Leveraging Digital Health Information for Vaccination Programs in the Democratic Republic of Congo: A Case Study

1. Why

The Democratic Republic of Congo (DRC) is one of the largest countries in the world and is home to an estimated 115.7 million people. It also ranks among the countries with the highest number of zero-dose children; over 750,000 infants (approximately 20%) have never received any vaccinations.[1,2]

The DRC faces significant challenges in providing widespread access to vaccines. Poor healthcare systems, especially in remote areas, coupled with outdated paper records, hinder effective vaccine management and tracking. The vast and diverse geography of the country increases logistical difficulties. Limited funding, vaccine shortages, and a lack of trained health workers further exacerbate the problem.

Given the high number of zero-dose children, DRC has been classified by Gavi, the Vaccine Alliance as one of five High Impact countries (along with Ethiopia, Nigeria, India and Pakistan). Combined, these High Impact countries represent approximately 26% of the world's population, 48% of total birth cohorts and 56% of all zero-dose children in Gavi-eligible countries.

In early 2022, the DRC, with funding from Gavi, the Vaccine Alliance, launched a new plan called "Mashako 2.0" to improve childhood vaccination rates in 9 of its 26 provinces. This plan aimed to increase the number of fully vaccinated children by 15% within 18 months, focusing on coordination, vaccine availability, and real-time monitoring and evaluation.

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> *The DRC digital health investments roadmap is therefore a valuable document and presents clear orientations in terms of investment priorities for the country. I believe that by being better coordinated and aligned behind this common vision, we will be able to offer the DRC a health system that performs well within the framework of Universal Health Coverage and more resilient than before.*
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> **Dr. Jean-Jacques MBUNGANI MBANDA**
> **Former MoH Minister,**
> *during the roundtable to disseminate the roadmap*
> *for Digital Health Investment in DRC on the 9 March 2022*

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1 Nimpa, M.M., Cikomola Mwana-Wabene, A., Otomba, J. et al. Characterizing zero-dose and under-vaccinated children among refugees and internally displaced persons in the Democratic Republic of Congo. Trop Dis Travel Med Vaccines 10, 17 (2024). https://doi.org/10.1186/s40794-024-00225-0

2 Mbunga, B. K., Liu, P. Y., Bangelesa, F., Mafuta, E., Dalau, N. M., Egbende, L., & Burstein, R. (2024). Zero-dose childhood vaccination status in rural Democratic Republic of Congo: quantifying the relative impact of geographic accessibility and attitudes toward vaccination. Vaccines, 12(6), 617. https://doi.org/10.3390/vaccines12060617

2. What

The DRC's National Digital Health Strategy (2020-2024) aims to leverage technology to enhance healthcare, particularly in immunisation programs and disease control. Despite facing challenges in funding, legal frameworks, workforce development, and infrastructure, the country has made notable progress. The Global Digital Health Monitor places the DRC at phase 3 of digital health maturity[3], indicating strong leadership and planning foundations. To fully realise its digital health potential, the DRC needs to invest in areas such as data privacy, digital health training, and information exchange systems. Complementing these efforts, Gavi's Digital Health and Information (DHI) Strategy (2022-2025) outlines a vision for the digital transformation of immunisation, aligning with the Gavi 5.0 Strategy and zero-dose agenda. This strategy focuses on six priority DHI intervention areas to improve immunisation outcomes and address common program challenges, ultimately aiming to increase access, quality, and use of data for comprehensive childhood vaccination coverage, including:

1. Identification and reach of zero-dose and under-vaccinated children

2. Digital supply chain information systems (eLMIS)

3. Real-time planning and monitoring of vaccination campaigns

4. Effective sub-national data use

5. Digital interventions supporting vaccine confidence and demand for vaccination

6. Electronic vaccine-preventable disease (VPD) surveillance data exchange for targeted vaccination and outbreak response

The DRC is working to achieve the goals in Mashako 2.0 by harnessing the power of technology. Their National Digital Health Strategy 2020-2024 outlines a clear plan of using digital tools to make healthcare services more efficient and accessible, with a focus on strengthening the operational level of the healthcare system, including the digitization of vaccination interventions.

The following section outlines ways that DRC is leveraging digital health information for vaccination programs.

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3   https://monitor.digitalhealthmonitor.org/country_profile/COD

Identification and reach of zero-dose and under-vaccinated children: In order to improve identification and reach of zero-dose and under-vaccinated children, DRC has adopted several initiatives:

- DHIS2 tracker, an electronic immunisation registry, to collect and monitor individual-level vaccination records. This digital system was originally deployed for Covid-19, but through Gavi's Equity Accelerator Funding (EAF), the system is being expanded to track routine immunisations and incorporate a birth registration module. This new module will provide all newborns with an electronic vaccination card and Unique ID through a QR code for real-time identification and tracking in order to better identify and track zero-dose and under-vaccinated children. The DHIS2 tracker is being implemented in 11 out of 26 provinces, with plans to scale nationally as resources are available.

