

Considerations for EIR Design

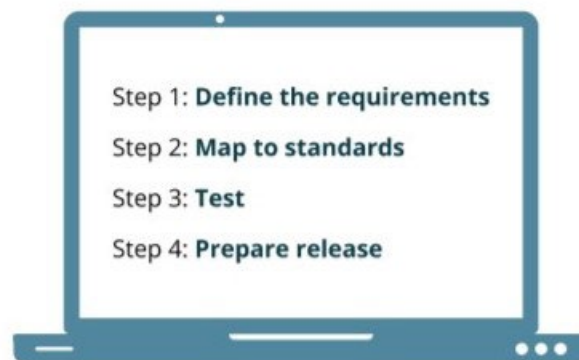
What are EIRs?

Electronic immunization registries (EIRs) are a solution that can replace the paper-based system of manual recordkeeping that has characterized most countries' immunization services until recently. EIRs are confidential, population-based, computerized information systems that record data on vaccine doses delivered. A growing number of countries have embraced EIRs to improve data quality and immunization program performance.

EIRs track critical information needed to ensure that every child is registered for immunization from birth and receives all recommended vaccines. By providing timely, accurate, and complete data, EIRs enable health workers to deliver immunization services more effectively and efficiently. EIRs can also save health worker time spent on paper-based record-keeping and reporting.

How should EIRs be designed?

The latest report from [Digital Square on EIRs in low- and middle-income countries](https://bidinitiative.org/wp-content/uploads/VAD_BID_LessonsLearned_SoftwareCycle_v1_rev03.pdf) captures requirements and lessons learned from existing EIR implementations. Requirements describe what the system should do, the service or services that it provides, and how the system should work. Defining requirements is the first step in the software development process.



Source: BID Initiative. *BID Initiative Briefs: Recommendations and Lessons Learned. Software Development Cycle*. Seattle, WA: PATH; 2017. https://bidinitiative.org/wp-content/uploads/VAD_BID_LessonsLearned_SoftwareCycle_v1_rev03.pdf



For more information on EIRs, see Digital Square's [Electronic Immunization Registries in Low- and Middle-Income Countries](https://bidinitiative.org/wp-content/uploads/VAD_BID_LessonsLearned_SoftwareCycle_v1_rev03.pdf)

Requirements

At a high level, there are 6 categories of functional requirements and 6 nonfunctional requirements.

Functional requirements describe what the system should do and how end users interact with the system.

| | |
|--|---|
| Registration and search | Registration and search requirements include the ability to register a child, assign a unique identifier (ID), and search for and manage clients in the EIR. |
| Patient records | This refers to the data captured for each patient record. This should include demographic data, vaccine event data, caregiver information, and potentially other health areas beyond vaccination. |
| Vaccination monitoring and follow-up | This group of requirements specifies how the EIR supports monitoring vaccination schedules, including by calculating individual vaccination schedules using embedded clinical decision support, identifying individuals who are due or overdue for vaccines, and generating reminder or recall messages. |
| Health facility registration and management | Health facility management is the ability to have a complete, comprehensive list of health facilities within the EIR. This includes the ability to register new facilities, edit existing facility information, and remove or otherwise indicate inactive facilities. An EIR user should be able to search across the health facility list. |
| Stock management | The EIR can manage inventories of commodities, like vaccines, to ensure adequate supplies and prevent stockouts by facilitating forecasting and planning for appropriate levels of stock. Stock information is also important to trace vaccine lots in case of quality or safety concerns. |
| Data and reporting | Data and reporting refer to the ability of the EIR to analyze the data to generate reports. This generally requires aggregating data at different geographic or administrative levels to meet reporting requirements and could include specific types of reports, such as for adverse events following immunization (AEFIs). |

Nonfunctional requirements describe how the system works or its quality attributes.

Data exchange and interoperability

Interoperability is the capability of two or more systems to communicate and exchange data through specified data standards and communication protocols. Interoperable solutions improve efficiencies in data collection, increase data quality, and enable more powerful analysis of data across systems.

