



Preliminary results from direct-to-facility vaccine deliveries in Kano, Nigeria [☆]



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ABSTRACT

Objective: As part of its vaccine supply chain redesign efforts, Kano state now pushes vaccines directly from 6 state stores to primary health centers equipped with solar refrigerators. Our objective is to describe preliminary results from the first 20 months of Kano's direct vaccine delivery operations.

Methods: This is a retrospective review of Kano's direct vaccine delivery program. We analyzed trends in health facility vaccine stock levels, and examined the relationship between stock-out rates and each of cascade vaccine deliveries and timeliness of deliveries. Analysis of vaccination trends was based on administrative data from 27 sentinel health facilities. Costs for both the in-sourced and out-sourced approaches were estimated using a bottoms-up model-based approach.

Results: Overall stock adequacy increased from 54% in the first delivery cycle to 68% by cycle 33. Conversely, stock-out rates decreased from 41% to 10% over the same period. Similar trends were observed in the out-sourced and in-sourced programs. Stock-out rates rose incrementally with increasing number of cascade facilities, and delays in vaccine deliveries correlated strongly with stock-out rates. Recognizing that stock availability is one of many factors contributing to vaccinations, we nonetheless compared pre- and post- direct deliveries vaccinations in sentinel facilities, and found statistically significant upward trends for 4 out of 6 antigens. 1 antigen (measles) showed an upward trend that was not statistically significant. Hepatitis b vaccinations declined during the period. Overall, there appeared to be a one-year lag between commencement of direct deliveries and the increase in number of vaccinations. Weighted average cost per delivery is US\$29.8 and cost per child immunized is US\$0.7 per year.

Conclusion: Direct vaccine delivery to health facilities in Kano, through a streamlined architecture, has resulted in decreased stock-outs and improved stock adequacy. Concurrent operation of insourced and outsourced programs has enabled Kano build in-house logistics capabilities.

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1. Introduction

Although vaccination remains one of the most cost effective life-saving public health interventions [1], immunization coverage rates in Nigeria remain low and inequitable, with northern zones of the country significantly under-performing southern zones [2]. As such, Nigeria remains a large contributor to the global burden of vaccine preventable diseases and associated childhood deaths [3]. Weak vaccine supply chains that fail to guarantee reliable and uninterrupted availability of vaccines at service delivery points

are widely recognized as a key barrier to immunization system performance in Nigeria and elsewhere [4–10]. An Effective Vaccine Management (EVM) assessment of Nigeria's vaccine supply chain revealed significant weaknesses, with only one out of nine assessed criteria achieving the $\geq 80\%$ threshold between 2010 and 2014 [7].

As of 2012, Kano, despite being the largest and most populous state in northern Nigeria and the epicenter of the country's polio transmission at the time, was experiencing major failures in its vaccine supply chain system. In addition to gaps in cold storage capacity, the government-run vaccine distribution system was largely ineffective, characterized by inadequate and unreliable funding, a complex multi-layered architecture that depended on several decision-makers at the state, LGA and health facility levels, and a poorly executed mixed push-pull distribution mechanism [11,12]. The vaccine supply chain could neither support the

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improved routine immunization coverage that was necessary to prevent a resurgence of polio in the state, nor accommodate the planned introduction of new vaccines [8,13].

Evidence from several countries show that streamlining vaccine supply chain architecture by reducing the number of layers involved in the storage and distribution chain increases efficiency and saves cost [4,5,14–19]. In addition, outsourcing of vaccine distribution has been shown to significantly reduce the inefficiencies that are typical of government-run systems, resulting in improved overall performance, decreased costs, and strengthened in-house government capacity to manage the supply chain [6,14,15,19].

The institution of a tripartite memorandum of understanding (MoU) to strengthen routine immunization between the Kano State Government, Bill and Melinda Gates Foundation and Dangote Foundation in November 2012 [20], provided a platform and funding to reorganize Kano's vaccine supply chain system, in line with UNICEF and WHO's comprehensive EVM framework including a four-step strategy for continuous immunization supply chain improvements, quality management, optimization and innovation [21]. In addition to the funding, the tripartite MoU stimulated political will and commitment which is key to the success of the transformation program. As part of interventions funded through the basket funds occasioned by the MoU, the state's vaccine storage and distribution architecture was redesigned such that vaccines are pushed directly from 6 state stores to primary health centers equipped with solar refrigerators, bypassing the 44 Local Government Authority (LGA) cold stores. In line with the national policy of one fully equipped and functional Primary Health Center per political ward [22], one health facility is equipped with solar refrigerators in each ward and vaccines are 'cascaded' to other health facilities in the ward weekly by designated ward technical officers (WTOs) as illustrated in Fig. 1B.

