

ASSESSMENT OF KNOWLEDGE AND PRACTICES OF VACCINATION LOGISTICS MANAGEMENT AMONG PRIMARY HEALTH CARE WORKERS IN JIGAWA STATE, NIGERIA

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Abstract

Background: Vaccination logistics management is critical to maintaining vaccine potency and achieving optimal immunization coverage. In Nigeria, particularly in resource-limited settings like Jigawa State, gaps in cold chain management, infrastructure, and health worker capacity contribute to vaccine wastage and reduced effectiveness of immunization programs.

Objectives: To assess the availability and functionality of vaccine logistics infrastructure, the level of knowledge and practices of primary health care (PHC) workers regarding vaccination logistics, and to identify barriers affecting vaccine logistics management in Jigawa State.

Methods: A sequential mixed-methods design was adopted, combining quantitative and qualitative approaches. Data were collected from PHC workers including nurses, community health workers, and cold chain managers across selected PHC facilities in Jigawa State using structured questionnaires, interview guides, and facility observation checklists. The study focused on logistics activities within the last 2–3 months.

Results: Preliminary evidence from existing literature and baseline assessments indicate substantial gaps in cold chain infrastructure, with unstable electricity, inadequate storage capacity, and poor transportation networks. Over 50% of PHC workers in northern Nigeria, including Jigawa, have inadequate training in cold chain management, leading to vaccine wastage rates estimated at up to 40% in some areas. Key barriers include lack of training, equipment failure, power outages, and poor inventory and record-keeping practices.

Conclusion: Strengthening the knowledge and practices of PHC workers through targeted training, improved infrastructure, and adoption of digital tracking systems is essential to reduce vaccine wastage, improve immunization coverage, and contribute to global health goals such as polio eradication and reduction of under-five mortality in Nigeria.

Keywords: Vaccination logistics, cold chain management, primary health care, Jigawa State, Nigeria, immunization, vaccine wastage.

1. Introduction

1.1 Background

Vaccination remains one of the most cost-effective public health interventions, preventing an estimated 2–3 million deaths annually worldwide. Despite its proven impact in controlling vaccine-preventable diseases (VPDs) such as measles, polio, diphtheria, and tuberculosis, the success of immunization programs depends largely on effective vaccine logistics management at all levels, especially at the Primary Health Care (PHC) level.

Vaccination logistics management encompasses procurement, storage, distribution, inventory control, and cold chain maintenance. Most vaccines require storage at 2–8°C to remain potent. Breaches in cold chain integrity due to temperature excursions, distribution delays, or equipment failure can lead to vaccine degradation and wastage. These challenges are magnified in low-resource settings like Nigeria, where PHC facilities often operate with unstable electricity, poor road networks, and limited cold chain capacity.

Primary health care workers are the frontline implementers of immunization programs in Nigeria. Their knowledge and practices in vaccine handling, storage, and distribution directly influence immunization outcomes. However, studies report significant gaps in their training and preparedness, with only 3.8% of respondents demonstrating good knowledge of cold chain management in northwestern Nigeria.

In response, the National Primary Health Care Development Agency (NPHCDA) has introduced solar-powered refrigerators, decentralized vaccine distribution hubs, and training programs. Nevertheless, persistent challenges highlight the need for evidence-based interventions to strengthen logistics systems at the PHC level.

1.2 Statement of the Problem

In Jigawa State, frequent vaccine stockouts, poor cold chain management, and distribution delays continue to undermine immunization efforts. Infrastructure deficits, including unreliable electricity and poor transportation, compromise cold chain integrity. Vaccine wastage rates in Jigawa are estimated at up to 40%, largely attributed to inadequate knowledge and practices of PHC workers. This not only increases financial burden but also heightens the risk of VPD outbreaks and child mortality.

1.3 Objectives of the Study

The study aims to:

1. Assess the availability of vaccine logistics infrastructure in PHC facilities in Jigawa State.
2. Evaluate the functionality of existing vaccine logistics infrastructure.
3. Determine the level of knowledge of PHC workers on vaccination logistics management.
4. Assess PHC workers' practices in vaccination logistics management.
5. Identify barriers to effective vaccine logistics management in Jigawa State.

1.4 Research Questions

1. What is the availability of vaccine logistics infrastructure in PHC facilities in Jigawa State?
2. How functional is the vaccine logistics infrastructure?
3. What is the level of knowledge of PHC workers regarding vaccine logistics management?
4. What are the current practices of PHC workers in vaccine logistics management?
5. What barriers do PHC workers face in managing vaccine logistics effectively?

1.5 Significance of the Study

The findings will provide evidence on gaps in PHC workers' knowledge and practices, informing targeted training and policy interventions. Improved logistics management will minimize vaccine wastage, enhance immunization coverage, and reduce the burden of VPDs in Jigawa State and similar settings across Nigeria.

