Data for Management: It’s Not Just Another Report

Vaccine Supply Chains: Reaching the Final 20 Policy Paper Series

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Policy Series Overview
We are mid-way through the Decade of Vaccines, marking a period of significant activity to prevent millions of deaths through more equitable access to vaccines. Today, about 80% of children around the world receive a complete routine of life-saving vaccines during their first year of life. The Decade of Vaccines was established to bring attention to the importance of reaching that final 20% of children without access to these life-saving vaccines. This decade is bearing witness to many exciting efforts to strengthen routine immunization, accelerate control of vaccine-preventable diseases, and introduce new and improved vaccines.

To a large extent, the evaluation of this decade’s success will be based on the degree to which vaccines reach the people who need them. A strong end-to-end supply chain should adapt to the resource constraints of these communities to ensure that delivery is complete: from the point of production of the vaccine to the point of immunization.

This policy series considers the different components of the supply chain, addresses the challenges faced at the last mile for distribution, and presents examples of innovative approaches to address those challenges. This fourth paper in the series focuses on the importance of data and its transformation into information for decision making.

VillageReach Overview
VillageReach has worked for more than a decade to develop, test, and refine system innovations to improve the performance of in-country vaccine supply chains. Working closely with the Ministry of Health in Mozambique and with support from the Bill & Melinda Gates Foundation, the Final 20 Project (designed to reach the final 20% of children without access to vaccines) is building a sustainable model of innovative supply chain design, enhanced data collection and reporting, and public-private partnerships to improve the vaccine supply chain.

To address the unique challenges of last mile distribution, VillageReach is engaged in a multi-year program in Mozambique to improve the performance of the vaccine supply chain, focusing on rural communities that represent over 50% of the country’s population. The approach – the Dedicated Logistics System (DLS) – was developed in collaboration with provincial governments and the Mozambican organization Fundação para Desenvolvimento da Comunidade (FDC). The DLS uses dedicatedlogisticians, level jumping, dedicated resources, and service delivery-level data to improve vaccine supply chain effectiveness and efficiency.
Requirements at the Last Mile
The Last Mile of Healthcare Delivery is the First Mile of Data

Data management is a key component of any supply chain in order to manage day-to-day operations effectively, assess performance over time, and identify opportunities for improvement. For the vaccine supply chain, key service delivery data on stock levels, vaccine consumption, wastage rate, stock-outs, target populations, and cold chain performance, among many other data points, are collected at the point of service or last mile of healthcare delivery. These data are validated, aggregated, and analyzed, which should then lead to decisions for improved supply chain management. In other words, the last mile of healthcare delivery is the first mile of data.

Given all the data available from service delivery points, advances in data management technology, and increased pressure for improved supply chain management, our focus must shift from a simple need for better data to improved data analytics for accurate decision-making purposes. Drawing on private sector approaches to reduce information overload, analytics is a systematic use of data and related operational insights to drive fact-based decision-making for planning, management, measurement, and learning. This process can narrow the data points collected to only what is needed for evidence-based decision making. Along the same lines, the global health conversation is shifting to see the value of transforming data into information. The Gavi Alliance prioritized data for management as a cornerstone of effective supply chains in its new Immunization Supply Chain Strategy. Data for management “addresses definition of standards, collection and use of high quality, timely, and relevant data for routine (e.g., avoiding a stock-out when a delivery is delayed) and strategic (e.g., procuring the right equipment based on an up-to-date inventory) decision making.” Essentially, vaccine supply chain managers are being encouraged to contextualize data for more effective, immediate and routine decision-making and subsequent policy formulation and practice.

Challenges to Last Mile Information

The many challenges affecting data quality at the last mile are well known. In low- and middle-income countries (LMICs), the bulk of data comes from health centers through labor-intensive paper-based systems, which can create an undue time burden on health workers. A perceived lack of usefulness of the tools and data leads to underutilization and the timeliness, availability, completeness, and reliability of data often degrades as it moves up the hierarchical administrative levels. This failure also leads to an often incorrect perception of lack of data by national managers and donors, who then create requirements for collecting as much information as possible.

