IOSR Journal of Pharmacy
(e)-ISSN: 2250-3013, (p)-ISSN: 2319-4219
Volume 16, Issue 3 Series. I (March 2026), PP.10-15
www.iosrphr.org

Situational analysis of the vaccine logistics cycle of the Expanded Program on Immunization

Marie-José Essi[1] , Jeanne Mauricette Mbole Mvondo[2], Esther Andriane Bitye Bi Mvondo[1]

[1](*Department of Public Health / University of Yaoundé I, Cameroon)*
[2](*Department of Pharmaceutics and Pharmaceutical Legislation / University of Yaoundé I, Cameroon)*
Received 15 March 2026; Accepted 31 March 2026

Summary
Introduction: *Ensuring the availability of vaccines determines the expected outcomes of vaccination. This depends on the quality of the logistics cycle put in place. The aim of the study was to take stock of the logistics cycle of vaccines in the Expanded Program on Immunization.*
Methodology: *A mixed-methods study was conducted over a period of 4 months at the Central Coordination of the Expanded Program on Immunization. Document review, complemented by direct observation of storage warehouses, allowed for the evaluation of the quality of the logistics cycle. All institutional and programmatic documents prepared by the EPI between 2018 and July 2024 were included. Data collection was carried out using the Logistics System Assessment Tool (LSAT).*
Results: *Two main actors were involved in the logistics cycle: the State and the partners. Regarding vaccine procurement, quantification was organized annually by a multidisciplinary committee and all purchases were handled by UNICEF. In terms of storage, the EPI warehouses met the required standards to maintain vaccine quality. Stock management was done through an information system consisting of monthly reports from the regions and management tools, mainly SMT tools. As for human resources, they were qualified and sufficient for the implementation of logistics activities. However, constraints related to vaccine availability were evident in stockouts and vaccine losses.*
Conclusion: *Despite a favorable political and organizational context, the efficiency of the vaccine supply chain remains a minor concern. Stockouts and vaccine wastage are the main obstacles to an effective supply chain and the achievement of vaccination goals.*
Keywords: *Vaccines; Supply chain; Expanded Program on Immunization; Cameroon.*

I. Introduction

According to WHO, vaccines are an integral part of primary health care and constitute one of the foundations of global health security. Thanks to them, the incidence of poliomyelitis has been reduced by 99%; likewise, the incidence and mortality attributable to diphtheria, pertussis, measles, tetanus, and meningococcal meningitis have been significantly lowered [1]. Yet, despite considerable progress, nearly 20 million infants each year still lack sufficient access to vaccines [2]. One of the objectives of the Global Vaccine Action Plan (GVAP) for 2030 is to ensure high-quality supply chains for vaccines and related products, as well as effective vaccine management, within the framework of primary health care delivery systems [3]. Indeed, vaccines must be delivered to areas that are geographically, culturally, and socially isolated, to marginalized populations, and to people affected by conflict, political instability, and natural disasters [4]. The vaccine logistics cycle refers to the set of steps that ensure vaccines are available, stored, transported, and distributed under optimal conditions to preserve their quality and effectiveness. In this regard, it encourages service utilization and increases the impact of immunization programs. Proper management of this cycle is a guarantee of program performance and is one of the most important aspects of disease prevention at all levels of the health system pyramid [5]. However, with the introduction of new vaccines, the achievement of new immunization targets, and the complexity of the logistics system for immunization products, the situational analysis related to the management of the vaccine logistics cycle in developing countries reveals numerous shortcomings that threaten access, availability, and quality of vaccines [6]. In Cameroon, despite the actions of the Expanded Program on Immunization (EPI) for more than 40 years, universal access to safe, effective, quality, and affordable essential vaccines remains a concern. Several bottlenecks have been identified at all levels of the health system pyramid, including storage capacity, stock management, distribution, and supply chain performance monitoring. These problems are the main causes of high vaccine wastage and stock-outs, with a negative impact on the performance of immunization services. To better

understand these issues at the central level of the health system pyramid, it is necessary to conduct a situational analysis of the vaccine logistics cycle within the Central Coordination Unit of the Expanded Program on Immunization.

