



BID INITIATIVE

Better data. Better decisions. Better health.

BID Initiative Lessons Learned Encyclopedia



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BID Initiative Team | PATH

Background

Routine immunizations and new vaccine introductions are two of the best buys in global health. However, a major obstacle to improving immunization coverage and optimizing service delivery is that decision-makers at all levels of the health system have not had access to high-quality data to use in effectively making decisions in planning, performance management, and the delivery of services.

The Better Immunization Data (BID) Initiative is grounded in the belief that better data, plus better decisions, will lead to better health outcomes. It was designed in partnership with the governments of Tanzania and Zambia to enhance immunization and overall health service delivery by improving data collection, quality, and use. The BID Initiative developed, tested, and rolled out interventions that address some of the most pressing routine immunization service delivery challenges, such as poor visibility into vaccine supplies and difficulty identifying children who default on immunization schedules.

BID took a holistic approach to address immunization data challenges by packaging together information system products, data management policies, and evidence-based practices with people who are empowered to improve decision-making. Additionally, through the BID Learning Network, many of the 20 participating countries across sub-Saharan Africa were consulted during the design and testing of tools to help ensure that solutions are relevant for and can be adopted by other countries interested in improving their health programs through better data.

The BID Initiative had three focus areas for interventions: an electronic immunization registry, stock management between the facility and district, and creation of a culture of data use. To build a culture of data use, change management techniques were used to understand where health care workers were with regard to confidence and consistency in data use, and from that information-gathering period, several interventions were developed, including data use campaigns and introduction of a data use guide for facilities.

This document captures the various lessons learned throughout the BID Initiative, from the design and testing phase through implementation, noting if the lesson was learned in the Tanzania or Zambia implementation (or both).

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Abbreviations

BID Initiative	Better Immunization Data Initiative
BLN	BID Learning Network
CHMT	Council Health Management Team
CRDM	Collaborative Requirements Development Methodology
DDUM	district data use mentor
EIR	electronic immunization registry
EMM	enterprise mobility management
HCW	health care worker
QR	quick response
SMS	short message service
TImR	Tanzania Immunization Registry
UNICEF	United Nations Children's Fund
USSD	unstructured supplementary service data
ZEIR	Zambia Electronic Immunization Registry

Data Quality and Use Interventions

User-centered design (Tanzania and Zambia)

Background: A user-centered design approach is a key strategy for the development and design of scalable and sustainable interventions. This process was started by sharing the proposed data quality and use interventions with and soliciting feedback from a user advisory group. Thereafter, the various interventions were tested in designated urban, peri-urban, and rural facilities in Tanzania and Zambia. User feedback contributed to design improvements of the interventions to produce a final package of data quality and use interventions designated for deployment. Through their consultation, users became part and parcel of the new product.

Solutions adopted: Not all proposed interventions were adopted, based on user input on the design approach. All the data quality and use interventions were tested, including the electronic immunization registries (EIRs), and only the refined recommended solutions deemed appropriate with the user advisory group(s) and government were adopted and implemented. In Tanzania the EIR adopted is called the Tanzania Immunization Registry or TImR and in Zambia the EIR is called the Zambia Electronic Immunization Registry or ZEIR.

Lessons learned and challenges:

- Involvement of users, especially district staff, is key. Ownership and acceptance of a new product or intervention is greatly increased when the users are consulted. When users are consulted, resources are not wasted by launching interventions that are not tested or accepted by the users.
- It is vital to not scale beyond the initial testing facilities if the intervention still has bugs or challenges; roll out the interventions into a few facilities first (6-20 depending on the size of the supporting team), before scaling into the whole district. This can mitigate issues that may be detrimental if the users lose faith in the quality of the intervention. While health care workers (HCWs) agree on common problems, they often disagree on common solutions, and an intervention design has to address a compromising solution.

Recommendations: Engage users at all levels of the health care system to gain feedback for system development and to ensure ownership and sustainability of the interventions.

Job description intervention (Tanzania and Zambia)

Background: One of the initial data quality and use interventions to be tested was an assessment of whether and how current standard operating procedures, policies, and job descriptions included data use as part of defined roles. The hypothesis was that if these documents did not include data use that discussions with the government about including data

use as a responsibility would increase both responsibility and accountability for data use across the health system. This documentation would clarify the roles and responsibilities within facilities surrounding data and the information flow, both vertically (facility to district) and horizontally (within the facility). In our assessment, we found no existing roles dedicated to immunization data quality or data use, but that data use occurred through administrative functions such as maintaining patient records and through periodic district supervision and feedback to HCWs at the facility level.

Solutions adopted: In the end, this intervention was neither developed nor implemented.

Lessons learned and challenges: Based on feedback from the user advisory group(s), which included HCWs from across the health system, the process to officially update the job descriptions would have been too time consuming. These modifications also would have required changes across several institutions beyond the Ministries of Health (e.g., the Ministry of Labor and the President's Office of Regional Administration and Local Government). Further, we learned that due to staff shortages, many HCWs do not refer to the documentation on their roles and responsibilities because most cover a wide range of activities in their health facility, beyond those in their job descriptions (e.g., an HCW will work in several clinical care services within one facility).

Recommendations:

- Establish a partnership between health facility supervisors and the district so that data review meetings are used to address data use gaps when these are not formally documented in official employee job descriptions. These meetings and supportive supervision can drive demand for data from the district level, and as facility HCWs aim to meet this demand for data use and performance expectations, data quality can also improve.
- Develop data use guides. The integration and use of tools such as data use guides for the facility can drive data use even when formal documentation of data use as a responsibility does not exist. Data use guides can help HCWs to strive beyond simple submission of a report to owning the process to use the data in their everyday activities.

Facility cross-site visits and WhatsApp peer groups (Tanzania and Zambia)

Background: [Early literature reviews](#) and [landscape analysis](#) demonstrated the value of peer learning networks as a way to engage and create cross-learning. Cross-site visits were identified as a potential intervention to provide a forum for facility-to-facility in-person exchanges and strengthening of the peer network. The focus would be to leverage data and system user champions between facilities to serve as influencers within the network and between facilities. Connecting champions with other peers working toward the same goals would allow for easy

sharing of solutions and lessons to leverage a higher success rate of adoption of the EIRs and use of the data. This intervention would create exchanges of creative solutions to improve service delivery in areas such as workflow efficiencies.

Solutions adopted: We tested cross-site facility visits in both Tanzania and Zambia, and while they proved to be useful, the visits were too costly for facilities and districts to own, thus unsustainable. Instead, peers began to connect across the health system using WhatsApp; use of this free tool continues in both Tanzania and Zambia.

Lessons learned and challenges: Cross-site visits between facilities as part of peer networking was discouraged due to lack of staff capacity within the Ministries of Health, limited time frames, and unsustainable costs (e.g., transport and lunch allowances). Instead, a peer network of immunization HCWs, district officers, and regional-/provincial-level immunization leaders formed through WhatsApp in both Arusha Region, Tanzania, and Zambia's Southern Province. In Tanzania, we observed HCWs using the WhatsApp network to reach out to peers about clarification on service delivery indicators. The regional immunization and vaccination officer also used the group, to share updates on immunizations, such as the upcoming change from the oral polio vaccine to injectable polio vaccine. In Zambia, we found a hybrid approach: HCWs first connected in person at centralized, classroom-style training session.

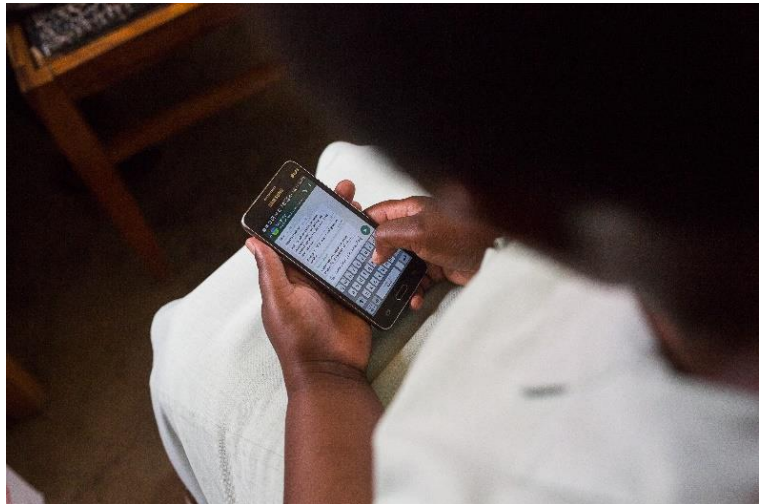


Photo: PATH/Trevor Snapp

Participants shared their experiences, lessons, and feedback to help improve their implementation strategies. HCWs then felt more confident to reach out to peers over WhatsApp after having met in person. Within this virtual network, health staff formed their own WhatsApp groups to enhance internal communication, such as a facility in-charges group. Two challenges to this solution arose: In Tanzania, not all HCWs had smartphones or could engage face-to-face. And in Zambia, while the number of HCWs connected through the virtual network increased after installation of WhatsApp on tablets used by facilities for immunization service delivery, some HCWs used up the data bundles earmarked for synchronizing to the ZEIR by downloading social items such as photo, videos, and unnecessary applications.

Recommendations:

- If possible, hold at least one central training at which HCWs from the same district can meet each other in person. This face-to-face sharing among peers can encourage ongoing virtual communication given the rapport built during the central training.
- Alternatively, use existing platforms, such as quarterly supervision visits, as opportunities for cross-facility learning, as the supervision teams include facility-level HCWs. The district could be deliberate about placing HCWs in teams to visit facilities where they can share and learn.
- In Tanzania, install WhatsApp on tablets with the EIR to provide access to the peer network for HCWs without smartphones. To ensure data bundles allocated for exchanging immunization data with the server are not depleted, a tool such as AppLock should be installed to prevent downloading of unnecessary applications such as social media apps. In addition, WhatsApp settings should be adjusted to prevent automatic downloads of photos and videos.

