs [23], or 24,117 people.

During this study, we were able to interview 137 people, including 51.82% women.

Non-recurring costs

Non-recurring costs (Table 3 and 4) amounted to 28,396,200 FCFA (USD 51,747). These costs were mainly represented by cold chain equipment (45%) and the construction of an EPI building (39%). Rental of rolling equipment accounted for 17%.

Recurring costs

Recurring costs (Table 5) amounted to 172,428,119 FCFA (314,220 USD). The main costs were for the purchase and transport of vaccine and consumables (43.7% and 32.6%), human resources (6%), reproduction of tools (8%) and social mobilization (3.4%).

Breakdown of total costs

The total cost (Table 6) of IDPs vaccination in the municipality of Dori is estimated at 200,824,319 FCFA (365,967 USD). It is made up of 14% capital costs and 86% recurrent costs.

In terms of expenditure categories (Table 7), the purchase and transport of vaccine and consumables accounted for over 60% of expenditure, followed by reproduction of tools (6.9%), cold chain equipment (6.3%), buildings (5.5%), human resources (5.2) and social mobilization (3%).

Cost integration

The amount of expenditure that could be integrated into the vaccination of the general population was 173,753,949 FCFA, i.e. 87% of the budget. The main items concerned were cold chain equipment, vaccine purchase and transport, laboratory inputs and management of AEFI (Adverse Events Following Immunization), training and coordination meetings (Table 8).

Costs specific to vaccinated people

The costs amounted to 905,175 FCFA, with an average of 6,607 FCFA. The lowest cost was 0FCFA and the highest cost was 49,000 FCFA. Loss of production due to time wasted on vaccination was estimated at 784,275 FCFA, or 87% of the costs. The of free care vaccination policy was effective, as no participant paid to be vaccinated.

Cost per person vaccinated

The total cost of the vaccination campaign was estimated at 200,824,319 FCFA for 24,117 people to be vaccinated, giving a cost per person vaccinated of 8,130 FCFA (15 USD).

Discussion

The vaccination campaign undertaken by the Ministry of Health is of great importance in the response to the pandemic, and the data analysed allow us to assert that internally displaced populations are being taken into account [24]. However, specific actions will need to be targeted at them, including motivation and reassuring communication [25] to ensure good community participation [26,27] and improve the level of IDPs' knowledge, especially those newly arrived in the city, and who may be less exposed to awareness-raising messages. In addition to this consideration, and in line with the guiding principles of the roll-out plan, a strict follow-up of the vaccine used, SII-AZ AZD1222, will be required, in view of the side effects already noted, to ensure maximum benefit for the population [9,14,28].

The total cost for vaccinating IDPs in the municipality of Dori is estimated at 200,824,319 FCFA. This amount is very high for a town in a developing country, and the share of recurrent costs indicates the need for support, and the COVAX initiative [11] will be supplemented by local partners. This is in line with the amount of the campaign announced at national level, which is 3 billion for the 3% of the population whose coverage needs are heavily dominated (86%, 87%) by recurrent costs [24]. The same observation was made by other studies that have examined strategies for implementing this vaccination [29].

These costs could be increased depending on the evolution of the security situation [15]. Beyond this cost, the benefits reported in various studies [15,30-32], and the impact of this pandemic on the economic fabric [6,33] with the risks of exacerbations due to the arrival of variants (LEMONDE), recommend that the necessary resources be found for the deployment of this vaccination in an equitable manner with effective consideration of IDPs. Skilful implementation based on well-monitored health logistics, with corrections of shortcomings resulting from good monitoring, will help to protect people and the economy [29,34] (Table 9-11).

Findings

The dominant cost in this evaluation remains the cost of vaccine acquisition, like several studies have shown. The cost of allowing these populations located in difficult areas to receive the vaccine is 8,130 FCFA (15 USD). This cost can be used by the Ministry of Health and its partners to plan other campaigns or develop vaccine strategies.

Conclusion, Limits & Recommendations

Burkina Faso has a deployment plan for COVID-19vaccination,

Table 3: Descriptive table of possible options for vaccination of IDPs and their consequences.

	Options	Consequences
Decision tree	PDI included in the routine system	Minimal additional cost Fewer IDPs vaccinated Risk of disease spread Epidemic persists over time in the locality High mortality among IDPs (vulnerable group)
	Setting up of a remote health post or training of specific teams to care for IDPs	Significant additional cost More IDPs vaccinated Rapid control of the epidemic in the area Protection of host population

Table 4: Data sources.

Item	Source and Method
Vaccine costs	Electronic stock management register (UNICEF)
Reproduction of tools	Micro-planning data for the immunization deployment plan with the department in charge of prevention through immunization
Rental of motorcycles and vehicles	Micro-planning data for the vaccination deployment plan with the department in charge of prevention through vaccination
Composition of AEFI kits	Guidelines for the use of 151,200 doses of Johnson & Johnson vaccine against COVID-19, 06 August 2021, Burkina Faso
Price of medicines and medical consumables	Joint Order N°2019-0306 MCIA/MS setting sales prices for essential generic medicines under international non-proprietary names
Number of IDPs	CONASUR - BURKINA FASO. Registration of internally displaced persons, 31/08/2021
Vaccination target (18 years old and beyond)	Population data for COVID vaccination of IDPs, July 2021 (DRS/Sahel)
Patient time	Response of vaccinated persons
Distances	Burkina Faso distance cards (DPV)
Fuel	DPV maintenance (0.2 liters per 100 km for vehicles and 50 FCFA/km for motorcycles) Joint order n°2020/014/MCIA/MINEFID setting retail consumer prices for hydrocarbons. Communiqué n°021/0008/MICA/CAB of March 19, 2021 on the increase in hydrocarbon prices.

