

MOMENTUM

Routine Immunization Transformation and Equity

HOW DATA SYSTEMS CAN HELP REACH ZERO-DOSE AND UNDER-IMMUNIZED CHILDREN

Key findings and recommendations from the landscape analysis of health information systems and data tools for identifying, reaching, and monitoring zero-dose and under-immunized children.

Vaccine equity is the focus of WHO's Immunization Agenda 2030. Gavi and other funders have aligned strategies to prioritize zero-dose children and missed communities—and leave no one behind.



Who should read this brief?

This brief is for **government decision-makers, funders, and partners** who are involved in advancing health information systems and data tools for identifying, reaching, and monitoring zero-dose and under-immunized children. It highlights findings and recommendations from the ***Landscape Analysis of Health Information Systems and Data Tools for Identifying, Reaching, and Monitoring Zero-Dose and Under-immunized Children.***

Introduction

Reaching zero-dose and under-immunized children—most of whom live in urban areas, remote communities, or conflict settings—requires information. As significant investments are being made in health information systems and digital tools, it is critical to understand which systems can identify—in real time—where these children live, in what numbers, and for what reasons they are zero-dose or under-immunized. To date, few systems have been designed with these specific uses in mind. Whereas household surveys can estimate the number of these children with precision, they are expensive to implement. The most commonly used routine health information systems cannot estimate the number of zero-dose and under-immunized children accurately or indicate exactly where they are.

Investing in better information systems and tools to capture, analyze, and use these data will enable health professionals to improve routine immunization for the children who need it the most. This brief summarizes findings and recommendations from a 2021 landscape analysis that mapped systems and tools to help country stakeholders identify, reach, and monitor zero-dose and under-immunized children. The landscape analysis was conducted by USAID's MOMENTUM Routine Immunization Transformation and Equity (the project).

Key concepts

Zero-dose children are those who have not received any routine vaccines.

Under-immunized children are those who have not received a full course of routine vaccines.

Missed communities are populations that face systematic constraints on access to immunization and other essential health services.



Landscape Analysis of Health Information Systems and Data Tools for Identifying, Reaching, and Monitoring Zero-Dose and Under-immunized Children

What does the report provide?

- Analysis of 11 types of immunization systems or tools.
- Actionable recommendations for using the systems and tools.
- Challenges to and opportunities for implementing and scaling up.
- Considerations for how to invest in strengthening health information systems.
- Country case studies on using the systems and tools.

About the Landscape Analysis

Through a non-systematic desk review, the landscape analysis describes information systems and tools that can identify, reach, and monitor zero-dose and under-immunized children—an approach based on Gavi's IRMMA (Identify, Reach, Monitor, Measure, Advocate) framework. It provides examples of how systems and

tools are used in project-supported countries, including the Democratic Republic of the Congo, Kenya, Mozambique, and Nigeria; considers how their use could be expanded; and describes challenges and opportunities related to implementation and scale-up. Information systems and tools in this analysis are both paper-based and digital, and used for immunization or could be adapted as such.

The landscape analysis examined over 160 documents from peer-reviewed and grey literature, including project reports, evaluations, case studies, literature reviews, policy papers, and reports. The report does not systematically review the effectiveness or cost of information systems and tools. It analyzes 11 types of systems and tools as well as a number of COVID-19 tools that may be adapted for routine immunization.

INFORMATION SYSTEMS AND TOOLS TO IDENTIFY, REACH, AND MONITOR ZERO-DOSE AND UNDER-IMMUNIZED CHILDREN

The landscape analysis identified 11 primary information systems and data tools, some of which are already being used to strengthen immunization equity, while others have strong potential or require slight adaptations. The systems and tools and their potential uses are described below, according to primary user.



Clients: Caregivers and families of vaccine-eligible children



Home-based records (HBRs) for health services received by an individual are usually maintained by caregivers in paper format. Health workers and families use them as reminders for vaccination, as a data source for administering vaccines, and for monitoring immunization programs.



Client communication systems can help reach children by reducing common causes of missed immunizations, such as forgetting appointments or having concerns about immunization. They include mass communications for specific audiences and tailored messages to individual clients. Messages are typically transmitted through phone calls, text messages,



Client feedback systems allow health workers to receive feedback on health services and ameliorate challenges that prevent caregivers from bringing children to the facility for vaccination. Feedback channels can be digital or part of community structures or discussion forums. Social listening and monitoring tools that collect feedback from online

media were widely used during the COVID-19 pandemic to track misinformation and take appropriate actions. While such systems can generate valuable information to improve immunization services, health workers and supervisors may not have the means to respond or manage the feedback.