Microtraining videos (Tanzania and Zambia)

Background: Four training sessions were provided to facilities in both Tanzania and Zambia to introduce the data quality and use interventions and collaborate with HCWs on using data for decision-making. As a way of providing ongoing training between those four sessions, microtraining videos lasting two to three minutes each were developed to capture system use and best clinical practices, as well as examples of data use. The intention was for the videos to be filmed by HCWs as a way to demonstrate these topics to their peers and show the improvements in service delivery performance that can result from the activities and lessons learned. In Tanzania, TED Talks focusing on data use were downloaded onto tablets as a form of educational entertainment.

Solutions adopted: The microtraining videos were deployed in both Arusha Region in Tanzania and Southern Province in Zambia. However, they were not deployed as part of the package of data quality and use interventions beyond Arusha (see the lessons learned and challenges, below). The microtraining videos used in Arusha Region and Southern Province covered the following topics:

- Use of the EIR.
- Clinical best practices, such as where on the child to inject specific doses of a vaccine, how to weigh a child correctly, and how to administer immunizations.
- Introduction to data visualization with images of how we see patterns in everyday objects.
- How to look for trends in data from the register and act on findings.

Lessons learned and challenges: As mentioned above, the goal of the microtraining videos was to provide supplemental training for HCWs between the four onsite training visits from the BID Initiative team. For example, in Tanzania, at the start of the rollout, the timing between the first and second facility visit was three weeks. However, HCWs reported that they often did not watch the videos due to an already heavy clinic schedule. Then, when the timing between the first and second facility visit shifted from three weeks to three days due to changes in the strategy for back-entry of data (see [Back-entry of data](#)), it became unlikely HCWs would view any of the videos within such a short time frame. Another challenge was how to measure the practical effectiveness of the microtraining videos, especially videos focused on the use of the TImR and clinical best practices, as HCWs were unable to access the videos during an immunization session to perform some of the activities explained. In Zambia, the microtraining videos were not loaded onto tablets but shared during the second facility training, which was a centralized, classroom-style training with HCWs and district staff present. The feedback received was positive, since HCWs could see their peers as champions of the ZEIR.

Recommendations:

- Create short (one- to two-minute) microtraining videos to increase the likelihood of HCWs watching them. When providing reference materials, consider the method of delivery and the accessibility of that method. For instance, information may be available on work hardware, such as the tablets provided during the BID Initiative's launch; however, this may make the information difficult to access outside of normal work hours, when HCWs may be more available to refresh their understanding.
- Make time for HCWs to watch microtraining videos during centralized, classroom-style training sessions.
- Plan for the implementation team to help develop the videos, since it is challenging for HCWs to feel comfortable and confident in front of the camera.
- Take advantage of already existing forums, such as in-charges meetings, data review meetings, and district quarterly review meetings, to provide a way to support HCWs in the areas covered in the videos (e.g., use of the EIR and best clinical practices).

Data visualization, dashboards, and reports (Tanzania and Zambia)

Background: Data visualization helps to condense large amounts of data into non-intimidating components that are quickly and easily understood. HCWs can more easily identify trends and patterns in larger data sets, identify story narratives that explain the data patterns, and plan for potential solutions to the observed challenges. While HCWs are already familiar with data visualization through immunization monitoring charts, the focus of this intervention was to help HCWs expand their understanding and use of large amounts of data presented through dashboards (both digital and paper). The traditional format of the monthly aggregate paper reports in both countries only allows a facility to see the data for one month, in numeric form,

without visualizations that allow for data analysis or insight into the meaning of that data. HCWs were unable to create this sort of visualization themselves because they did not always have access to data for the previous month and sometimes did not have paper to use to create graphs for their own visualization.

Solutions adopted: The functional requirements in both Tanzania's and Zambia's EIRs include dashboards for key indicators such as dropout rates, stock on hand, and coverage. These dashboards are accessible both on the tablet for facilities to review their service delivery performance against targets as well as on the web application at the district for district leaders to assess the district's overall performance.



Photo: PATH/Chimwasu Njapawu

Lessons learned and challenges: In both countries, before the EIR was deployed, we learned that by creating a simple graph with data from aggregate reports covering several months, HCWs would begin to identify trends (e.g., more defaulters were reported in June than in July and August). We suggested using a calendar or even the back of an old poster to plot aggregate data over several months to see trends, if HCWs had access to the data. This was a creative way to use the data immediately, rather than waiting for new dashboards from the EIR. As HCWs better understood the process of interpreting their data, we encouraged documenting the data on available paper to at least capture and use that information. In the EIR, the use of stoplight colors to indicate performance on key indicators is an intuitive way for HCWs to understand their data. For instance, in Tanzania, as HCWs began to understand the colors in relation to the data and service delivery performance, they started to ask questions about that data, such as: *If we vaccinated so many children this month, why is our coverage in yellow?* Sharing and discussing reports and data trends from the TImR generated at the facility level with HCWs helped to improve on data-based action-taking as well. For example, the defaulter report from the TImR has helped HCWs to more easily access and trace children, as the report contains enough information to trace.

Recommendations:

- Be creative and meet HCWs where they are in their capacity for data analysis and how to use data dashboards for decision-making. Listen to HCWs as they identify existing challenges in using and documenting data (e.g., no graph paper), and work together to find creative solutions (e.g., recycling paper and old posters no longer in use at the facility). The

importance or significance of data and its usefulness becomes apparent as HCWs walk through the steps of processing and understanding the data. Therefore, a focus on the process of using data, such as knowing what data to use, identifying trends, and discussing possible solutions based on what is seen in that data, is useful when encouraging data use.

- When creating dashboards, use stoplight colors to identify areas needing attention or action. This helps HCWs to quickly assess data and allows better understanding and engagement with the data, prompting staff to ask questions about the data. The use of stoplight colors (e.g., red, yellow, green) on performance-based reports in an EIR is intuitive to health care staff at facilities in Tanzania and Zambia.

Data use video games (Tanzania and Zambia)

Background: The team looked for free analytical tools in the form of video games that could be accessed by HCWs using the tablets, in order to improve decision-making capacity. One key game found was “Hospital Hustle,” in which a nurse has to triage patients as they come into the hospital. The goal was to employ a fun way for HCWs to understand how data are used all the time to make important decisions such as triaging patients, and how that same skill set can be used with current facility data to improve service delivery.

Solutions adopted: “Hospital Hustle” was used during the test period but was not included as part of the suite of interventions launched by the BID Initiative team.

Lessons learned and challenges: One challenge with the video games found online was the requirement to pay for licenses, the cost of which would not be sustainable on health facility budgets. In Tanzania, the games were not used due to the Internet/data requirements, as well as the cost of the license fee. The user advisory group(s) also flagged concerns that the games could become a distraction for HCWs, and negatively impact service delivery. Games were also seen as depleting tablet batteries quickly.

Recommendations:

- Consider video games with an analytical focus, with the awareness that cost may be unsustainable unless a free game is found.
- Encourage the use of non-traditional learning methods to engage HCWs. However, it is important to work with the user advisory group(s) to understand some of the unintended consequences of having games on tablets, such as distracting HCWs from attending to clients.

District data use guide (Tanzania and Zambia)

Background: One of the biggest challenges to building data use is the disparity in capacity from HCW to HCW, facility to facility, district to district, and up to the national level. Variables such as staff turnover, individual capacity, and limited training factor into these challenges. Data use guides were proposed as succinct job aids to provide easy guidance on the data elements generated at the facility level. These guides would assist users with the interpretation of data and interconnectedness of the data elements, and how they can be used in their daily work.

Solutions adopted: Guides were developed for both the facility and district levels, with a focus on the data elements used at each level. The facility-level guide focused on which data were currently being used to make decisions and how often, as well as the impacts of those decisions. The district-level guide focused on which key areas to target when reviewing facility reports as well as hypotheses about what HCWs may be seeing in the data trends. Both Tanzania and Zambia deployed these guides and they are currently in use.

Lessons learned and challenges: In Zambia, the guide became the champion document because the information was relatable to facility-level data, and the benefits of the guide were seen and felt immediately. It was very important, however, to be clear with HCWs that the guide was not meant to be part of an assessment but a way to learn and share lessons from the process with their colleagues. The guide was planned to be introduced at the second “touch” (i.e., facility visit) of four touches per facility, but ended up being used as early as the first touch. While going through the guide, HCWs began to understand the normal processes of collecting and using data in service delivery. Sometimes the HCWs would check standard operating procedures to be sure. HCWs began healthy debates about the process itself; and in those conversations, would pool their knowledge to come up with a shared solution. What our team observed in this process was that HCWs had not received training for some time, so this was an opportunity to provide a refresher on best practices and data use.

Recommendations:

- When working with HCWs and district staff on the data use guide, be sure to clarify that it is not an assessment tool. When HCWs feel they are being assessed, it limits transparency and candidness, and hinders the learning process.
- Be sure to use actual facility data when going through the guide with staff; this creates a greater feeling of ownership.
- Ensure that the demand for data from the higher level is strong, as this drives data use across the health system.
- Having a connection to any available electronic tool (such as the EIR) and any specific decision support available in this tool is important. Institutionalization of the data use guide as part of the reporting process and supportive supervision is vital for data accountability and sustainability of the intervention.

Data use posters (Tanzania and Zambia)

Background: Motivating HCWs to see data use as part of their responsibilities and as a way to improve immunization service delivery was part of the BID Initiative's work to create a culture of data use. Within this, one of the interventions tested by the teams was data use campaign posters. These posters were meant to motivate HCWs with specific phrases during each facility touch as a way to match the progression of data use across the four touches.