II. Methodology

Type of Study: This was a mixed qualitative study combining desk research based on pile sorting and direct observations.
Study Site: The study was conducted in Cameroon, in the Centre Region, within the Central Coordination Unit of the Expanded Program on Immunization (EPI).
Study Duration: The study lasted eight (08) months, from December 2023 to August 2024. The data collection period itself was four (04) months.
Target Population: Strategic documents on vaccine supply in Cameroon.
Source Population: Strategic vaccine supply documents of the Expanded Program on Immunization (EPI).
Inclusion Criteria: Any document developed by the EPI between 2018 and 2024.
Exclusion Criteria: Any document that did not allow the research objectives to be addressed.
Sample: The sampling was exhaustive.
Data Collection Procedure : After validation of the research protocol, it was submitted to the Ethics Committee of the Faculty of Medicine and Biomedical Sciences (FMSB) of the University of Yaoundé I for ethical clearance. Subsequently, a request for authorization was filed with the Permanent Secretariat of the Expanded Program on Immunization (EPI), and data collection was initiated following favorable approval. The principles of confidentiality and dissemination of results were respected. Data collection was carried out after obtaining research authorization from the Permanent Secretariat of the EPI. It was based on the compilation of programmatic and strategic documents, identified using an extraction grid. The information was then consolidated using the revised Logistics System Assessment Tool, designed in line with the study objectives. Finally, a visit to vaccine warehouses was conducted to describe storage conditions.
Data Analysis: Quantitative data were stored in a virtual database using Microsoft Access software and analyzed with Microsoft Excel. Results were expressed as percentages and presented in the form of diagrams.For qualitative data, content analysis was conducted using a color-coding system, based on a dimensional matrix and performed manually. Findings were presented in the form of text, tables, and graphs.

III. Results

Study Limitations:
This work presents limitations inherent to qualitative research and to any knowledge review. Documentary research studies depend on the sources available, which may be biased or incomplete. They require considerable time, leave ample room for interpretation, and therefore involve a certain degree of subjectivity. Moreover, data evolve over time. An update of this work would thus be necessary to maintain its long-term relevance.

Study Population:
The study population consisted of the following documents:

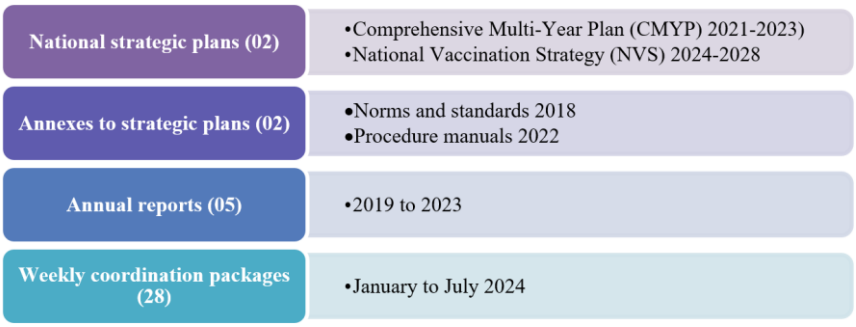

Figure 1: Study population

Vaccine Acquisition Mechanisms
Vaccine acquisition was the first step of the logistics cycle and included quantification and procurement. The study revealed that needs quantification was conducted annually and was based on demographic data (target population) and essential logistics data (Average Monthly Consumption). Moreover, it was carried out by a multidisciplinary team bringing together the main actors of the national supply chain (EPI, DPML), as well as partners.

Procurement was centralized by UNICEF through its Supply Division in Copenhagen. However, acquisition mechanisms varied depending on whether the supplies were intended for Routine Immunization Activities (RIA) or Supplementary Immunization Activities (SIA). The completeness of delivery was also influenced by donor funding.