For the vaccine program, the accuracy of the data collected at health centers and aggregated up the many levels is a quietly acknowledged problem, both at national levels and globally. One data quality audit implemented in 27 countries verified the quality of national reports based on administrative monitoring systems. The results documented inconsistencies in immunization data with discrepancies

in information between health units and their corresponding districts.\textsuperscript{4} The study also identified inconsistent use of monitoring charts and poor monitoring of completeness and timeliness of reporting. With all the focus in the recent decade on the importance of vaccines and data management, improvements must have been made since this study was implemented in 2005. However, currently sub-national levels somewhat frequently report estimated vaccine coverage that can exceed 100%, either due to outdated censuses, poor population projections, or poor administrative data.\textsuperscript{5}

Many root causes contribute to poor quality data, one of which is often cited as insufficient human resource capacity. The core task of health workers is caring for patients; stock management and data collection get added on to their task list but become secondary activities due to an overload of patient care. A recent data burden assessment of clinical care and immunization programs in low-income countries documented the daily challenges faced by health workers:\textsuperscript{6} the proliferation of data points; data collection tools that are not used at the health facility level; lack of time for completion of data collection; and perceived mistrust in the quality of the data and lack of connected systems. Additionally, a significant finding also documented too much emphasis on what is collected and not enough emphasis on what is shared. No common tools for sharing, analyzing, and interpreting results exist to provide a feedback loop between the different administrative levels.

Even if one were to address the challenges of data collection by health workers, having good data and analytics does not necessarily lead to use of the information for improved decision making.\textsuperscript{7} The vaccine program has taken on a culture of reporting rather than a culture of using the information for continuous improvement.\textsuperscript{8} Wall charts are displayed prominently at immunization posts that show the clinic reaching the target group with a certain vaccine each month, but the numbers may vary wildly from 40% to more than 120%. Without a feedback loop between different administrative tiers and the understanding of how to interpret the data, the opportunity for meaningful interpretation is lost and appropriate decisions cannot be made.

The challenge of using analytics for improved decision making is not unique to the Expanded Program on Immunizations (EPI) in LMICs. Similar challenges were identified in the healthcare industry in the United States,\textsuperscript{9} noting the biggest stumbling block for analytics adoption is not just lack of data but also the other extreme of the sheer volume of data that must be analyzed. Other obstacles identified that are also similar to the LMIC context include a culture that does not encourage information sharing, a lack of understanding of how to use data for decision making, and the inability to make a case for change. We see this in LMICs with health workers submitting data that give false representation of reality at the health center, graph charts on the walls of supervisor offices that have no real value, and


\textsuperscript{9} MIT Sloan Management Review and IBM Institute of Business Value. (2010). The new path to value. \textit{Massachusetts Institute of Technology}. 
existing evidence for policy change but issues of “turf” preventing any changes to be made to those policies.

**Promising Practices for the Last Mile**
An emerging area of focus related to data for management for the global vaccine community is data visualization and utilization. Adding analytical capability to data coming from the health center levels can provide forward thinking guidance that can move toward continuous improvement. Analytics must be accompanied by systems and processes that guarantee reflection on information, improved decision-making capability, and the responsibility and power to make necessary improvements.

**The DLS Approach**
An informed push distribution model, the Dedicated Logistics System (DLS) has changed the system design to improve efficiency and cost-effectiveness in the vaccine supply chain in four provinces in Mozambique. Previous policy papers have touched upon the system’s design, human resource practices, and cold chain maintenance. In terms of improved data for management, the DLS has incorporated three innovations linked to data collection, data visualization, and processes for data utilization.

**Data collection.** The DLS uses dedicated logisticians to manage monthly transport loops for direct delivery from the provincial level to the health centers, skipping the district level as a storage unit while maintaining and reinforcing their supervisory role. Among other duties, these dedicated logisticians are responsible for data collection from the health center, a process which confirms the quality of the data, triangulating from different sources to confirm validity. Stock and consumption data are verified against reality, physically counting existing vaccine vials, comparing that against stock cards as well as electronic data from the previous month’s distribution and consumption.