Two distribution systems are being implemented in parallel in Kano. From May 2014, the state outsourced distribution of vaccines

from the state satellite stores to health facilities in four of its six sub-state zones (Bichi, Nasarawa, Rano and Wudil) to a third party logistics (3PL) provider. In September 2014, the state commenced in-house distribution to the remaining two sub-state zones (Dawakin Tofa and Gwale). Both the out-sourced and in-sourced programs implemented biweekly deliveries from the central state store until August 2015, when the programs were transitioned to monthly deliveries from the state central cold store and 5 state satellite stores to reduce overall program costs and better align with the state's administrative structures.

The objective of this paper is to describe the preliminary results from Kano's direct delivery operations. We do not, however, discuss in detail the broader contextual considerations in the immunization program and local political economy that would influence decisions or guide implementers and policy makers on approaches for implementing direct vaccine deliveries.

2. Methods

This study is a retrospective review of data on the performance of the direct vaccine delivery program as of January 2016 (following 20 months of implementation).

2.1. Data collection

Quantitative and qualitative data was collected from stakeholders in both the in-sourced and out-sourced vaccine delivery operations, and from frontline health workers, by trained personnel. Stock data for all 7 vaccines included in Nigeria's routine immunization schedule was obtained through physical stock counts by vaccine distributors during deliveries to each cold chain-equipped health facility, and verified through random spot checks by the review team. Delivery completion and timeliness data was obtained from daily vaccine delivery reports completed by vaccine

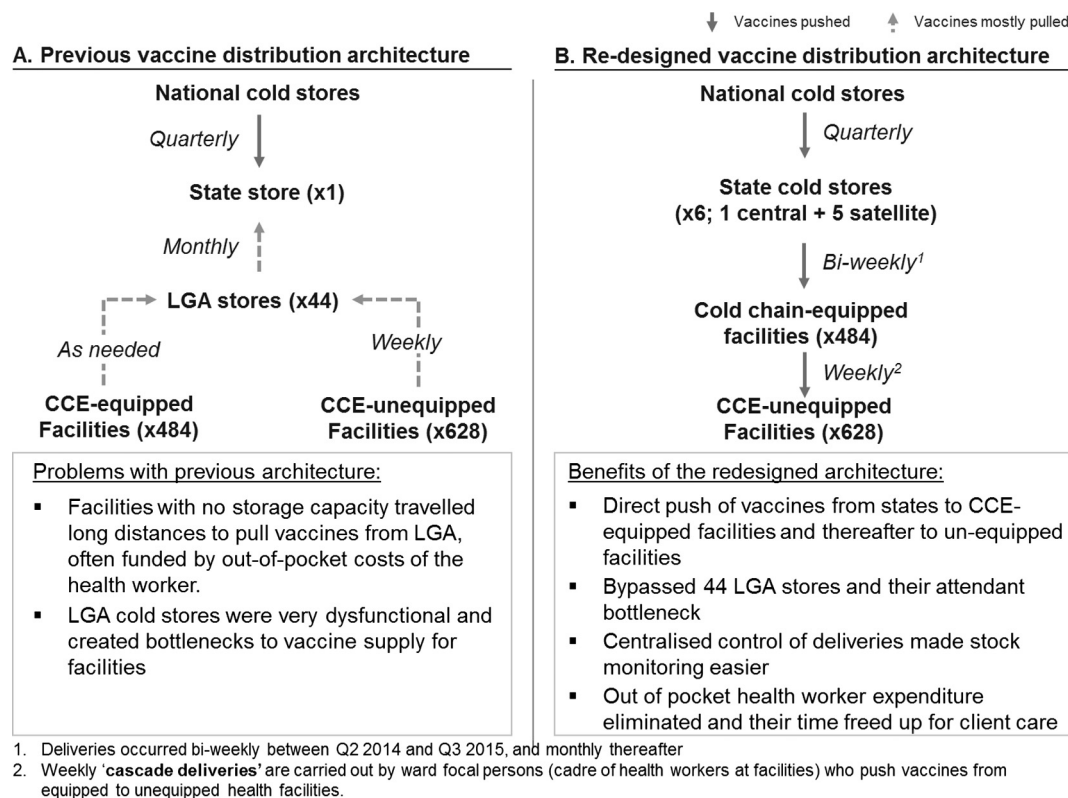


Fig. 1. Vaccine supply chain architecture re-design in Kano.

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