Table I: mécanismes d'aquisition des vaccins

	Routine Vaccination Activities	Supplementary Vaccination Activities /Campaign
Needs assessment	Annual	Sporadic
Updating forecasts	Semi-annual	Sporadic
Supply plan	Available	Available
Order frequency	Semi-annual	Sporadic
Supply lead time	Safety stock + delivery time (3 months)	Stock depending on the target to cover
Purchase procedure	Purchase in coordination with the State and UNICEF for the acquisition of vaccines.	UNICEF Purchasing Centralization

Regarding international shipments, they were the responsibility of UNICEF, and the subsequent process was under the responsibility of the EPI, namely receiving and storing, as shown in the figure below:

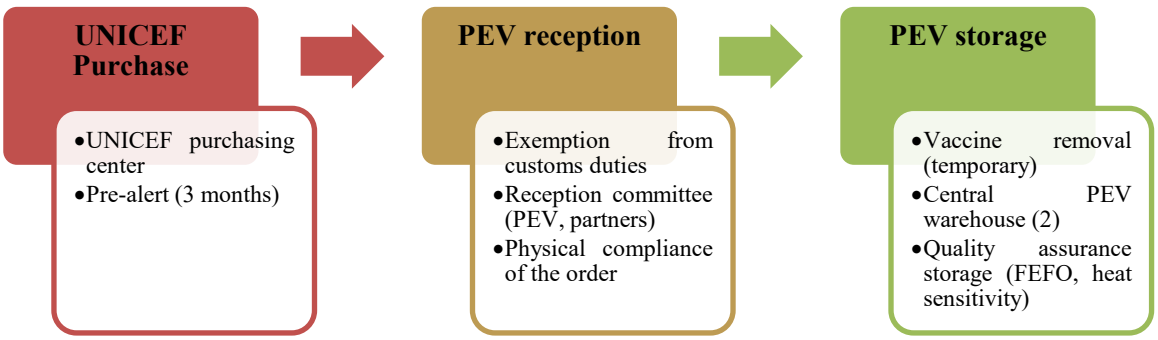

Figure 2: Vaccine transit and storage process

Information System and Logistics Management

To ensure effective inventory management, two information flows were used: the regional monthly reporting system and the ordering and delivery system. The frequency of transmission of overall stock reports was monthly, from the intermediate level to the central level, while inventories were conducted quarterly. In practice, although manual management tools were used, the SMT software was the most frequently used and systematically applied.

Table II: Information and logistics management system

Tools	Order	Reception	Delivery
Hardware	Stock Register Stock Sheet Inventory Sheet	Stock register Vaccine Arrival Report Pre-alert Packing list	Purchase order Delivery note Batch identification sheet Distribution plan Waybill

Software	Stock Management Tool (SMT) Unicef cost estimate Unicef request form Unicef forecasting tool	SMT PROMEDEO	SMT

Vaccine availability

They concerned stockouts and vaccine losses. Stockouts were observed over the past 6 years for 8 vaccines (Figure 3). In 2023, 36.4% (4/11) of vaccines experienced stockouts. The longest recorded stockout duration was 143 days for the HPV vaccine. For the other vaccines involved, the stockout periods extended to 61 days for the tetanus vaccine, 52 days for the pentavalent vaccine, and 10 days for the rotavirus vaccine.

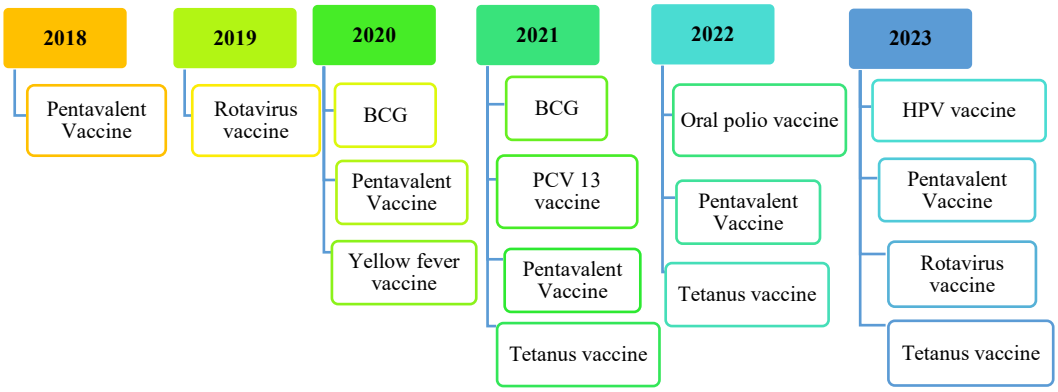

Figure 3: Vaccines that experienced a stock shortage between 2018 and 2023

Regarding the losses, 72.7% (8/11) of the vaccines were affected, as shown in the table opposite.