Consolidating logistics tasks to dedicated logisticians improves data quality and availability by allowing these trained logisticians to focus full-time on what they have been trained to do. During each distribution visit, the logistician reviews registers and stock cards together with health workers, allowing for an informal data quality audit and an opportunity for correcting errors in calculations and assumptions, with on-going supervision reinforced with each visit. Monthly review of the data together with the health workers also leads to its improved quality.

The benefit of this approach also extends to health workers by reducing the burden of data collection and allowing for focus on patient care, their core skilled task. This is not to say that nurses are no longer required to collect and maintain data, but using a dedicated logistician reinforces the data collection system and provides an extra layer of quality control.

With this change in the system design and data collection process, the Provincial Directorate of Health (DPS in Portuguese) has insight into relatively real-time data from the health center level, which is nearly impossible to get from other multi-tiered distribution systems with only aggregated paper-based reporting, and without adding tasks to health workers. This comprehensive insight and streamlined data collection can lead to improved decision making by turning data into more reliable information.
Data Visualization. The information management system used by the dedicated logisti- 
can, *Sistema Electronica de Logísticas de Vacinas* (SELV), is built on the *OpenLMIS* 
platform. Data is entered either on a tablet directly at a health center or on a 
desktop computer upon return to the provincial capital. One beneficial aspect of 
SELV is the analytical function provided in the monthly reports. The data collection 
forms were designed to provide root cause analysis for determining follow-on actions to 
improving supply chain management. This approach streamlines the process to collect only 
the relevant data points.

One example of targeted data management and utilization is the tracking of delivery 
intervals between distribution visits, a key performance indicator in SELV. The goal is to 
achieve monthly deliveries; however, delays inevitably occur. The drill-down capability of 
the SELV reports allows insight into the reasons for delay — if funds were not 
available to purchase fuel, a problem with transport, or if weather prohibited travel or 
access, to name a few. The data is presented in graphs for key performance indicators, 
which provide a quick overview of the performance of the distribution system, and 
all data points are available for deeper

“SELV facilitates decision-making at the base level and corrects the same problems 
identified during [distribution] visits; it eases data entry and management of vaccines and 
supplies at the health center level.”

– Arcanjo Alberto Macariche, Field 
Coordinator/Logistician
Niassa Province, Mozambique

Processes for Data Utilization. After each monthly 
distribution, participatory follow-up sessions are held 
each month where the dedicated logistics review the 
dashboard with the provincial EPI manager, 
medical chief, and the DPS logistics supervisor to 
identify bottlenecks and ways to improve subsequent 
distribution activities. In the previous example of
examining reasons for delay, the DPS can begin to see trends in causes of delays in distribution and course correct, as in the case study from Niassa province (see Box 1).

At the health center level, this analytical capacity can be even more insightful. With immediate access to the previous month’s data, the dedicated logistician can check against previous deliveries and consumption data to find gaps in data that may not have been recorded by the health workers during the month. For example, this deeper analysis may identify some emergency stock that was procured from a nearby health center during the month yet not recorded on the stock card. Knowing this information can improve forecasting and distribution practices for that particular health center, that distribution loop, and, ultimately, the overall planning for the country.

Since launching SELV and establishing the review process and feedback loop, we have seen a better understanding of distribution bottlenecks at the provincial level, with more attention on finding solutions to challenges in the supply chain. Direct data collection has improved visibility at the last mile of the distribution system, led to better analytics and interest in analysis, which all leads to action to improve the supply chain. The ultimate goal is a sustainable approach with the DPS and the Ministry of Health taking full responsibility for using the information, the dashboard, and ensuring vaccine availability through to the last mile.
Box 1: How Data Transformed Niassa Province

Maintaining a 33-days interval between vaccine deliveries to a health center is a global standard for vaccine supply chains. Erratic delivery schedules lead to poor vaccine availability, higher stock-outs and wastage, because health centers are either under-supplied or over-supplied if the next visit date is unknown; routinized, 33-day interval schedules deliver sufficient stock for the period, knowing that the next visit will be within a set time period.

SELV analytics on delivery intervals over the past year in Niassa province in Mozambique clearly show an improvement starting in August, soon after the launch of SELV. The EPI manager recognizes that many factors influenced this improvement, but one significant factor acknowledged was the monthly review process of SELV reports, with the dedicated logisticians having a better understanding of the benefits of data to perform their activities.