Solutions adopted: In Tanzania, three posters were developed and printed in Swahili.

- Data awareness: Notice regarding changes to improve data quality and use across the health system.
- Data quality and data use: How data quality and use are important for improving and providing services.
- Barcode awareness: This was created during implementation as a way to address community fears about why barcodes were being used.

The following posters were used in Zambia.

- Better services: A focus on good data leading to good decisions and better planning for health services.
- Data as an eye opener: Included a photo of an HCW reviewing data.
- Work not documented is work not done: Promoting the documentation of services provided.

Lessons learned and challenges: In both countries, we learned that the posters were not effective in driving a culture of data use. HCWs were very busy during service delivery and did not always read the posters. In many facilities, the posters were lost among other posted materials.

Recommendations:

- Use vocal ways of conveying a data use campaign, such as radio or messaging points to HCWs.
- Ensure change management practices are in place to create a culture of data use, such as supportive supervision and a demand for data from higher levels of the health system.

Workflow redesign (Tanzania and Zambia)

Background: Workflow redesign was intended to address some of the bottlenecks in immunization processes at clinics. The average wait time for caregivers whose babies did not require immunization decreased because facility staff were able to better manage patients. In a

busy urban setting, workflow redesign was especially important, since caregivers were more likely to receive care at multiple immunization tables in a day over the course of the baby's visit to the facility. The burden on HCWs to separately capture and collate data for aggregated reporting was high initially and could be addressed through workflow redesign.

Solutions adopted: Brainstorming strategies were applied to come up with suitable workflows for any particular facility, with emphasis on where the tablet would be placed and how to improve workflow efficiency to benefit both patients and HCWs.

Lessons learned and challenges: Standardized operating workflows were initially proposed according to the facility category and whether the facility served a high or low patient volume. However, practical implementation on the ground proved different, as individual facilities had their own challenges based on environment. For example, at Libuyu clinic, the proposed workflow was not conducive because of the infrastructure of the building and staffing levels. Therefore, workflow redesign should be done onsite in consultation with facility staff. When health staff appreciate the concept of workflow redesign, they are able to refine and apply the same in any situation (e.g., static or outreach stations) to make their work easier. Districts appreciated the concept of redesigning workflow to suit each unique environment, especially in clinics with limited staff.

Recommendations: Even when modifications/improvements in workflow redesign are obvious, do not propose solutions to HCWs immediately. Instead, provide a platform (e.g., through brainstorming and asking direct questions) so that HCWs identify their own challenges and solutions for a better work flow, for enhanced ownership and sustainability.

Data use best practices (Tanzania and Zambia)

Background: One component of the BID Initiative intervention package was a data use campaign aimed at strengthening adoption of data to inform decision-making. Multiple tools and activities were tested to determine the best method for encouraging data use.

Solutions adopted: We tested several interventions and deployed a subset to motivate HCWs to use data. The final set of interventions was then used in targeted data use campaigns throughout launch, including such interventions as peer networking, data use guides, targeted supervision, workflow redesign, and data visualization.

Lessons learned and challenges: Only certain aspects of the data use campaign proved to be relatively effective and were retained for larger deployment. Several lessons were learned around the data use work when introducing interventions at facilities.

- Use the current data available in the facility or district when training on data use. By using data already in the paper registers at facilities, the training provided an opportunity to tease out and focus on current challenges as an initial step to build data quality for what is then put into the EIR. This also helps in identifying challenges in data use that can be shared with the district as part of supportive supervision, so supervision is targeted to the specific needs of HCWs.
- Normalize data visualization. This includes framing data use from the perspective that we can see patterns in things (i.e., identify trends) and use data (e.g., to manage talk time), and this can translate into aspects of data use for service delivery. We also framed that data use is an ingrained part of health care rather than an added step to the work.
- District immunization and vaccine officers have managed to use their data from EIRs by sharing examples of data use in best-performing facilities with HCWs. This has generated discussions regarding the data trends of underperforming facilities and how to improve.
- Sometimes errors in data come down to misunderstanding of arithmetic. Although EIRs perform calculations, strengthening this skill across the health system is important, especially when HCWs rotate between clinical care services and need to calculate different indicators for service delivery performance.
- Calculations done by the TimR and ZEIR have freed up HCW time to visualize their data, compare trends, and more deeply discuss data quality improvement. Doing calculations by hand was time consuming and left little time to go through the data results and implications.



Photo: Bill & Melinda Gates Foundation/John Healey

Recommendations:

- Be patient when working with HCWs. Everyone is at a different level of using and understanding data. Providing multiple interventions reinforcing the same skill are important, as people learn differently, and mastery grows with repetition.

- Support HCWs with an improved EIR that generates actionable data to help them to use their data easily. For example, defaulter reports and alerts regarding nutritional status and stockouts from EIRs has allowed HCWs to take action more efficiently.

Change Management

Change readiness assessment (Tanzania and Zambia)

Background: The ability and openness to change can vary from individual to individual and fluctuate over time. The ability to understand the current context can have a strong effect on program adoption for those being asked to change. The change readiness assessment measures current resources and gaps within a specific context that would enable or hinder change. A high score on change readiness increases the likelihood of the change succeeding. The Change Readiness Assessment Tool was first developed in Zambia and later used in both Zambia and Tanzania.

Solutions adopted: Two versions of the tool were developed and used for the change readiness assessment. The first version consisted of questions with responses scored on a Likert Scale. The score was used as a way to determine an HCW's readiness for or reluctance to change and informed the implementation team of how to engage with that HCW. A second version of the readiness assessment came later and was designed with open-ended questions to elicit conversations about factors to succeed in implementing new ideas at the facility, challenges with implementing those ideas, and the resources needed for those changes. The outcomes of these assessments were mapped to [Kotter's 8-Step Process for Leading Change](#) and used by the implementation team to understand how to continue to motivate HCWs along the process steps.

Lessons learned and challenges: Answers to the initial questionnaire, scored using the Likert Scale, led to incorrect assumptions about HCWs' readiness or not to change. The second version included open-ended questions, such as: *What factors have helped you successfully implement new ideas at this facility? What resources (people, finances, tools) do you have access to that can help you to overcome challenges when implementing new ideas?* These open-ended questions facilitated feedback and sharing of challenges for HCWs and the BID team to address together: for instance, stockout of stationery for a month, but data can be documented anywhere. If displayed prominently, the data will be seen and used. The open-ended questions also provided a platform for discussions with HCWs and became a nice way to introduce activities for each touch. The tool became more useful because HCWs could share and discuss real rather than perceived challenges. Within the Tanzania context, a unique approach was adopted to assess readiness to change, rather than administering the change readiness tool. The introduction of interventions was generically designed to address intrinsic

and extrinsic value of data quality and use regardless of HCWs' positions in the readiness to change matrix. This provided room for HCW self-reflection in relation to data quality and use in their work and the team capitalized on this as a foundation to improve their practices on data quality and use interventions.

Recommendations:

- Use open-ended questions to fully grasp the spectrum of responses to enable better understanding. Closed-ended questions result in limited responses. Through inquiry and understanding, program staff are able to gain trust and involvement with facility staff. This allows facility staff to lead discussions and speak from their experience rather than a partner team coming in with assumptions.
- Be open and creative when coming up with solutions with HCWs.

Community understanding of barcodes (Tanzania and Zambia)

Background: With the introduction of new tools in facilities, such as tablets, barcodes, and quick response (QR) codes, we learned that it was important for community members to understand what the tools were being used for and what this meant for the services they receive. We developed messaging on community sensitization for HCWs to explain the tools.

Solutions adopted: In Tanzania, we developed messaging about the barcodes to explain to communities why they were being used (e.g., to ensure children receive lifesaving vaccines). In Zambia, we also developed messaging about the QR codes, relatable to communities by comparing QR codes with the barcodes used at the grocery store to make for a more efficient checkout process.

Lessons learned and challenges: Where community sensitization was most helpful was around the barcodes in Tanzania. Some communities perceived the barcodes to be a way to mark their children and became fearful of bringing their children in for immunization services. However, by having the messaging about the barcodes come from HCWs, trusted by the communities, these communities felt more at ease about the use of barcoding. The messaging included examples of how barcodes ensured that children received the correct dose and could create efficiencies in service delivery by ideally reducing waiting times for caregivers. In Zambia, caregivers were not too concerned about the QR codes, but sensitization was helpful in encouraging caregivers to permit HCWs to take their child's photo for the system. Some caregivers declined, and other caregivers were okay with the photo being in the system. What the team learned is that it is important for the HCW, someone known in the community, to explain to caregivers the benefits and reasons behind QR codes, barcodes, and photos. With increased use of WhatsApp across Zambia, the culture of digital tool use has become more acceptable, which could be why many

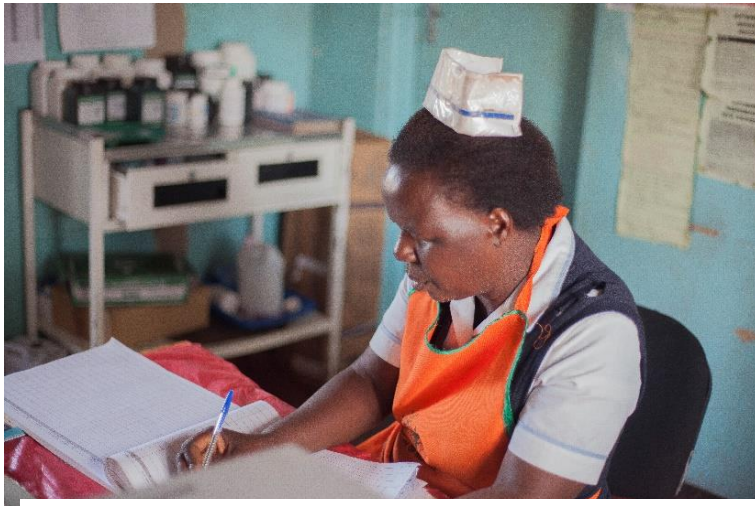


Photo: PATH/Chimwasu Njapawu

caregivers in that country did not mind having their child's photo taken for the ZEIR. Partners did not see the value of including children's photos in the system and requested that functionality be removed; however, given caregivers' feedback, this function was retained.