Offline capability

An EIR should be able to work in an environment subject to power loss or loss of connectivity. This may include entering and storing data when there is no or limited internet connectivity and then syncing that data to the online registry later.

Alignment with international standards

International standards are documents that have practical information and best practices on an agreed way of doing something. This may include alignment with care guidelines, content guidelines, coding standards, interoperability standards, or other types of standards.

Data privacy and security

An EIR should align with national or international standards on data privacy and security. This can be achieved through confidentiality, authentication, audit trail and logs, and user management.

Scalability and system capacity

EIRs should have the ability to scale nationwide, accommodate concurrent users, and be deployed across multiple devices and web architecture. They should be designed in a way that is flexible to accommodate new vaccines, age groups, facilities, or other changes to the vaccination program.

Usability

An EIR should be user friendly, easy to learn, and intuitive for users.

When designed and implemented well, EIRs can capture important data to strengthen vaccination program service delivery.



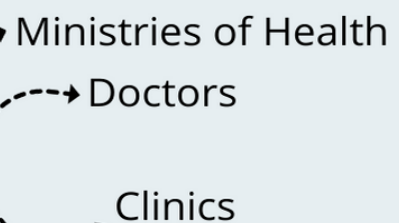
Information about vaccine doses delivered is captured at point of care.



Data are captured in the digital EIR system.



EIR data are used to inform service delivery and vaccination program monitoring and more.



Lessons Learned

The full report presents lessons learned for each EIR requirement, based on country experiences designing and operationalizing EIRs. While there are over 60 lessons learned captured in the full report, at a high level there are five overarching lessons learned to consider when designing an EIR.

1 Ensure acceptability and usefulness for end users

Ensure the EIR is acceptable and useful for health workers and aligned to their clinic workflows. This can be achieved with a user-centered design process. EIRs should be designed to identify individuals who miss one or more vaccine doses, known as defaulters. The way the EIR presents this information should be useful and actionable for health workers to support their daily tasks. Including the caregiver's name, phone number, and address in defaulter list enables the health workers to make phone calls or send text message reminders. In Pakistan traffic light colors were used to indicate defaulter status so health workers could easily interpret and act on the information at a glance.ⁱ

2 Create a minimum viable product

Start with the critical requirements for a minimum viable product and take an agile development approach to iterate and add new requirements over time based on user feedback. The registration and search functional requirements include the ability to register a child, assign a unique ID, and search for and manage clients in the EIR. The Zambia EIR was not initially designed to automatically identify new child records as possible duplicates, but based on experience, the implementation team suggested this functionality for inclusion in a minimum viable product (the most basic set of functionality in a software required for use).ⁱⁱ

3 Design for interoperability

Design the EIR to be interoperable with existing systems (e.g., birth registries, facility registries, national IDs, or logistics management information systems). In Costa Rica, the EIR and birth registration system are designed to be interoperable in real time. When a patient's national ID number is entered, the EIR automatically connects to the national registry and fills in details, such as the person's name, date of birth, calculated age, and sex.ⁱⁱⁱ This fulfills the functional requirement that an EIR should support client management, which is often facilitated by unique IDs.

4

Consider local context

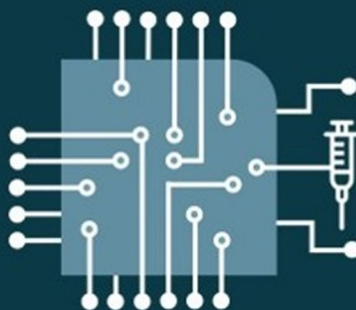
Adapt the EIR for the local context and engage the community to understand the health data that are entered into the registry and to address any fears or misconceptions surrounding the digital systems. Plan for community sensitization on unique IDs to build knowledge and trust. For example, in Tanzania, some mothers were initially confused by or did not trust the barcode stickers included on their child's vaccination card, sometimes removing them. Some mothers even thought that the barcodes were a way to track and kidnap children, so they feared attending vaccination services as a result. After health workers communicated the purpose and benefits of barcodes, community perceptions and acceptance of the barcodes improved. It was important for this messaging to come from health workers who were trusted by the community.^{iv, v} The need for sensitization will be context dependent; for example, in Zambia, there were not the same concerns about QR codes.^{vi}