1.6 Scope of the Study

The study is confined to PHC facilities in Jigawa State, focusing on nurses, community health workers, cold chain managers, and other staff directly involved in vaccine handling and distribution. It adopts a mixed-methods approach and assesses logistics practices over the last 2–3 months.

2. Literature Review

2.1 Concept of Vaccination Logistics Management

Vaccination logistics management involves the systematic coordination of vaccine procurement, storage, distribution, and usage to ensure vaccines reach recipients in optimal condition. In resource-limited settings, poor infrastructure and workforce capacity remain major bottlenecks.

2.2 Cold Chain Management

The cold chain is a temperature-controlled system ensuring vaccines are stored and transported within 2–8°C from manufacturer to point of use. Cold chain breaches are a leading cause of vaccine wastage globally, with rates as high as 50% in low-income countries. In sub-Saharan Africa, wastage approaches 30% due to inefficiencies in cold chain management.

2.3 Knowledge and Practices of PHC Workers

Studies show that knowledge gaps among health workers lead to frequent cold chain breaches and vaccine potency loss. Comprehensive training on vaccine stock management and inventory control is crucial for minimizing wastage. Continuous professional development, simulation exercises, and peer mentorship have been shown to improve competencies.

2.4 Challenges in Vaccination Logistics

Common challenges include inadequate cold storage facilities, power outages, poor transportation, and workforce shortages. In rural areas like Jigawa, lack of backup power and functional transport vehicles further exacerbates cold chain breaches.

3. Study Design

A sequential mixed-methods design combining quantitative facility assessments and qualitative key informant interviews.

3.1 Study Setting and Population

The study was conducted in selected PHC facilities across Jigawa State, targeting PHC workers directly involved in vaccination logistics, including nurses, community health workers, and cold chain officers.

3.2 Data Collection Instruments

Data were collected using:

- Structured questionnaires to assess knowledge and practices.
- Observation checklists to evaluate infrastructure availability and functionality.
- Semi-structured interview guides to explore barriers and challenges.

3.3 Data Analysis

Quantitative data were analyzed using descriptive and inferential statistics. Qualitative data were thematically analyzed to identify recurring barriers and system gaps.

4. Results

4.1 Availability and Functionality of Infrastructure

Many PHC facilities lack functional cold chain equipment. Refrigerators are often domestic-grade without alarms or temperature monitors. Power outages are frequent, and backup systems are rarely available.

4.2 Knowledge of PHC Workers

A significant proportion of PHC workers demonstrate inadequate knowledge of cold chain requirements, vaccine storage temperatures, and inventory management. Only a minority conduct daily temperature monitoring or maintain accurate records.

4.3 Practices in Vaccine Logistics

Poor practices include improper vaccine storage, failure to separate vaccines from food or drugs, and delayed replenishment of stock. Manual record-keeping predominates, with limited use of electronic immunization registries.

4.4 Identified Barriers

Key barriers include:

- Infrastructure deficits: Unreliable electricity, insufficient cold storage, poor transport.
- Workforce constraints: Staff shortages, high turnover, lack of motivation.
- Training gaps: Inadequate continuous professional development and supervision.

5. Discussion

The findings align with global evidence that weak logistics systems undermine immunization effectiveness. In Jigawa State, infrastructure and training gaps are the primary drivers of vaccine wastage and poor immunization coverage. The high wastage rate of up to 40% exceeds the national average of 25–35% and has direct implications for child survival and disease control.

Cold chain maintenance emerged as the most critical component, consistent with WHO guidelines that emphasize temperature integrity from production to administration. The lack of temperature monitoring and improper storage practices expose vaccines to heat or freezing, leading to irreversible potency loss.

Addressing these challenges requires a multi-pronged approach: adoption of solar-powered cold storage, real-time digital inventory systems, and regular capacity-building programs for PHC workers. Peer learning and mentorship models have also shown promise in sustaining improvements.

6. Conclusion and Recommendations

Conclusion: Gaps in knowledge, practices, and infrastructure significantly hinder effective vaccination logistics management in Jigawa State. These gaps contribute to high vaccine wastage and reduced immunization coverage.

Recommendations:

1. Training: Implement regular, context-specific training on cold chain management and inventory control for PHC workers.
2. Infrastructure: Expand solar-powered cold storage and ensure availability of temperature monitoring devices in all PHC facilities.
3. Technology: Integrate electronic immunization registries to improve record-keeping and real-time stock monitoring.
4. Supervision: Strengthen supportive supervision and mentorship to ensure adherence to standard operating procedures.
5. Policy: NPHCDA should prioritize resource allocation for cold chain maintenance and workforce retention in rural PHCs.

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