One change resulted in better vehicle management. Through review of the monthly reports, the DPS noted common delays on distribution departure days, thus contributing to longer delivery intervals. Through deeper analysis, they discovered these delays were due to the vehicles not being sent to maintenance in a timely fashion. The monthly SELV reports provided clear analytics of the domino effect of one or two days delay for vehicle maintenance accumulating up to two weeks delay in the delivery cycle and thus higher stock-out rates. The simple switching of the vehicle service period to immediately upon returning from the distribution cycle has essentially eliminated delays in distributions.

The cold chain provides another example of improved supply chain management practices in Niassa. Reports showed consistent problems with low refrigerator uptime, usually less than 80%. The monthly review process acted as a constant reminder of this problem with the DPS not being able to avoid it. To that end, the DPS created a budget for refrigerator spare parts and began to include the technicians on distribution activities to provide on-going and regular preventive and corrective maintenance. By the end of 2014, the rate of functioning refrigerators increased to over 90%.
Global Innovations at the Last Mile

VillageReach is not alone in bringing more attention to data collection, visualization, and improved processes for decision making for the vaccine supply chain. As part of a global shift to prioritize health systems strengthening, several initiatives are addressing this, both in vaccine programs and general health system.

Reducing Information Asymmetry to Improve Stock Availability: Logistimo, in India, has introduced a data for management system that has resulted in demonstrated improvements in data use for action.10 Designed to address the issues of information asymmetry of supply and demand and ad hoc distribution practices, this innovation has resulted in increased vaccine stock availability and improved response time to replenish stock after a stock-out.

Logistimo introduced a “Bulletin Board” system with increased visibility at the decision-making level of the supply chain. Data on vaccine utilization is collected from health centers using mobile phones with a user-centric design, averaging 15 minutes of data entry time per week, greatly reducing the data burden. The data analytics are shown on the dynamic HTML page Bulletin Board that continuously streams and highlights abnormal events, such as stock-outs, low stock, and user inactivity. The information is presented in a way that is quickly consumed, actionable, and using an element of social pressure to motivate people into action.

The Bulletin Board, by providing increased visibility and analytics, has enabled improved response time to replenish vaccines in the event of a stock-out, resulting in increased vaccine availability at the last mile. Key factors noted for the success of this innovation are the quality and timeliness of data, and having an effective service design for data capture and visibility. With these elements in place, marked behavioral changes related to improved stock management are evident. Vaccine stock availability has increased to 99% and replenishment responsiveness has improved by 64%.

Improved Information Management Systems. The Better Immunization Data (BID) Initiative is an innovation from PATH to improve data quality and utilization in order to lead to better decisions in immunization that could spread to other health service delivery areas. It is a holistic approach that encompasses information systems, policies and practices, people, and packaging solutions for scale. One component, a peer support network, empowers health workers to proactively seek out solutions through identified champions or high performers. This enables health centers to solve their own challenges. Monthly dashboards are being developed that are tailored to the context of the target audience. These dashboards show the performance of health centers in a general vicinity, enabling any given facility to reach out to colleagues from health centers that are high performing in any given aspect of supply chain management. The initiative includes social media groups for health workers, including District Immunization and Vaccine Officers (DIVO) as well as Regional Immunization and Vaccine Officers.

Anecdotal evidence is already beginning to demonstrate the utility of this network. In one example, health workers alerted the social media group about a temporary stock-out, which resulted in a health center with excess stock quickly working to send stock to the health center in need. In another instance,

a health worker took a picture of a particular report she was having difficulty with and shared the picture with the social media group with a request for assistance on filling out the report, promptly receiving assistance.

For health centers where connectivity and cell reception are not available, a one-page newsletter will supplement the monthly dashboard to enable the DIVO to have a regular forum to speak about district-wide challenges or opportunities. The newsletter will also highlight champions within the district who can be targeted for advice on a particular topic, help resolve challenges, or introduce solutions.