- The Mapping for Health project used geospatial data to strengthen the planning and implementation of vaccination services in seven provinces with a focus on the identification and immunisation of zero-dose children. These tools enable health workers to develop detailed micro-plans which provide a better understanding of where people live, where they need healthcare, and how to reach them with vaccination services, ultimately allowing for more effective and equitable vaccination service delivery. An evaluation of this program found that geo-referenced micro-plans were well-received, leading to significant improvements in identifying and reaching zero-dose children, with immunisation coverage increasing from 8.9% in 2020 to 92% in 2022 for Pentavalent 3 antigen. Additionally, a gender intervention was perceived to improve women's ability to engage in vaccination efforts.

Digital supply chain information systems (eLMIS): Two systems have been historically used to track vaccination stock. At the primary healthcare level, supervisors have used ODK to collect logistics information about stock levels, expiry dates, and request new stock and document wastage. However, this system only provides visibility of data at the health facility level and does not aggregate up to the national level, where decisions about stock management are made. At the national level, health program managers use a basic stock manager Excel tool (SMT) to track vaccine stock distribution, but there is no coordinated system to link the health facility with the national level and provide visibility into the supply chain at all levels of the system. The government has decided to build an end-to-end electronic logistics management information system (eLMIS) using the existing SMT tool integrated with DHIS2 which will enable data input and visibility at all levels of the health system, starting at the health facility and going up to the central (national level). This system has already been developed and is being scaled up nationally.

Real-time planning and monitoring of vaccination campaigns: The EPI launched an innovative polio vaccination campaign in Haut-Lomami province in November 2023 as part of the Integrated Digitization of Public Health Campaigns project. Vaccinators enter aggregate data daily about the number of households visited, immunisations given, vaccine stock, wastage and other metrics, which are then visible on DHIS2 immunisation dashboards and PowerBI which allows health managers to view daily progress and make mid-course corrections during a campaign. This real-time monitoring system was piloted in two health zones in one province and is being integrated into plans for future vaccination campaigns, including an upcoming Yellow Fever vaccination campaign.

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The digitization of the polio campaign has revolutionised multiple aspects of the process. By leveraging DHIS2, healthcare professionals gained the ability to collect and analyse evidence-based data in real time. This capability enabled more targeted and accurate interventions. Additionally, it eliminated the need for providers to manually compile data at the end of each day, a task that frequently introduced errors. This digital transformation has significantly improved the efficiency and accuracy of the campaign's operations.

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Patty Keto, HISP DRC Group Lead

Subnational data use: During monthly supervisory visits, data from paper reports are collected from health facilities and brought to the health zone where it is input into DHIS2. This is then aggregated at the provincial and national levels within DHIS2 dashboards; however, there is a significant lag between when services are delivered and when data is visible because health facilities are not equipped with digital tools to input data in real-time. At the subnational level, DHIS2 dashboards are available at the health zone and provincial level; however, the use of data for decision making remains weak and there is a need for increased capacity around data use.

Digital interventions supporting vaccine confidence and demand for vaccination:
During the Covid-19 pandemic, the DRC received funding and support to develop a number of digital platforms to support vaccine confidence and demand. This included the HealthAlert chatbot that allowed the community to ask questions and receive accurate information, an EPI Facebook page with educational content and updates about Covid-19, and an EPI webpage that included a dashboard with up-to-date tracking of Covid-19 related statistics. However, with the exception of the Facebook page, these initiatives have not been carried forward nor expanded for routine immunisations due to lack of continued funding.

Electronic vaccine-preventable disease (VPD) surveillance data exchange: Case-based surveillance for vaccine-preventable diseases is currently being piloted within the DHIS2 platform. In addition, an electronic surveillance app (eSURV) is being used by government surveillance officers to carry out active searches of polio. The Early Warning and Response System (EWARS) is being implemented at various entry points to the DRC in order to enhance surveillance to provide early warnings of potential outbreaks. DRC is also piloting the Tec4med remote temperature monitoring system to monitor lab samples temperature during transport and track the geo-location of the polio lab samples in real-time in 3 provinces. Future plans include expanding the EWARS system to all 26 provinces, developing a middleware to facilitate data exchange between EWARS and DHIS2 and implementing adverse events following immunization (AEFI) management module within DHIS2.