Recommendations: As HCWs come to own the process and tools, work with health facility staff on messaging for HCWs to convey to the communities they serve

regarding why the new tools are being used. As countries choose paths to digitally transform their health systems, they need to consider the health care consumers, who need to be made aware of the importance of the new tools.

Parallel reporting systems can inhibit adoption of new tools (Tanzania and Zambia)

Background: When introducing the new data collection tools (tablets) for the TImR in Tanzania and the ZEIR in Zambia, the legacy paper tools were used in parallel with the EIRs as they went through version updates and bug fixes based on user feedback and lessons from the implementation. Months and even up to a year after implementation, parallel systems are still in use. The challenge becomes more complex if the parallel system also includes another electronic tool collecting similar but not identical data, as adoption is hindered not only by the multiplicity of tools themselves but by external factors that might send confusing messages around which tools to focus on and use. During a visit to Chile, BID Learning Network (BLN) participants learned that the country's process to remove the paper tools happened over years, with the requirement that facilities consistently use the EIR 90 percent of the time. Chile stakeholders recommended that rather than waiting for the entire country to reach this performance level, as soon as a region reaches the target, the legacy paper process should end. This was done in Chile to prevent early facilities from running parallel systems for years, while facilities more recent to use the electronic process only had to use parallel systems for several months. Not all countries have to follow this methodology, but this is one example of an approach that can be taken.

Solutions adopted: Team members worked closely with the governments of Tanzania and Zambia to address the use of parallel systems early on in our collaboration. Part of that process included assurance that the EIRs could produce the data needed for the patient-level paper tools at the facility as well as the aggregate reporting tools used from the district to the national level. Both registers were also built to exchange data with District Health Information System 2, the national-level reporting tool in both countries. We are seeing progress in Tanzania as the country scales. The government identified key indicators to measure progress as well as what targets facilities must meet to discontinue use of legacy paper tools. As of March 2018, the government of Tanzania had determined that 33 facilities across Tanga Region could discontinue use of a set of identified, legacy paper tools for immunizations. Zambia is beginning a similar process to determine performance indicators to remove paper tools when facilities meet certain targets.

Lessons learned and challenges: The challenge of not setting expectations is that both systems (legacy paper process and the new digital process) are used infrequently and data quality overall can suffer as a result. In addition, HCWs may lose motivation to use the new tool because running both systems in parallel presents a greater burden.

Recommendations:

- Set clear expectations and guidelines and gain agreement at the ministry level prior to implementation and communicate to HCWs so they know what is needed to discontinue use of parallel systems.
- Develop a clear roadmap with health ministries during the transition to paperless, with milestones to both aim for and document progress. This can include system and logistical changes, but also can be paired with areas such as policy support and standardization. Communicate clearly to HCWs that the parallel process will be burdensome in the short term but the roadmap outlines steps to full transition to use of only the digital system.
- Identify stakeholders who will own and lead this process to better ensure accountability for this shift.

Rollout/Implementation Strategy

Touches strategy: Timing of facility (onsite) touches or classroom-style touches (Tanzania and Zambia)

Background: The BID Initiative was built following an implementation model that consisted of an on-the-job training approach organized into sets of touches (visits), each with a predetermined set of activities at both the health facility and district levels. The timing of the facility and district

touches was strategically set to ensure service provision was not compromised. These touches provided a phased approach to learning of interventions; encouraged district ownership, leadership, and involvement; and encouraged the progression of data quality and use and decision-making for facilities (see **Figure 1**).

Solutions adopted: Tanzania began rollout in Arusha Region with four facility touches led by BID Initiative staff. The last three districts in Arusha Region and additional regions (Kilimanjaro and Tanga) were led by district government staff data use mentors (see [Data use mentors](#) below). Zambia also began with four touches to facilities and went through three phases of changes during launch.

Lessons learned and challenges: Tanzania and Zambia began with four facility touches and implementations led by BID staff. As lessons were learned, the methodology was adapted. In Tanzania, in the final districts of Arusha Region as well as Tanga and Kilimanjaro Regions, implementation was led by district-level government staff trained by the BID team to continue the rollout process (see [Data use mentors](#)). This strengthened government buy-in and ownership. In Zambia, implementation occurred over three stages. The first stage began as the ZEIR was being developed. The change management strategy to improve the data use culture was launched in the first three districts of Southern Province. This created a focus on tools such as data visualization, clinical workflow redesign, and the data use guide for reporting. The second stage occurred when the ZEIR was ready for use in facilities. Rather than having all four touches be onsite at the facilities, the second touch in this hybrid model occurred in a classroom-style training that brought together representatives from all facilities within the same district as well as district leadership to focus on using the ZEIR and the data in the system. The third stage began in late 2017 with a focus on scaling the ZEIR to all remaining districts in Southern Province. All remaining facilities received their initial touches at this stage, bringing use of the ZEIR to all 254 facilities providing immunizations in Southern Province. The final touches were then launched in early 2018 with a strong focus on supporting HCWs in use of the data in the ZEIR, including for decision-making.

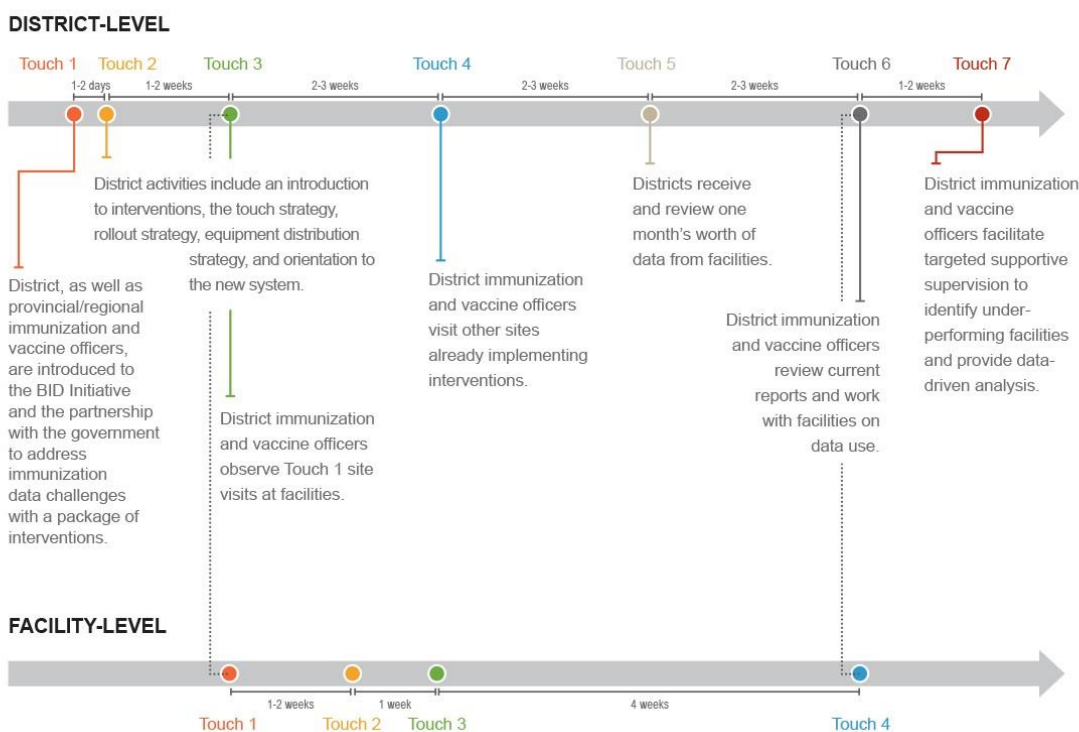
Recommendations (refer to the BID Initiative brief on the [rollout strategy](#)):

- Starting with the district engagement and support helped ease the implementation process and allowed the district to conduct supportive supervision in facility sites simultaneously, enabling sustainability. The deployment of the touch strategy is dependent on circumstances on the ground. If there is significant commitment from district-trained mentors and district staffing levels are sufficient, onsite training is ideal to reach out to as many staff as possible at a facility while allowing continuity of service delivery at the point of care.
- Engaging district staff during implementation is both effective as an entry point to facilities and increases sustainability. When the district was onboard with the activities, HCWs were

more likely to make time to work with BID staff during the touches, which were part of onsite training.

- Involving all health personnel found at the facility while conducting onsite training allows the maximum number of people to be trained and increases efficacy of information-sharing.

The figure below depicts the timeline of the original plan for touches at the district and facility levels in Tanzania and Zambia and reflects their consolidated strategies; each country adapted this timeline based on the country-specific needs discussed above.



Graphic: PATH/Shawn Kavon

Define what makes a touch successful (Tanzania and Zambia)

Background: Each facility was budgeted to receive four touches during the rollout process. As the BID Initiative team began deployment of the data quality and use interventions, it became evident that clearly defining the activities and expected outcomes of each touch would ensure consistent delivery of the activities for each touch as well as the overall success of the touches both independently and collectively.

Solutions adopted: To create a consistent method of delivery and assessment for each touch, a checklist was developed for implementers to reference and complete during each touch. Checklists included the necessary topics each implementing staff member should cover during a specific touch. Monitoring and evaluation forms were also developed and utilized for measuring success.