Health care providers: Nurses, doctors, other vaccinators, and community health workers



Community health workers (CHWs) use **community-based information systems (CBISs)** to collect, manage, and analyze data on health and related services provided to communities outside facilities. CBISs enable CHWs to know how many infants are born and link them to services. Using CBISs to identify zero-dose children requires CHWs to be in contact with all persons and households. Using them in combination with geospatial technology helps ensure that specific communities are not missed. Scaling CBIS use requires strong CHW coverage, and access to tablets or mobile phones and the technical capacity to use them.



Electronic immunization registries capture vaccine records for individual children, which facilitates monitoring and understanding of coverage gaps. EIRs are used to highlight missed or overdue vaccines in an individual's record and prompt targeted follow-up by health workers or send reminders to caretakers via SMS. In some countries, EIRs have been linked to CBIS or birth registries to find zero-dose children who are not in the system because they have never been to a facility. Adopting and scaling up EIRs requires substantial initial infrastructure and planning investments, and long-term commitment to training, supervision, and change management.



Monitoring charts and data dashboards are digital and paper-based tools that help health workers analyze routine immunization data and make informed decisions to improve immunization services. At the facility level, such tools are used to minimize

dropout rates through defaulter tracking. At the district level, they track immunization coverage trends and target low-performing facilities for training or supportive supervision. Numerous countries are benefiting from both paper-based and digital tools, and can expand their capabilities with technologies such as the DHIS2 toolkit for immunization, which includes an EPI dashboard and analytics package.



Health system or resource managers: Those involved in the administration and oversight of public health systems, including at district, regional, and central levels.



Denominator estimation methodologies and equity analyses include approaches and interim solutions for improving target population estimates for immunization when a country's administrative data are outdated or inaccurate. The analysis identified four types of commonly used methodologies, which sometimes require governmental willingness to make the necessary improvements for more accurate estimates.



Immunization coverage surveys can produce more accurate estimates of immunization coverage than administrative data, but their use is limited by cost and frequency of data collection. Some countries have implemented coverage survey improvements or alternative analyses, including continuous household surveys and surveillance, SMS and phone surveys, and lot quality assurance sampling (LQAS). Tools such as LQAS make it easy for immunization program managers to detect communities that are likely to have a high proportion of zero-dose children and target them for follow-up.



Health management information systems (HMIS) record and store aggregated service delivery data and facilitate immunization coverage monitoring by giving program managers and district staff access to real-time data to track performance. Because monitoring immunization coverage at the aggregate level can mask

inequities in coverage, some countries are expanding the interoperability between HMIS and systems that handle individual-level data, such as EIRs and CBIS, as well as using the DHIS2 toolkit for immunization, which includes apps and metadata packages for identifying gaps in coverage. Expanding HMIS interoperability with systems that collect individual-level data can also mitigate data entry challenges but is performed manually in most countries and is both administratively burdensome and more prone to data entry error.



Geospatial technologies include satellite imagery, geo-positioning, drones, and mobile network operator data that can be used to identify zero-dose and under-immunized children through improved population estimation and mapping. When used to support immunization microplanning, geospatial technology creates more accurate program targets to help immunizers determine if they are reaching all children. Detailed maps also enable immunizers to identify communities that may have been missed entirely. The lack of long-term investment, government leadership, and involvement in geospatial data collection and management are barriers to expanding use.



Data services: Crosscutting functionality to support multiple types of users with activities related to data collection, management, use, and exchange.



Data quality assessments gauge the quality of vaccination data gathered in the health information system. Methodologies have expanded to include a broader assessment of systemic causes of poor data quality, with more attention to the people and environments required for functional information systems. The WHO immunization data quality self-assessment tool has components for recording immunization cards and population denominators, which could be used for monitoring zero-dose and under-immunized children, but examples of their use for this purpose have not been documented.

Functionality of Information Systems and Tools

The systems and tools identified by the review have multiple functionalities and uses related to identifying, reaching, and monitoring zero-dose and under-immunized children. The table on the right maps each of them to its specific capabilities, or use cases, and can help decision-makers choose the right system or tool for the immunization data use and management gap they are trying to fill.