Tableau III: Challenges Related to Inventory Management in 2023

N°	Vaccines	Frequency	Break durations	Losses
1	**BCG**	+	-	0
2	**VAA**	+	-	410
3	**PCV 13**	+/-	-	160
4	**HPV**	+/-	143 Days	40
5	**RR**	-	-	10
6	**TD**	++	61 Days	630
7	**PENTA**	++	52 Days	0
8	**VPI**	-	-	30
9	**bVPO**	+/-	-	6300
10	**ROTA**	+	10 Days	126 580
11	**Covid**	-	-	0

Organizational and personal context

The implementation of logistical activities within the CC-PEV was handled by the Logistics and Maintenance Section. In this study, the LMS had a staff of 13 people. Those responsible for managing vaccines were mostly health logisticians and pharmacists. It also appears that the personnel were experienced in tasks related to vaccine management, with at least 2 years of seniority within the section.

Tableau IV: Personnel de la SLM en 2024

	Quality	Quantity	Continuing education
Managers	Health Logistician	(1)	+
	Senior Health Administrator	(1)	+
	Health Logistician	(1)	+

Executives	Pharmacist	(3)	+
	Data Manager	(1)	+
	Warehouse Manager	(2)	+
	Warehouse Supervisor	(2)	+
	Others	(2)	+

IV. Discussion

The study revealed that the quantification of EPI vaccines at the national level was carried out by a committee composed of a multidisciplinary team, based on the target population and previous consumption, while taking into account the available budget, in accordance with the WHO-recommended methods for estimating needs. As for procurement, it was centralized by UNICEF. This result is explained by the fact that UNICEF manages purchases for GAVI member countries. Indeed, international procurement mechanisms offer clear advantages for resource-limited countries in terms of cost-effectiveness, expenses, and order planning, helping to avoid stockouts or overstocking, unlike bilateral mechanisms. In Mali, the supply of vaccines and consumables is handled through UNICEF, with two deliveries per year, according to the forecast jointly developed and validated by WHO, UNICEF, and the national authorities [7].

To ensure the quality of health products, it is essential to maintain proper storage conditions. Product expiration dates are determined based on ideal storage conditions, and it is necessary to have standards and procedures for the proper storage of all products in order to maximize their shelf life and ensure their rapid availability for distribution [8]. Storage areas must therefore be designed to maintain the required conditions. In general, Storage conditions were deemed satisfactory. The EPI had a procedures manual relating to the storage and warehousing of vaccines. The central EPI warehouse met the required standards for storage in accordance with the guidelines on vaccine management standards and practices [9].

The study results show that the EPI had standardized tools enabling the management and monitoring of vaccine stocks, and the SMT tool was systematically used throughout the process. The frequency of transmission of overall stock reports was monthly, from the intermediate level to the central level, while inventories were conducted quarterly. This result corroborates that found in Mali in its cMYP 2017–2021, where stock management and vaccination information were handled through an information system consisting of monthly or weekly reports and IT tools mainly based on SMT [10].

An effective information system follows the rule of the 'six rights': the right information (essential data), at the right time (timely enough to act), in the right place (where decisions are made), and in the right quantities (all essential data from all structures) [11]. Its importance in a resource-limited country lies in improving availability, avoiding stockouts, and preventing overstocking. The study revealed that between 2018 and 2023, the EPI experienced vaccine stockouts: BCG, bOPV, HPV, PCV13, ROTA, YF, PENTA, and Td. The frequency of stockouts varied from one vaccine to another and could last more than four months. This could have several possible causes, notably poor needs estimation, insufficient funding since most of these vaccines are co-financed and the State's contribution is sometimes delayed. The COVID-19 pandemic also had a visible impact on vaccine and supply stocks.