Table 5: Breakdown of non-recurring costs for IDPs' vaccination in the municipality of Dori.

Components	Amount CFA	Amount USD	Proportion
Cold chain equipment (refrigerators, accumulators, vaccine carriers)	12646200	22993	45%
Buildings	11000000	20000	39%
Rolling equipment (vehicles and motorcycles)	4750000	8636	17%
Total Non-recurring costs	28396200	51629	100%

1 USD=548,75 (07/09/2021), <https://www.bceao.int/fr/cours/cours-des-devises-contre-Franc-CFA>

Table 6: Breakdown of recurring costs for IDPs' vaccination in the municipality of Dori.

Components	Amount CFA	Amount USD	Proportion
Vaccines and consumables	75354611	137320	43.70%
Transport of Vaccines and consumables	56247988	102502	32.60%
Laboratory	2251400	4103	1.30%
Individual protective equipment	1550000	2825	0.90%
Human resources	10393000	18939	6.00%
Training and meetings	2259470	4117	1.30%
Tool reproduction	13832500	25207	8.00%
Transport	1493000	2721	0.90%
Social mobilization	5946000	10836	3.40%
DBM management	224400	409	0.10%
Campaign evaluation	1077500	1964	0.60%
Management of AEFI case	1198250	2184	0.70%
Other costs (Unforeseen)	600000	1093	0.30%
Total Recurring costs	172428119	314220	100%

1 USD=548,75 (07/09/2021), <https://www.bceao.int/fr/cours/cours-des-devises-contre-Franc-CFA>

and internally displaced populations are clearly considered. The assessment of the costs of IDPs' vaccination in the town of Dori focused on the estimation of recurring costs, which appear high and in line with national and international planning. These recurring costs essentially comprise the purchase and transport of vaccine and consumables, human resources, the reproduction of tools and social mobilization. A large part of these costs could be integrated into a vaccination campaign for the general population. The advantages of vaccines such as those supplied by Astrazeneca mean that we can hope for a more cost-effective implementation, regarding the health logistics already in place in the field.

The main recommendation was to strengthen the mobilization of partners working in the humanitarian field, which remains essential to support the health district in meeting the costs that could arise

Table 7: Breakdown of different categories of expenditure for IDPs' vaccination in the municipality of Dori.

Components	Amount CFA	Amount USD	Proportion
Cold chain equipment (refrigerators, accumulators, vaccine carriers)	12646200	23045	6.30%
Buildings	11000000	20046	5.50%
Rolling equipment (vehicles and motorcycles)	4750000	8656	2.40%
Vaccines and consumables	75354611	137320	37.50%
Transport of Vaccines and consumables	56247988	102502	28.00%
Laboratory	2251400	4103	1.10%
Individual protective equipment	1550000	2825	0.80%
Human resources	10393000	18939	5.20%
Training and meetings	2259470	4117	1.10%
Reproduction of tools	13832500	25207	6.90%
Transport	1493000	2721	0.70%
Social mobilization	5946000	10836	3.00%
DBM management	224400	409	0.10%
Campaign evaluation	1077500	1964	0.50%
Management of MAPI cases	1198250	2184	0.60%
Other costs (Unforeseen)	600000	1093	0.30%
Total Costs	200824319	365967	100%

1 USD = 548,75 (07/09/2021), <https://www.bceao.int/fr/cours/cours-des-devises-contre-Franc-CFA>

Table 8: Breakdown of costs by type of cost for the vaccination of IDPs in the commune of Dori.

Components	Amount CFA	Amount USD	Proportion
Non-recurring costs	28396200	51747	14%
Recurring costs	172428119	314220	86%
Total	200824319	365967	100%

1 USD=548,75 (07/09/2021), <https://www.bceao.int/fr/cours/cours-des-devises-contre-Franc-CFA>

Table 9: Estimated number of vaccine doses required.

Items	Values
Number of IDPs for the municipality of Dori (31/08/2021)	52428
Target population (Tp)	24117
Planned number of doses per person (Dc)	1
Target vaccine coverage (Vc)	100%
Wastage rate (Wr)	15%
Wastage factor (Wf)	1,1764706
Requirements in covid vaccines (Tp*Dc*Vc*Wf)	28373

from any deterioration in security conditions complicating the operationalization of the campaign.

This study shows the importance of such evaluations, which could be carried out rapidly by Joseph Ki-Zerbo University, the Ministry

Table 10: Composition of a MAPI management kit.

The Ministry of Health recommends at least 1 kit at each vaccination site. In our study, we proposed 2 kits at each site.

Item	Quantity	Unit cost*	Total cost
SSI 500 cc	10	500	5000
Ringer 500 cc	10	500	5000
SGH	10	500	5000
Paracetamol tab 500 mg	1000	7	7000
Hydrocortisone inj 100 mg	10	350	3500
Adrenalin inj	10	450	4500
Intranule G18	10	125	1250
infusion sets	10	150	1500
Gloves	100	30	3000
TOTAL			35750

Table 11: Estimated number of vaccination teams

Item	Quantité
Total number of people to be vaccinated (N)	24117
Number of people to be vaccinated per day (n)	100
Number of vaccination days (t)	10
Number of teams required (N/(n*t))	25

of Health's National Institute of Public Health and all other research institutions, and inform the decisions to be taken for better coverage of hard-to-reach populations.

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