3. How

Decisions about digital health in DRC are led by the National Agency for Clinical Engineering and Digital Health (ANICNS), the agency tasked with digitising the country's healthcare system to provide Universal Health coverage. ANICNS collaborates with stakeholders from the EPI and other programs within the Ministry of Health to ensure decisions around digital health support vertical program needs. For example, ANICNS is currently working in partnership with EPI to develop a cost DHI for immunisation roadmap aimed at improving the country's vaccination program for the period 2025-2030, which will help to target future investment in DHI for immunisation.

KEY ACTIVITIES WITHIN THE DHI FOR IMMUNISATION ROADMAP INCLUDE:

Identifying and reaching zero-dose and under-vaccinated children

- Digitization of the micro-planning process
- Strengthening the electronic data management system

Digital supply chain information systems

- Improved and efficient logistics data management system to ensure last-mile visibility of immunisation data

Real-time planning and monitoring of vaccination campaigns

- Integrated digitization of mass campaigns: Improved planning and real-time monitoring of preparations and implementation of supplementary immunisation campaigns

Efficient use of data at sub-national level

- Strengthening the electronic data management system
- Improved use of DHIS2 data at sub-national level

Digital interventions supporting confidence in and demand for vaccines

- Strengthening digital communication and combating vaccine-related misinformation, including the introduction of HPV and other routine vaccines

Electronic surveillance of VVMs, data exchange for vaccine targeting and epidemic response

- Strengthening of VPD surveillance system using:(i) e-Surv for real-time trend visualisation and early warning system for timely investigation and response and (ii) case-by-case VPD surveillance data management using DHIS2
- Strengthening the MAPI management system

While there is some coordination occurring between EPI and ANICNS, there is an opportunity to further strengthen coordination mechanisms to provide EPI with a larger role in decisions around digital health, and a need to increase digital health capacity within EPI.

> **The digitization of EPI interventions is relevant, especially as it facilitates the monitoring of actions and saves time.**
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> *Dr. Aimé Chikomola, former EPI Director*

4. Results

Through designing, piloting and scaling DHI interventions for vaccination, DRC has learned valuable lessons and faced challenges. The sections below outline the enablers and barriers experienced to-date:

Enablers:

- Leadership and governance through the creation of the National Agency for Clinical Engineering and Digital Health (ANICNS) to coordinate digital health initiatives

- Development of a national digital health strategy and investment roadmap

- Efforts to establish interoperability standards and enterprise architecture for health systems

- Implementation of DHIS2 as the national health data warehouse across all health zones

- Pilot projects for digital microplanning, campaign digitalization, and electronic immunisation registries

- Capacity building of health workers on digital tools through e-learning platforms

Challenges and Limitations:

While there are a number of enablers supporting DHI for immunisation in DRC, challenges and limitations exist, including:

- Unreliable electricity and limited internet, especially in rural areas, which make it difficult to use and update electronic devices

- Lack of IT professionals to maintain digital systems, and low levels of digital literacy among some health workers

- Poor data quality, especially when entering data from paper records

- Fragmentation of interventions supported by partners at the provincial and health zone level, requiring better coordination and affecting securing long term sustainability.

- Insufficient existing funding to support digital health operations and human resources

- Poor digital infrastructure, leading to significant limitations in connectivity, especially in rural areas.

5. So what

ANICNS has made notable advancements in healthcare through a comprehensive strategy. This includes implementing sustainable renewable energy solutions, the development of a digital health enterprise architecture to improve data interoperability via a centralised data centre platform for health information exchange and promoting standardised electronic health records. The agency is enhancing digital literacy through healthcare workforce training and community outreach, promoting gender equity by creating opportunities for women in healthcare technology and developing gender-specific health solutions, fostering private sector partnerships, and establishing supportive policies like the "Code Numérique" for data protection.

Continued investment and adaptation are necessary to fully leverage digital tools for vaccination efforts and overall health management. Despite these obstacles, the combined technological and capacity-building efforts have contributed to a more robust and responsive health information ecosystem in the DRC. The adoption of DHIS2 has particularly improved health information system governance and capacity building. Local stakeholders report increased ownership of data-related tasks and motivation to use data for decision-making at all levels of the health system.

Looking ahead to 2024/2025, the EPI is integrating digitalization into campaign planning, prioritising training, and investing in reliable infrastructure. The focus is on leveraging existing resources and improving stakeholder coordination. The implementation of digital health systems for vaccination has shown significant potential for improving vaccination programs and health information management. These efforts collectively create a more efficient, inclusive, and technologically advanced healthcare system in the DRC.