Lessons learned and challenges: Conducting feedback sessions after touches and sharing experiences helped the BID team to redesign the strategy for effectiveness and continuous improvement. This was especially true for the first districts of the implementation, where feedback sessions occurred daily. As the team discussed what worked well, what did not work well, and what could be improved, the touches became more effective.

Recommendations:

- Develop a set of talking points for all team members to cover during each touch to ensure each facility receives the same attention, information, and quality across the implementation. All team members should cover this important content, but it can be delivered in their own style and for the context of the specific facility or district.
- Create a checklist of what activities and tools are needed for each touch. Given HCWs' busy schedules and the onsite training approach, sometimes a few areas may not be covered. Using the checklist, teams can identify which activities were not completed or which tools not shared so that during the next touch the team can focus on ensuring those aspects are covered.
- Define success indicators. By creating a tool to measure the success of each touch, the team was able to use that data to modify parts of the rollout and/or touches through an iterative and adaptive process. Tools thoughtfully designed for implementation allow staff to use the data from those tools to facilitate a process of adaptive management. [Role-playing](#) was a useful tool in building staff confidence and capacity to deliver touches. The rehearsal of these trainings ensured that core messages, such as objectives, were communicated in a consistent way.

Data use mentors (Tanzania)

Background: Capacity development is a key element of facilitating improved access to sustainable and high-quality immunization services. The BID Initiative began with an on-the-job training approach (see [Touches strategy](#)); PATH staff visited facilities to provide training to HCWs. The training across the four touches was based on a training plan prepared with support from Council Health Management Teams (CHMTs), which serve as district supervisory bodies. The implementation team conducted facility touches accompanied by CHMTs in the first five districts of Arusha Region. Throughout the launch, the team met to review progress and identify areas for improvement. It was during these reviews that a new approach was identified to

increase rollout speed, ensure sustainability, and reduce costs, resulting in a more scalable model. This model was initially used in the last two districts of Arusha Region and later in Tanga and Kilimanjaro Regions.

Solutions adopted: Whereas the initial touches in the first five districts were completed by BID staff, following the new model used in the last two districts of Arusha Region and beyond, touches were completed by district-level government staff called district data use mentors (DDUMs). This was done to increase government ownership and encourage sustainability beyond the BID Initiative. This was a viable solution under Tanzania's decentralized government; sufficient human resources were available at the district level due to the greater capacity for districts to be decision-makers. The government individuals selected for this role were identified by district health management teams as knowledgeable regarding the health sector, data, and basic computer functions. As part of this shift, the BID team employed a training-of-trainers model, partnering with and training DDUMs to conduct facility touches with the suite of data quality and use interventions. DDUMs received training and certification of training completion, and thereafter were partnered with two BID staff for ongoing support. Ultimately, the initial five districts in Arusha Region also identified DDUMs, who were then trained by BID so that the entire region followed this model. Today, DDUMs provide ongoing supportive supervision to facilities, especially in system use and adoption, as well as ongoing technical support for data use.

Lessons learned and challenges:

- Originally, CHMTs were to provide ongoing support to HCWs during implementation. However, due to the number of facilities and workload, CHMT members primarily focused on their respective technical areas and did not have time to provide the needed support to HCWs in areas outside their focus. Therefore, CHMTs took on a supervisory role to ensure effective use of the EIRs and related interventions, as opposed to providing regular and timely technical support to health facilities.
- In the original strategy, the BID implementation team worked with one district at a time through the first three touches. This approach took, on average, three to four months per district. As a result, the BID team was unable to work in multiple districts concurrently. In addition, due to team bandwidth limitations, they were unable to provide timely support to struggling health facilities in districts they had already visited. CHMTs were expected to address facility issues after facilities completed the third touch; however, CHMT members were unavailable to provide this support.

- Although two separate teams, BID staff and district staff, were responsible for assisting struggling facilities, needs of facilities still were not met. We learned that we must ensure government staff at the district level are capable of providing needed support to HCWs on data quality and use interventions at the facility level, when required.
- In the original strategy, the BID implementation team trained CHMTs to take an active part in launch and ongoing support. BID Initiative staff were also responsible for developing the data use capacity of HCWs through frequent visits to facilities, but without CHMT capacity to provide ongoing support, it was difficult to ensure smooth transitioning of the BID implementation roles from PATH to district authorities to maintain and sustain the initiative. In the new strategy, DDUMs took an active role in the training of HCWs as well as providing ongoing support to health facilities. This allowed for a smooth implementation capacity transition from BID Initiative staff to the district through both training and practice as part of the rollout process.
- In the original strategy, increasing the rollout pace meant increasing the size of the BID implementation team to cover multiple districts at the same time or reducing the number of weeks they spent in a district. Developing district capacity to conduct the rollout using DDUMs increased the pace of the launch while maintaining a manageable BID team size.



Photo: Bill & Melinda Gates Foundation/John Healey

Recommendations:

- Make time to review and adjust implementation strategies (e.g., what works; what could be improved). Lessons from the original rollout strategy came out of a learning and appraisal meeting led by key staff from the health system in Arusha Region. This provided a depth of understanding; the decision to shift to using DDUMs came from the lessons and recommendations shared in this meeting. When possible, convene key persons for feedback and input; this can alter the course of activities in a positive way.
- When considering staff in the health system who can lead the implementation, maintain a realistic understanding of work demands. CHMTs were too busy to provide ongoing technical support to HCWs but could manage to act in a supervisory capacity during implementation, while district staff who were already following up with facilities more naturally fit into the role of DDUM. A mix of CHMTs and non-CHMTs in the DDUM-type role

is the preferred combination, as that will allow for both smooth implementation and supervision.

- Determine the human resources capacity within the health system and if there is sufficient capacity to implement a strategy like this. As an example, Zambia does not have the same decentralized model as Tanzania, and therefore districts do not have sufficient staff to implement the DDUM strategy. Adaptations were made with the group touch with facilities instead, and district-level involvement (but not sole leadership) in the touches. Adapt to the human resources available at the district level to lead and implement this type of strategy.

Training BID and district-level Ministry of Health staff to understand the interventions through role-play exercises (Tanzania and Zambia)

Background: A classroom-style approach was originally selected when BID Initiative staff went through training to deliver the data quality and use interventions to facilities. This training would cover each intervention: the purpose, the tools, the outcomes. After the initial week of classroom-style training, the team added more time for role-play exercises. One team member pretended to be a HCW as the other team members acted as BID staff providing touches. The team became familiar with and created strategies to address HCWs who would be resistant to change and those excited about change, and how and when to interact based on busy clinic days. Overall, role-playing introduced the need to be flexible in the way interventions were presented during touches based on the facility environment.

Solutions adopted: This type of role-playing was incorporated into all training for both BID and district-level staff involved in the implementation (DDUMs and others).

Lessons learned and challenges: The implementation of this technique helped prepare the team for facility visits and for the unconventional instructional setting. This training also helped to identify strengths and weaknesses in the staff's training style and allowed a safe space to resolve the weaknesses. Lastly, the exercise instilled confidence among team members in their abilities before they visited the health facilities.

Recommendations:

- Focus classroom-style trainings on uniformly instructing all staff on the purpose, tools, and intended outcomes of the interventions. This will ensure everyone has the same foundational knowledge of each intervention and how the interventions will evolve with each touch and complement each other.
- Allow two days for role-play exercises to ensure adequate time for both practice and feedback to team members.

Peer learning network

Embedded within the BID Initiative is the BLN, an Africa-led and member-owned peer-to-peer learning network designed to share lessons learned and assist in the development of common tools, practices, and policies to enable scalable data solutions. The BLN Communication Strategy outlines several channels of communication through which peers can share information and knowledge. These include face-to-face meetings and virtual platforms.

Have a community manager in place

Background: The BID Initiative hired a manager to ensure the effective management and coordination of the BLN for participation and engagement of members from across the globe. Originally, the BLN engaged a consultant who rendered intermittent and inconsistent support, not conducive for the building of a strong community.

Solutions adopted: The BID Initiative recruited a full-time community manager to enable effective management and coordination of the BLN community.

Lessons learned and challenges: Managing a virtual and peer learning community comes with challenges such as geographic, cultural, and language differences. A dedicated coordinator is essential for building collaboration, learning, and information-sharing spaces as well as trust-building among interacting members through virtual and in-person meetings. Peer learning is a continuous and iterative process with no prescribed path and requires adjustment and refinements as the needs arise. A challenge that arose was that as the network grew, the part-time consultant managing the community was not able to monitor the growth and changing needs of the network. Consequently, member needs were not identified and addressed in a timely manner. Surveys that were critically essential to determine progress and understand member needs and preferences were not regularly conducted. This limited the learning process and valuable lessons were likely lost.

Recommendations:

- To create a robust virtual community, closely monitor and engage the community to ensure processes are running smoothly and to the standards of the community. Ideally, the structure for engagement should be paired with a monitoring and evaluation plan to track progress and strengthen strategies to improve the value of the peer network. A coordinator who can focus on and manage these processes is vital to shaping this structure and triaging feedback from members. The coordinator needs to closely monitor the evolution of the network over time to match the needs of the community.

- Conduct periodic surveys to gather information as a way to understand the benefits of the network and what participants want to learn. The results of these surveys can be used to enrich the network's own learning process. Continued contribution from members is essential to a thriving community.

Webinars

Background: Webinars on different technical topics were held monthly with different countries to share their experiences of success and failure and lessons learned on their projects and programs. Webinars were first conducted by BID Initiative staff, but later were BLN country led.

Solutions adopted: Webinars were held once a month; on special request, two webinars were held within a month. An annual webinar schedule was established to maintain the cadence and to coordinate appropriate presenters. Presentation guidelines were also established, to promote successful webinars. Reminders were sent over Google groups and WhatsApp to inform members of upcoming webinars.