A public health supply chain that integrates multiple products at all levels and across all sectors requires good organization to manage coordination, demand, supply planning, and the distribution of pharmaceutical products. To this end, countries increasingly recognize the importance of creating a Logistics Management Unit (LMU), a management structure responsible for organizing, monitoring, and supporting all supply chain activities within the logistics system [12]. Accordingly, the EPI had a Logistics and Maintenance Section and two units: the Vaccine Supply and Logistics Unit, and the Equipment Management and Maintenance Unit. In addition, procedures describing all activities of the components of a logistics unit were available. In this study, most of the personnel responsible for vaccine management were health logisticians and pharmacists. It also appears that the staff were experienced in tasks related to vaccine management, with at least two years of seniority within the section. Indeed, personnel constitute one of the dynamic links in the medicine supply chain, and a shortage of qualified and sufficient staff could hinder the achievement of vaccination program objectives and the optimal implementation of supply chain activities [13]. These figures are lower than those found in Côte d'Ivoire, where the staff of the logistics section of the Central EPI Directorate numbered 30 people in 2018 [14]. Furthermore, an evaluation conducted in 2023 in Congo revealed that logistics staff were insufficient, and their ranks did not allow for an assessment of their qualification to perform the roles and responsibilities assigned to them [15].

V. Conclusion

At the end of this study, whose objective was to conduct a situational analysis of the vaccine logistics cycle, we can state that despite a political and organizational context favorable to the establishment of a functional logistics cycle, the quality of logistics was only approximate. The main constraints related to vaccine availability were stockouts and vaccine losses, which compromise not only the effectiveness of the logistics cycle but also the

overall objective of vaccination. To avoid these impacts, proactive stock management, rigorous management systems, and contingency plans are essential to ensure a continuous flow of vaccines within public health programs.

References

[1]. Organisation Mondiale de la Santé (OMS). Global Vaccine Action Plan 2011- 2020. Genève : OMS ; 2011
[2]. OMS, Fonds des Nations Unies pour l'Enfance (UNICEF). Franchir une nouvelle étape dans la gestion des vaccins grâce à l'outil de gestion des stocks en ligne (SMT). Genève : OMS, UNICEF ; 2022
[3]. OMS. Immunization Agenda 2030. Genève : OMS ; 2023
[4]. Organisation des Nations Unies (ONU). Une disparité mondiale existe dans l'accès aux vaccins essentiels [En ligne]. 2022 [Consulté le 29 novembre 2023]. Consultable à l'URL : https://news.un.org/fr/story/2022/11/1129697
[5]. Mkandawire T. Renforcer les chaînes d'approvisionnement de la Santé publique : Un cadre d'intégration. Vill Reach ; 2022
[6]. Zaffran M, Vandelaer J, Kristensen D, Melgaard B, Yadav P, KO Antwi-Agyei, et al. L'impératif de renforcer les systèmes d'approvisionnement et de logistique des vaccins. Vacc. 2013 ; 31 : B73-80
[7]. GAVI. Gavi alliance Co-financing Policy. Washington: GAVI; 2015
[8]. World Health Organization Expert Committee on Specifications for Pharmaceutical Preparation. Model guidance for the storage and transport of time - and temperature-sensitive pharmaceutical products. Geneva: World Health Organization; 2011
[9]. Guimond C. Payette A. Boisvert C. Bélanger G. Bessette L. Guide des normes et pratiques de gestion des vaccins. 2021
[10]. Programme Elargi de Vaccination (PEV). Plan Pluriannuel Complet Mali 2017-2021. Mali : PEV ; 2018
[11]. Fédération Internationale Pharmaceutique, Organisation Mondiale de la Santé (FIP/OMS). Bonnes Pratiques Pharmaceutiques. Lignes Directrices conjointes FIP/OMS sur les bonnes pratiques pharmaceutiques : normes pour la qualité des services pharmaceutiques. Genève : FIP/OMS ; 1992
[12]. John Snow, Inc. Manuel de logistique : Un guide pratique pour la gestion de la chaîne d'approvisionnement des produits de santé. Arlington VA : Usaid/proj deliv; 2011; 208
[13]. OMS. Indicateurs harmonisés pour le suivi et l'évaluation des systèmes de gestion des achats et des stocks. Genève : OMS ; 2011
[14]. PEV. Plan pluriannuel Complet 2016-2020. Abidjan : PEV ; 2016
[15]. Fonds des Nations Unies pour l'Enfance (UNICEF). Revue externe du Programme Elargi de Vaccination au Congo en 2023. Brazzaville : UNICEF ; 2023