5

Build in flexibility

Design the system to be flexible to adapt, change, and scale over time. EIR requirements related to vaccination monitoring and follow-up include embedded clinical decision support to calculate the vaccination schedule for each individual. EIRs need to be flexible enough to accommodate new vaccines, new schedules, and special situations. For example, many African countries added inactivated polio vaccine to the routine schedule in the last decade, and now some countries are adapting their schedules to include COVID-19 vaccines. The EIR should be flexible to update the clinical decision support to reflect changes to the recommended vaccine schedule.

EIRs can provide a reliable, data-rich way to help ensure that the right patients receive the right vaccinations, at the right time. Over 50 LMICs were discovered through this research to have piloted or implemented an EIR. There is a lot of country experience to learn from and share on how to develop a successful EIR. Some of the lessons learned from operationalizing EIRs have implications for the design of EIRs. Learning from other settings can inform more effective, higher-quality EIR design. It is recommended that decision-makers who are designing new EIRs or improving/expanding existing EIRs take into account these lessons learned when designing requirements.



-
- ⁱ Zaidi S, Shaikh SA, Sayani S, et al. Operability, acceptability, and usefulness of a mobile app to track routine immunization performance in rural Pakistan: interview study among vaccinators and key informants. *JMIR mHealth and uHealth*. 2020;8(2):e16081. <https://doi.org/10.2196/16081>.
- ⁱⁱ Seymour D, Werner L, Mwansa FD, et al. Electronic immunization registries in Tanzania and Zambia: shaping a minimum viable product for scaled solutions. *Frontiers in Public Health*. 2019;7:218. <https://doi.org/10.3389/fpubh.2019.00218>.
- ⁱⁱⁱ Arroba Tijerino R. Data quality and nominal electronic immunization registries: lessons learned from Costa Rica. BID Learning Network webinar. December 20, 2017. Accessed May 13, 2021. <https://bidinitiative.org/resource-library/posts/bln-webinar-data-quality-and-nominal-electronic-immunization-registries-lessons-learned-from-costa-rica/>
- ^{iv} Chen L, Du X, Zhang L, et al. Effectiveness of a smartphone app on improving immunization of children in rural Sichuan Province, China: a cluster randomized controlled trial. *BMC Public Health*. 2016;16(1):909. <https://doi.org/10.1186/s12889-016-3549-0>
- ^v Pancholi J, Birdie R, Guerette J, Chritz S, Sampath V, Crawford J. Landscape Analysis of Electronic Immunization Registries: Lessons Learned from a Landscape Analysis of EIR Implementations in Low and Middle Income Countries. Seattle, WA: VillageReach; 2020. <https://www.villagereach.org/wp-content/uploads/2020/07/Final-EIRLandscape-Analysis.pdf>.
- ^{vi} Dang H, Dao S, Carnahan E, et al. Determinants of scale-up from a small pilot to a national electronic immunization registry in Vietnam: qualitative evaluation. *Journal of Medical Internet Research*. 2020;22(9):e19923. <https://doi.org/10.2196/19923>. <https://www.jmir.org/2020/9/e19923/PDF>.



Digital Square brings partners together to improve how the global community designs, uses, and pays for digital health tools and approaches. By strengthening the coordination among digital health stakeholders, Digital Square reorients the market to better match tools and approaches to the needs of countries and communities.

Digital Square is a PATH-led initiative funded by the United States Agency for International Development, the Bill & Melinda Gates Foundation, and a consortium of other donors. This brief was made possible by the generous support of the American people through USAID. The contents are the responsibility of PATH and do not necessarily reflect the views of USAID or the United States Government.