Lessons learned and challenges: Good publicity, constant reminders, and timely invitations helped to increase the number of webinar participants. Presenter confidence, resulting in higher-quality presentations, was boosted through practice runs prior to delivery of the webinars. The use of multiple platforms for communication and webinar reminders allowed everyone to maintain communication within their comfort level. Webinar invitations were sent through Google groups; however, this was not a seamless solution. Most BLN members resided in countries with limited internet connectivity, making it difficult to access Google group invitations and alerts. Language remained a barrier in group communication among the Francophone and Anglophone countries, which was a challenge to moderate. Thus far, the Francophones were presented in English, which created a somewhat unequal level of access to BLN information.

The shift from BID-led to BLN country-led webinars increased the participation of country members and each was eager to present on their experiences implementing digital health tools. Participant sign-up for these presentations was robust, with a 12-month waitlist to present.

Recommendations:

- Package information and lessons learned from the webinars as a valuable resource for running a virtual community.
- Provide written materials for easier translation to be discussed in the webinar, to help promote greater engagement with the webinar and to ensure the non-English speakers have

an opportunity to share information over webinars in comfortable languages. These materials can be shared through existing virtual platforms such as the BLN Google group.

Communication mediums and engaging the community

Background: We began and continue to focus on keeping discussions active on the BLN Google group, with a membership of close to 450 people across the globe built over the past four and a half years.

Solutions adopted: Due to challenges with access to the Internet to participate in the Google group, BLN country members created a WhatsApp group at the discussion meeting in Zambia in 2017 to use in addition to the Google group, which remains as a larger list of global, regional, and country partners.

Lessons learned and challenges:

- While the Google group has been quite effective in reaching out to members from global agencies, funding agencies, and nongovernmental organizations, it has not worked as well among the BLN country members themselves. Many of the BLN members spend an extensive amount of time working in the field, where Internet access can be limited and unreliable. What we found is that WhatsApp is also an effective medium for our BLN members. In an online survey conducted to learn what would be preferred by country participants, we requested a recommendation for the most suitable communication medium. Members overwhelmingly responded with WhatsApp as the highest-trending, most affordable, and accessible platform within the African context. A majority of members have access to a smartphone and are familiar with the WhatsApp platform through their social and other business communication.
- At the BLN discussion meeting in Lusaka in September 2017, BLN members established a WhatsApp group and identified a bilingual member to moderate discussions, with oversight from the BLN community coordinator. This solved the language disparity for Francophone members who did not have access to the Google group comments, allowing them to communicate in French. However, it has been a lot of work for the volunteer moderator, who is assisted by the community coordinator. The coordinator and the moderator do exchange notes when the moderator is available.
- The WhatsApp platform is used to send out notifications and alerts for discussions, webinars, surveys, and other announcements that are posted on the Google group, which has created greater engagement in group discussion than when the schedule of topics was disseminated only through the Google group. The group has engaged in discussions, learning, and questions around immunization information systems and logistics/supply chains over WhatsApp.

- Responding to BLN country member needs and tailoring the communication style to make their engagement less taxing has resulted in a higher level of participation. Although the use of multiple platforms has increased the administrative burden of managing the group's communications, it was a necessary step in the effort to ensure effective communication with members within the African context. The addition of WhatsApp proved effective in garnering member responses in a timely manner by encouraging members to check their emails and Google groups and register for webinars. Alerts sent to the WhatsApp group have been useful in ensuring BLN members respond to surveys posted on other platforms.
- Despite the advantages of using WhatsApp, some members are still not taking part in the discussion boards. This could be due to the high level of work expected of BLN members outside of BLN activities.

Recommendations:

- When establishing a learning group, determine the comfort and accessibility the group has with different communication platforms. Members were much more engaged after the platform for communication shifted, proving that their disengagement was not due to disinterest, but due to inaccessibility. The best solution for a group may be one in which the group has multiple ways of posting and discussing on platforms, which allows cross-posting.
- Understand the limitations of the communication platforms. There are approximately 180 BLN individual members, some of whom are currently part of the WhatsApp group, and since maximum membership on any given WhatsApp group is 256, we may have to shift platforms (or divide the group) if the group grows significantly.
- Find out what interests individual and group members to create greater engagement. Members have been requesting segmented thematic areas for engagement to allow for engaging in relevant or interesting content or opting out of specific topic areas. This will require volunteer members to manage subgroups and communicate with the community coordinator.

Peer network governance structure

Background: Country ownership and leadership in the communal learning process were a fundamental ethos of the BLN. It was critical that mutual learning occurred across BLN countries



Photo: PATH/Trevor Snapp

to enable the design of appropriate and acceptable solutions to data quality, availability, and use challenges that had been identified by the community. It was important in this instance to ensure a governance structure that allowed the country voice to be heard and shared.

Solutions adopted: Initially, we adopted a loose governance structure that included a director, a community manager, and a peer advisory group composed of six

country representatives (three from West Africa and three from East/Southern Africa). In addition, three-tiered country membership included the two demonstration countries (Tanzania and Zambia) that pioneered the design and implementation of interventions to improve data availability, quality, and use; 20 design countries that formed a collaborative and invested time and intellectual resources in interventions that were being designed by the demonstration countries; and discussion countries and members that accessed information coming out of the BID Initiative and the BLN.

Lessons learned and challenges: The loose BLN governance structure sufficed for the initial purpose for which it was set up. However, BLN members noted that the current BLN structure has been inadequate to address issues beyond immunization, follow up on activities and progress in design countries, and enable sustainability and scale of identified solutions. It was further noted that the BLN had not galvanized optimal support from donors, regional bodies, and African governments—a key component for sustainability and scale.

Recommendations: BLN members made the following recommendations in relation to creating a stronger BLN governance structure:

- The focus of the BLN was too narrow; the BLN could be utilized in an expanded role that goes beyond immunization data alone.
- There could be benefits in having a mechanism to better follow up activities in countries beyond the initial demonstration countries; one potential way to do this would be to have country focal persons reporting to the secretariat from member countries to augment inter-country learning and accountability of countries to the network. These country focal persons would promote and advocate for the BLN in-country, as well as collect and share key

information on in-country progress where solutions to improve data availability, quality, and use were being implemented.

- The BLN would benefit from a steering committee with representation from countries, partners, and regional economic bodies to enhance sustainability, increase access to a wide range of expertise, and enhance the ability to strengthen political will to adopt and scale promising practices in BLN countries.
- Ideally, countries could show greater commitment to the BLN by committing personnel and by making monetary contributions to the activities of the network.

Sustainability and Scale

How Tanzania and Zambia are scaling

Background: From the earliest planning stage, each BID Initiative intervention was designed and implemented with a focus on sustainability and scale. This is important because once a program is started, shifting to account for sustainability and scale can be difficult and costly. The BID Initiative focused on country representation and involvement from the beginning, with specific government roles established to transition to full government ownership at the end of the project grant.

Solutions adopted: Designing the interventions with a health system–thinking approach allows for the consideration of the needs, capacity, and processes already embedded within the health system. Interventions were designed from the perspectives of both frontline HCWs and policymakers through the user advisory group(s). Design of EIRs considered openness and existing in-country technology that would help to sustain the program beyond the project as well as the capacity of end users of the system. Government ownership of the BID Initiative included data use mentors trained by BID staff but employed through the government. This increased the number of skilled staff within the government, ensuring the program would continue beyond BID staff involvement. Additionally, close engagement with government from the beginning enabled the BID Initiative to coordinate with governments on larger health system strategies. In Tanzania, this resulted in inclusion of the interventions in Health System Strengthening grants, as well as the Gavi, the Vaccine Alliance, Targeted Country Assistance grant. This support was in a way to support additional scale in-country, and to proactively transfer BID Initiative technical expertise to the government. In Zambia, the BID Initiative is coordinating with the government on the Expanded Programme on Immunization to further support the EIR developed with BID and the government and to seek funding for scale. Lastly, facilitating partnerships between local technology partners and governments allows in-country technical support to improve the stability of the program.

Lessons learned and challenges: Although the BID Initiative interventions were designed to scale, the timeline of the interventions shifted drastically when appropriate technologies were unavailable for implementation as originally planned. This delayed introduction and scale-up of the interventions. However, although the intervention strategy shifted, the sustainability and scale built into the program remained robust, with constant communication and coordination with government throughout the process. BID Initiative staff also had transparent conversations with ministries of health to understand their capacity to support the program beyond the BID Initiative grant, including the costs, and how to best include ongoing funding in government budgets or from other funding sources.

Recommendations:

- Design interventions for sustainability and scale from the beginning planning stages. This ensures that program funds are spent in the most effective manner to allow for full transition to government ownership.
- Engage the government as an active partner in the implementation strategy and a partner in the design of the intervention to establish government ownership and promote government adoption at the end of the grant.

Electronic Immunization Registries

Unique identification of children using barcodes or QR codes (Tanzania and Zambia)



Photo: Bill & Melinda Gates Foundation/Riccardo Gangale

Background: Each facility had an under-five paper register in which all children within the catchment area were recorded. This was for the sole purpose of tracking services offered to children. At the facility level, HCWs generated a child's identification number with the number sequence built upon the provincial/district code, facility code, serial number, and year code for the year starting at one. However, what was written in the register and on under-five cards was just the serial number and the

year, which was not unique at first glance, unless referencing the home facility written on the card.

Solutions adopted: Due to this potential for discrepancy, the user advisory group(s) in Zambia recommended a ZEIR code generated by the system to uniquely identify each child. To quickly identify a child during a visit, QR codes were generated, printed, and adhered to the child's card. A random seven digits were generated and assigned to each child during registration. This unique identification was correlated with the QR code attached to the child's card. In Tanzania, barcodes were used. Each barcode used a number containing ten random digits. The barcodes were affixed to the child's health card, scanned, and as the HCW registered that child by entering the name and other information, the child's record became associated with that barcode in the EIR.