Functionality	Systems					Tools					
	Community-based information systems	Electronic immunization registries	Client communication systems	Health management information systems	Client feedback systems	Geospatial technologies	Denominator estimation methodologies	Home-based records	Immunization coverage surveys	Monitoring charts and data dashboards	Data quality assessments
IDENTIFY											
Population data & denominators	●	●			●	●		●			
Enrollment at birth	●	●					●				
Unique identifiers	●	●					●				
Triangulation with data from other sources	●	●			●	●				●	
Non-routine vaccine event data	●	●			●	●	●				
Clinical decision support	●	●	●				●		●		
REACH											
Individual demographic data	●	●			●	●	●	●			
Vaccine event data & report	●	●					●				
Linkages to other health areas	●	●		●			●		●		
Reminder and recall messages	●	●	●				●		●		
Human resource tracking		●									
Financial resource management											
Service delivery planning & management	●	●	●	●	●	●	●	●	●	●	
Health facility data		●	●								
MONITOR											
Identification of undervaccinated individuals	●	●	●		●	●	●	●	●	●	●
Surveillance & outbreak detection	●		●		●				●		
Stock management	●	●	●						●		
Data use practices	●	●	●	●			●		●	●	

Recommended Actions

Below are four high-level actions for advancing information systems and tools to improve the identification, reach, and monitoring of zero-dose and under-immunized children, as well as suggestions for what to do in the short, medium, and long term. Decision-makers and program managers should consider their country's needs, digital health maturity, and existing national strategies and roadmaps for digital health and immunization. As the landscape analysis did not comprehensively review evidence of intervention effectiveness, the recommended actions offer suggestions for further consideration and study.

WHO CAN TAKE ACTION TO ADVANCE VACCINE EQUITY THROUGH DATA SYSTEMS AND TOOLS?



Government decision-makers

- National EPI program managers and their supporters
- Ministries of health
- Agencies responsible for health information systems



Funders

- Funders of health information systems and tools for immunization and civil registration and vital statistics



Partners

- UN agencies and multilaterals
- Implementing partners



Improve accuracy of immunization program denominators

Inaccurate population denominators prevent immunization programs from identifying, reaching, and monitoring zero-dose and under-immunized children. Health information systems and data tools that can solve the problem are underused. Government commitment is required for technological solutions that can generate more accurate population estimates.

RECOMMENDED ACTIONS

Short term:



Consider approaches for adjusting sub-national population estimates to improve accuracy of immunization denominators.



Invest in community mapping and enumeration, using low- or high-tech tools, or a combination of the two.



Invest in coverage and equity surveys using novel approaches such as oversampling, LQAS, and data triangulation.

Long term:



Coordinate across health programs for integrated investments to strengthen health information systems and their foundational eHealth building blocks.



Expand use of data and systems to locate missed children

Despite advances in technological solutions such as geospatial technology, many low- and middle-income countries are not yet fully benefiting from what they can offer. Data already collected by immunization programs and other health and social safety net programs could be used more effectively to find children who miss routine immunizations.

RECOMMENDED ACTIONS

Short term:



Improve use of existing data to detect communities and individual children who missed immunizations.

Medium term:



Use geospatial data and technologies where there is uncertainty about the presence and size of missed communities; involve communities to validate data.







Move toward comprehensive tracking of vaccination status


Some countries have made progress introducing an EIR, which captures patient-level data in health facilities. Digitizing data collection will require coordinated action and broader investment in the foundational eHealth building blocks, such as support for the development of national digital health strategies.

RECOMMENDED ACTIONS


Short term:

-  For countries that are using DHIS2 Tracker for COVID-19 and do not have an EIR, explore the tracker's feasibility for routine immunization and review to determine which software platform is most appropriate.
-  Invest in data capacity at community and facility levels, including health worker skills and practices for collecting, recording, managing, and analyzing.
-  Explore systems and tools to facilitate integration and triangulation of information across health programs to identify zero-dose children.
-  Strengthen the use of client communication systems to notify caregivers of vaccinations.

Medium term:

-  Invest in digitizing data collection at community and facility levels; investments could initially focus on the most underserved areas.

Long term:

-  Prioritize interoperability between information systems and tools at all levels of the health system.




Strengthen routine immunization monitoring systems

Despite advances in technological solutions such as geospatial technology, many low- and middle-income countries are not yet fully benefiting from what they can offer. Data already collected by immunization programs and other health and social safety net programs could be used more effectively to find children who miss routine immunizations.

RECOMMENDED ACTIONS

Short term:

-  Invest in tools that facilitate data analysis and use, such as data dashboards, and explore systems and tools for collecting different kinds of data, such as client feedback and surveillance.
-  Consider using rapid survey tools such as LQAS to supplement routine monitoring of immunization coverage.
-  Strengthen investments in strategies that support data use practices for front-line health workers.
-  Incorporate data quality monitoring alongside coverage monitoring.