**Utilizing Geospatial Tracking for Polio Eradication.** eHealth Africa (eHA) works with national, state, and local governments in Nigeria as they complete the final push in eradicating polio from the African continent. eHA contributes to eradication efforts in Nigeria through a suite of complementary activities and projects aimed at better data, improved coordination, and more efficient operations. The program is designed to help vaccinators reach their intended targets, collecting smart data and utilizing geospatial information to streamline and strengthen immunization activities, while reporting near-real-time results with high-quality monitoring & evaluation along the way.

To achieve this, eHA works in partnership with Novel-T to operate a custom Vaccinator Tracking System (VTS) & dashboard, enabling administrators to monitor the movements of vaccinators, view the percentage of area covered, and identify missed settlements. The software is built to identify instances in which vaccinators spend an adequate amount of time necessary to vaccinate a child and detect events that may indicate a missed household. Each vaccinator is supplied with an Android-based mobile phone equipped with a custom tracking application. At the end of each day of the four-day polio vaccination campaign, the vaccinators’ “tracks” are uploaded to a server, missed areas are identified, and new locations are scheduled for campaign “mop-up” days. This system becomes a positive feedback loop, and gives administrators the data needed to modify strategy, adjust resources, and rectify noncompliance, to ensure that transmission of polio stops. During each monthly immunization-plus campaign, eHA provides mobile phones to 12,000 vaccinator teams, harnessing data from 80 local government areas across Northern Nigeria.

**Conclusion**
The need for data for management to strengthen the vaccine supply chain is clear. However, the need goes well beyond simply collecting data and filling out reports. One way to look at this concept is using a capability progression.\(^\text{11}\) Adapted to the LMIC context for the vaccine supply chain in many countries, the *aspirational* stage involves basic data collection, with the monthly reports being aggregated and sent up the hierarchical chain. A country at the *experienced* stage moves to more use of the data through improved analytics and increased ability to share information and insights. Finally, the *transformed* stage is achieving a culture of analytics and using the information for improved decision making.

Global health thought leaders are currently digging into the details of this progression as they develop the Visibility and Analytics Network (VAN). An initiative led by the Bill & Melinda Gates Foundation, this initiative has brought key global vaccines and supply chain leaders together to define approaches to

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improve product availability, gain visibility to beneficiary needs, create deeper analysis to garner insight, leading to continuous improvement of effectiveness and efficiency of public health supply chains.\(^\text{12}\)

Many of the key design principles involved in a VAN, adapted from the private sector “control towers”, reflect the approaches described in the global innovations already discussed in this paper:

- **People.** Supply chain professionals in a centralized and integrated team; trained on and applying quantitative analysis of supply chain performance.
- **Process.** Data driven, using analytical methods to plan and proactively respond to problems in the supply chain; provide recommendations of continuous improvements.
- **Technology.** Systems for data collection and aggregation that generate alerts and deliver actionable insight.
- **Policy.** Visibility of the end-to-end supply chain encompassing all programs and tiers; empowered to measure performance.

It is encouraging to see the global shift to improved data analytics. As more countries move beyond simply monthly data collection and reporting to new approaches that streamline and improve data collection, and encourage in-depth analysis of relevant information, public health vaccine supply chains are poised to become more efficient and better performing. The lives of the final 20 percent of children who are not receiving vaccines today are depending on it.

This paper is the fourth in a series addressing the components of the vaccine supply chain. The health supply chain is a dynamic ecosystem which can increase access to high quality products by efficiently bringing the different components together to ensure delivery of commodities, as seen in the figure above. System design involves the set-up of the components of the supply chain system and how they interface with each other. The processes and policies determine how logistics practices get implemented in the field. Information and data flow influence forecasting, procurement, and daily management of the system, both at the global and in-country levels. Equipment ensures vaccines are delivered and have proper storage at every point of the supply chain. A key component is the people who operate and influence the supply chain and their capabilities, expertise, culture and behavior. The availability of funding, and particularly the flow of funding for each of the different levels of the system, is vital to ensuring delivery of vaccines. Finally, political will and the aspirations of leaders and champions can influence the performance of a supply chain by regulation and creating an enabling environment. Determining how the seven main components of the vaccine supply chain work together ultimately influences the degree of availability of vaccines at the point of immunization.

Future papers in this series will address other components, drawing on the evidence from the last mile of vaccine distribution through the Final 20 Project and global experience.

For more information, please visit www.villagereach.org.