Lessons learned and challenges: It was challenging to identify a local vendor capable of printing barcodes and QR codes in bulk, making it difficult for the government to procure these items and maintain logistical sustainability. However, the team was able to find a local vendor to produce the barcode stickers. For the barcodes to be read, the program tablets needed to be equipped with a five-megapixel camera, adding to the requirements for tablet procurement. The size of the barcode also impacted the success of the barcode scan. The camera most easily read the barcode when it was larger, and adequate light was available. Lastly, as mentioned in the [Change Management](#) section, the idea of barcode identification was not easily accepted by parents, and some had negative reactions to their use.

Recommendations:

- As technology improvements continue, more in-country vendors are being identified that can provide tablets and barcodes. Continue to assess the local market for vendors that may begin to produce and distribute items such as barcodes and QR codes.
- In cases in which there may be supply disruption of the barcodes or QR codes, ensure that the EIR also has unique identification in the system that can be seen by the HCW. In these scenarios, the HCW can write the system identification on the child health card in the case that the barcode or QR code stickers are not available.

Community birth registration (Tanzania and Zambia)

Background: Collecting data on children when they are born is critical for accurate recording of children in need of immunization, also known as collecting an accurate denominator for service delivery. In both Tanzania and Zambia, most births occur at a facility or hospital, but some births still occur at home. Facility births are documented in paper registers; however, births that occur at home often go undocumented, especially if the child is not brought to the facility during the

mother's postnatal care. When children are unaccounted for, facilities cannot track all children in the community who need lifesaving vaccines. This also has an impact on stock management and reporting for immunization coverage, as it is difficult to plan for children not born in a facility.

Solutions adopted: In Tanzania, home births were captured and sent to the EIR via SMS using the bring-your-own-device approach, as it was not cost-effective to buy equipment for community leaders. The SMS notifications allowed the EIR to queue a child for immunization based on the date of birth sent via SMS, and the child could be accounted for in his/her home facility. However, given the low volume of home births and the high cost of training community leaders, paired with the high volume of data entry errors, the SMS birth notification process was cancelled in Tanzania. In Zambia, SMS functionality was not fully implemented because the Ministry of Health requested that BID work with the United Nations Children's fund (UNICEF) on the SMS component to do this in the near future.

Lessons learned and challenges:

- In Tanzania, data quality from community leaders using SMS was very poor and the technology did not allow for built-in quality checks. Other available choices for technology, like unstructured supplementary service data (USSD) and mobile applications, would have been better suited; however, each has limitations, whether it be number of characters, session time between navigation for USSD (as messages have to be sent back and forth with USSD), or cost for mobile application hardware. Even after the incorrect information was sent to the EIR, community HCWs would send an additional SMS with updated and correct information. However, this created multiple records for the same child and duplicate data in the registry.
- It was difficult to manage even the discounted rate for sending SMS messages for health.
- The team in Tanzania partnered with the Registration and Insolvency Trusteeship Agency, which is developing initiatives to provide birth certifications to study the possibility of integrating data from the EIR and their system, and this will help with the process of capturing home births and using that data in the EIR.
- In Zambia, the team has been working with UNICEF to use the



Photo: PATH/Trevor Snapp

data from their mobile vaccination application (mVacc), which collects birth notifications. This information would also be shared with the EIR to capture home births for a more comprehensive picture of the target population for facilities.

- Current SMS technology is insufficient to guarantee high-quality data. Data quality from the field can suffer given lack of experience and training among community-level HCWs or community leaders.

Recommendations:

- Work with partners who are focusing specifically on home birth notifications and set out technical plans for an integrated approach to the data being collected for the EIR.
- Work closely with governments and partners to ensure that SMS is provided free of charge or at reduced cost when being used for health equity.

Locking devices to conserve data bundles (Tanzania and Zambia)

Background: Tablets were distributed to HCWs to collect and enter patient data into the EIRs. Initially, the tablets were not locked to prevent downloading of additional apps, to build trust with HCWs. However, users added applications, which quickly depleted data bundles. BID Initiative staff then installed software to prevent the download of applications.

Solutions adopted: In Tanzania, AppLock was installed on tablets to prevent downloads of unnecessary applications. This prevented users from accessing the app store. In Zambia, Vault App was installed on the facility tablets, which restricted access to certain Internet services, such as YouTube, and web browsers.

Lessons learned and challenges:

- One challenge to this solution was that AppLock prevented all downloads, including new updates to the TImR software. The team adjusted by no longer locking the Play Store but locking non-TImR application downloads.
- Zambia faced other challenges with Vault App. Only five applications could be blocked free of charge; blocking of additional apps required a paid subscription. Therefore, the team locked the system settings to restrict access to certain applications. In rare cases, the facility figured out the password and uninstalled the blocking application. In some instances, a user simply removed the SIM card from the tablet, put it in their device, and used up the bundles. We learned to involve the district in monitoring for abuse of data bundles, tied to maintenance of clinical equipment.
- In Tanzania, HCWs were able to access the locking password when requesting technical support. Technical support employees inadvertently revealed the password when providing

assistance, and HCWs were able to unlock their devices. In some instances, HCWs were able to uninstall the AppLock application.

Recommendations:

- To protect data bundles, install software to prevent downloading of unnecessary apps. Although free security apps can be used to protect data, it is important to select the correct option.
- Highlight the importance of respecting the data bundle. This was successful in mitigating use of apps not necessary for normal program needs.
- Involve district leadership in monitoring bundle utilization when conducting supervision visits to facilities, which we found successful in creating accountability for data use among HCWs.
- Consider enterprise mobility management (EMM) applications as a way to manage devices. These tools can provide insight into which applications are running on a device, the version of those applications, and when the devices are connected to the Internet. Although EMM has a wide range of functionalities, most require an Internet connection.

Back-entry of data (Tanzania and Zambia)

Background: The initial BID Initiative strategy called for back-entry of children's historical immunization records in order to populate EIRs with children at the beginning or middle of their immunization schedule. The purpose of back-entering data from current immunization records at the facilities into the EIRs was to provide HCWs with a more efficient start-up when adopting the new data collection tools. For example, rather than registering every child and entering all the child's past immunizations into the EIR during their first visit with the electronic system in place, already back-entered data would allow the HCW to quickly search and confirm the child's correct immunization history and update the record with the services provided that day only.

Solutions adopted: Initially, Tanzania contracted with an external company to digitize the data from the paper registers into the EIR. A PATH team member took photos of the paper immunization register at the facility and uploaded the photos to a secure database. The photos were digitized into an Excel spreadsheet that was then entered into the database to populate the EIR. Due to the challenges detailed below, the team shifted the strategy to include data entry staff at selected facilities and finally moved the back-entry process to HCWs, with support from DDUMs, as children came to the facility. Zambia initially identified an external company to back-enter information taken from photos of children's under-five cards on a web-based data collection platform. Once the data were cleaned, the system developers then exported the data to the EIR. However, this approach did not yield the expected results because many records were not being entered, leaving gaps in data. The strategy shifted to engaging HCWs to

conduct back-entry directly into the EIR; a small stipend was provided based on the volume of records entered. Under-five cards were the source documents for this process as well.



Photo: PATH/Trevor Snapp

Lessons learned and challenges: The process of back-entering data was not as straightforward as initially anticipated due to two main factors: the technology used to convert paper data to digital data was not as flexible as anticipated, and existing data were low quality (especially in the paper register books). In Tanzania, the system used to digitize photos of immunization forms into the EIR database required perfectly straight photos with legible notes. The team went through many iterations attempting to work within the system, including building photo stands to steady the camera and immunization form, but it took considerable time to render images that worked with the system. In addition, the quality of the data in the immunization register books was low. Often, HCWs entered data first into the child health cards kept by caregivers, then the tally sheets for reporting, and finally the immunization book at the facility. The team attempted to clean the data, so

the immunizations matched the schedule, but this became time consuming due to the large quantity of records. Although the dates may have been correct, the schedule may have been wrong in comparison to the national schedule. The decision was eventually made to discontinue use of paper registers as the sources of data for back-entry in both countries. The team then switched to images of the child health cards, given that these had the better-quality data. However, the most efficient way to ensure the timeliness and quality of back-entered data was for HCWs to enter the data directly into the EIRs. This proved more successful and allowed for faster, more accurate back-entry of data. In Zambia, a success from this process was the shift of data entry protocol. Originally, HCWs first entered data into the paper immunization registry and then entered the data into the EIR. As governments look to digitize their health care services and data, the relatively simple switch to having HCWs enter data into the EIR first and the immunization book second (or not enter data into the books once policies are in place) will increase use of the new tools by the HCWs, use of the data because it is in real time, and supervision from the district since the data are readily available, and provide a catalyst for the adoption of digital health solutions.

Recommendations:

- When discussing back-entry of data, first identify the need for back-entry, or the benefits of utilizing these data, including more efficient initiation of HCWs into use of the new tools and/or having the data in the database for monthly implementation reports. This should help to inform other specifics such as parameters around the historical data to be entered and the time frame to be captured.
- Choose the best-quality data source. Although Tanzania captured data from the paper immunization register, Zambia opted to capture data directly from child health cards, given their often higher quality of data, and the facility staff actually chose to enter records for all children, not just for children younger than nine months.
- Once the data source is identified, the back-entry of records can be time consuming. Start with a few facilities with different populations of children due for immunizations (high volume and low volume) to gather evidence on the average time needed to back-enter records based on the criteria (e.g., nine months of data) as well as the quality of the data source chosen to test the feasibility of back-entry, and then make plans based on what is learned in the test.