Adapt Digital COVID-19 Tools for Routine Immunization

Numerous digital tools have been adapted and deployed for vaccine planning, delivery, and monitoring of COVID-19 immunization. Lessons from these deployments can inform country decisions about investments in systems and tools for routine immunization.


Examples of information systems and tools to identify, reach, and monitor zero-dose and under-immunized children

This graphic has examples of how the four high-level recommended actions and specific information systems and tools have been applied in different geographies to identify, reach, and monitor zero-dose and under-immunized children.




Latin America

In Latin America, countries use electronic immunization registries and other data sources to disaggregate immunization data by equity dimensions. This helps to identify population sub-groups or localities with more zero-dose and under-immunized children, and tailor strategies to reach them.




Nigeria

In Nigeria, polio vaccination campaigns use **geospatial technology** to generate more accurate population denominators and identify missed populations.



Kenya

In Kenya, CHWs use **community-based information systems**, such as CommCare, to register pregnant women and children for vaccination and other services.



Pakistan

In Pakistan, patient-level data captured in an **electronic immunization registry** is triangulated with polio zero-dose registries to identify and enroll zero-dose children for routine immunization.



Mozambique





Mozambique has tested a new **methodology for calculating population estimates** that has improved the accuracy of immunization program denominators.



South Africa

In South Africa, an SMS-based **client feedback system** in the MomConnect platform enables health workers to address issues that may deter caregivers from seeking vaccination.

RECOMMENDED ACTIONS

-  Improve accuracy of immunization program denominators
-  Expand use of data and systems to locate missed children
-  Move toward comprehensive tracking of vaccination status
-  Strengthen routine immunization monitoring systems



Adrienne Surprenant, IMA World Health

What You Can Do Immediately

Decision-makers, partners, funders

Share and discuss this brief and its recommended actions with colleagues and partners. Read the full report for additional details and insights.

- Discuss the relative strengths and merits of investing in various health information systems and tools.
- Discuss gaps and opportunities in your work related to health information systems and tools.

Decision-makers, partners

Support, participate in, or lead development or refinement of national strategies related to immunization or digital health. Consider the actions and integrate them where feasible.

Decision-makers, funders

Align investments and resource allocation toward a mix of systems and tools that achieve short-, medium-, and long-term goals using funding opportunities such as Gavi's health system and immunization strengthening framework.

FURTHER READING

[Landscape Analysis of Health Information Systems and Data Tools for Identifying, Reaching, and Monitoring Zero-Dose and Under-immunized Children](#)

- Digital Square. Global Goods Guidebook. Last updated June 10, 2022. <https://digitalsquare.org/resourcesrepository/global-goods-guidebook>.
- Digital Square. Electronic Immunization Registries in Low- and Middle-Income Countries. Last updated May 26, 2021. <https://digitalsquare.org/resourcesrepository/eirlandscape>.
- Digital Square. COVID-19 Map & Match. <https://digitalsquare.org/covid19-map-match>.
- Equity Reference Group for Immunization (ERG). Discussion Papers. Last updated August 1, 2021. <https://sites.google.com/view/erg4immunisation/products?pli=1>.
- Gavi, the Vaccine Alliance. Improving Immunisation Coverage and Equity through the Effective Use of Geospatial Technologies and Data – A Landscape Analysis and Theory of Change. Last updated September, 2020. https://www.gavi.org/sites/default/files/document/2020/GIS-and-Immunisation-Landscape_EN.pdf.
- Paper-based Health Information System in Comprehensive Care (PHISICC) project. <https://paperbased.info/>.
- UNICEF. Accelerating Results for Children with Technology and Digital Innovations. Last updated September 21, 2020. <https://www.unicef.org/reports/accelerating-results-children-technology-and-digital-innovation-2020>.
- VillageReach. Landscape Analysis of Electronic Immunization Registries. Last updated April, 2020. <https://www.villagereach.org/wp-content/uploads/2020/07/Final-EIR-Landscape-Analysis.pdf>.
- WHO. Technical Resources for Improving Immunization Coverage and Equity. Last updated on April 30, 2021. <https://www.technet-21.org/en/knowledge-hub/main/7095-technical-resources-for-improving-immunization-coverage-and-equity?Itemid=1758>.
- WHO. Reaching Every District (RED) – A guide to increasing coverage and equity in all communities in the African Region. Last updated March, 2017. <https://www.afro.who.int/publications/reaching-every-district-red-guide-increasing-coverage-and-equity-all-communities>.