Procurement

Background: The interventions identified by the countries to address their data challenges included developing an EIR. In order for facilities to collect and use patient-level data, tablets needed to be procured for the mobile application of the EIRs. Before tablets were procured, software developers working on the EIRs provided hardware requirements and specifications necessary for the system to function; these became the purchasing guidelines for BID staff. Tanzania procured around 700 tablets for use and Zambia around 270 tablets.

Solutions adopted: Technology changes frequently, and our procurement team had to stay in close connection with local vendors to ensure adequate quantities would be available for procurement in-country, and items could be replenished.

Lessons learned and challenges: Both countries were able to procure tablets with an Android operating system. However, team research showed that tablets compliant with the hardware specified by the EIS software developers were not easily found in-country. This lack of availability made it difficult for staff to find tablets that met all the standards of the EIRs and were affordable and would be able to access the in-country network. For example, tablets procured from outside the country were sometimes locked, thus unable to access in-country mobile networks, meaning that to “break into” the tablets, key features would have had to be disabled. These tablets were returned to the vendor.

Recommendations:

- In initial discussions with the software developers about what specifications tablets should have, share a list of the devices available for purchase locally to see if these options would work. The BID teams approached local vendors to see if the demand for and quantity of tablets would be enough to shift the procurement and availability in-country. This may be especially relevant when scaling nationally, as the bulk purchase of items creates an alternative opportunity for local vendors. Be sure to check the specific model number of each tablet because this will show whether or not those tablets are locked to prevent access on specific mobile networks. Before going to sites such as Amazon for procurement, check regional hubs (e.g., Nairobi or Johannesburg) for hardware options.
- Work closely with the Ministry of Health and the information and communication technology group to understand thoughts and policies on procurement as well as to possibly negotiate costs in the future.

Software Development Process

Change logs (Tanzania and Zambia)

Background: As bugs were documented during testing and launch of the EIRs, new Android Application Package files addressing certain bugs were published by the developers. The most thorough releases included change logs that captured which bugs were fixed and what new features or functionality were included. If a change log was not included, it created confusion when the team was unable to identify appropriate areas for user testing.

Solutions adopted: Change logs became required for every release in the development of both EIR systems.

Lessons learned and challenges: As the systems increased in complexity throughout the development process, ad hoc structures needed to be standardized to ensure appropriate communication among the implementation team and the software developers.

Recommendations: Develop and adopt standards throughout the implementation process as needed. Make sure to identify areas where protocols would be helpful and provide the necessary support to implement them at the beginning of the process.

Defining system requirements (Tanzania and Zambia)

Background: As a way to document the requirements – functional (or technical specifications) and non-functional (or operational specifications) – of both countries' EIRs, Tanzania and Zambia used the [Public Health Informatics Institute's Collaborative Requirements Development Methodology \(CRDM\)](#). CRDM documents who interacts with which data within the context of clinical workflows as a way to understand how information systems can support those workflows. Tanzania and Zambia put these requirements into requests for proposals and supported the government in deciding on the vendors to develop the registries. Kick-off meetings were held in both countries with developers, PATH staff, and the Ministry of Health (comprising national, provincial, district, and facility staff from the user advisory group[s]) to define and approve the requirements for the EIRs.

Solutions adopted: The user advisory group(s) with representation from all levels of the health system and key test facilities was formed to advise on system requirements, definitions, and clarifications throughout the process of developing the EIRs, as well as all other interventions. This was done to ensure all appropriate stakeholders participated in defining the needs of the government, the appropriateness of the interventions for the users, and the feasibility of the implementation strategy.

Lessons learned and challenges: Field visits were conducted, which included interviews and observations, to further understand and clarify some requirements. Later, as the system was being implemented, other needs came to light and new requirements needed to be included, which required trade-offs with less important requirements. For instance, in Zambia, initial requirements did not include recording supplements like vitamin A and deworming, but as the system was tested, it proved more efficient to include these, as this metric was normally captured by HCWs at the same time as immunization data were collected. Collecting the appropriate data elements for service delivery and reporting were critical for the register to eventually replace the legacy paper system. Other requirements shifted as feedback from staff and testing revealed a need to further accommodate existing workflows, such as adding growth monitoring information for children who attended an under-five clinic for only a weight check. Additionally, in Zambia, we learned that the OpenSRP immunization module that had been used in Pakistan required a few adjustments to match Zambia's country needs.

Recommendations:

- When defining requirements, include high- and lower-level stakeholder staff to ensure a balance of understanding that creates a more robust list of recommendations.
- Take time to observe service delivery in the field, to better understand workflows and address other staff difficulties that may come up when adopting the system.

- During testing, ensure the system is exposed early to all levels of stakeholders identified during establishment of requirements. The danger of non-inclusion is rejection of system changes based on the lack of testing feedback.

Local support for software development is needed (Tanzania and Zambia)

Background: The different software development groups that partnered with PATH on the work of the EIRs had teams based in Albania, Canada, Kenya, and Norway. Not having the lead developers in-country made communication challenging given time zone differences as well as contextual understanding of the local use cases. Additionally, when there were critical system issues, the fixes were often delayed due to the time zone differences and limited capacity outside of the software teams without resources located in the demonstration countries.

Solutions adopted: Mohawk (TImR developer) and Ona (ZEIR developer) partnered with in-country software companies in Tanzania and Zambia. This allowed the team, users, and Ministries of Health to have direct contact with a developer team in-country, as well as built in-country capacity for sustainable system maintenance.

Lessons learned and challenges: By partnering with local software companies, response times to bugs were more efficient given the shared time zone and context. This partnership also strengthened capacity for digital health within the country, both for the software company and for the Ministries of Health, as the local software company could train ministry staff over the long term.

Recommendations: Identify local software companies with experience in digital health and a desire to learn and involve them in the process early and throughout.

System and software updates (Tanzania and Zambia)

Background: When deployment first began, new Android Application Package files for the TImR were sent to the BID team by email, and in Zambia, posted to a private software site. As more facilities began to use this system, this process became difficult for the BID team to manage. There were times that the software releases sent over email did not include version numbers, making it difficult for the team to keep track of which facilities were using which version (important when logging bugs).

Solutions adopted: The team opted to switch from email and private websites to posting the software releases and updates to the Google Play Store.

Lessons learned and challenges: During an iterative development process, new software releases can come as often as every two weeks. In the testing phase of the EIR, major changes to the software were shared via email and private sites. While this worked well for accessibility when only a few facilities were using the system, it still required the BID team to drive to the different facilities to either collect tablets and bring them to the PATH office to update the version of the system or take data bundles to the facilities and attempt system updates onsite. This method was not a viable way for facilities to update and use the most recent software versions when scaling. Once the system was stable, software releases were deployed a last time through email or a private site. Now, with a focus on bug fixes in both Tanzania and Zambia, more minor releases with these bug fixes are deployed through the Google Play Store, making the system readily accessible to all facilities once data or Internet connectivity is established.

Recommendations:

- Identify early on the necessary procedures and protocols for seamlessly scaling programs. Using the application purchasing site to roll out current product versions created better version control and enabled a sustainable system for updates beyond the life of the program implementation.
- Consider EMM applications as a way to push updates to deployed devices. These tools can provide insight about what applications are running on a device, the version of those applications, and when those devices are connected to the Internet. Although EMM has a wide range of functionalities, most require an Internet connection.

Development time from three to six months or longer

Background: In the initial request for proposals process for the first EIR in Tanzania, the BID Initiative required responders to confirm that the software could be developed to have a product ready for deployment within three months. In the initial EIR development process, we learned that three months was not enough time for development, as the technology was not as prepared to meet user needs as we had anticipated. Contributing factors included the challenges of having a system that could host multiple users on a single Android device, syncing between devices in the same facility, and offline functionality for mobile devices at the facility level.

Solutions adopted: The next request for proposals for the EIRs (the second one in Tanzania and both processes in Zambia) provided a development timeline of six months to have a minimum viable product ready for deployment.

Lessons learned and challenges: Countries are forward-thinking when it comes to the functionality required of digital health solutions to improve data use and immunization service

delivery. Specifically, it was challenging to design a system that could host multiple users on a single Android device, sync data between multiple devices in the same facility, and provide offline functionality for mobile devices. We learned that the technology was not as far along as we had anticipated and therefore needed more development time to meet the basic set of requirements.

Recommendations: Ensure requirements are grouped into minimally viable product categories and which system requirements can be worked on and easily updated later, during rollout. This allows a balance of getting the product available to users within a reasonable period of time and addressing bugs that arise with the product, but also provides space to do ongoing work to fix bugs and strengthen the platform over the long term.

Deciding on a new system when the current system does not meet requirements

Background: The BID Initiative partnered with the governments of Tanzania and Zambia to define the functional and non-functional requirements for their EIRs and through the request for proposals advised on which systems could best meet those requirements. Functional requirements included activities such as HCWs recording the doses provided and the system automating reports. Non-functional requirements included auditing, security, and the ability for the system to exchange data with national-level reporting systems. Time frames were set at between three to six months for development of the EIRs to meet a minimum set of the requirements for a minimally viable product that could begin to be deployed and used.

Solutions adopted: Both Tanzania and Zambia refined the requirements based on lessons learned and sent out new requests for proposals when challenges arose with the systems initially selected. Tanzania kept the existing EIR in several facilities already using the system, so developers could fix the backend challenges. Zambia pulled the initial system from the test facilities, as it was only in a few at the time.

Lessons learned and challenges: The launch in Tanzania was paused when challenges with the EIR were first identified. In Zambia, when challenges were found, especially with lack of auditing, the system was withdrawn from the test facilities. Both countries modified their requirements based on lessons learned from implementation and these requirements were shared for Ministry of Health approval. The requirements were then shared through an updated request for proposal process. Tanzania continued rollout of its EIR while backend issues were fixed to make the system function more appropriately. Zambia moved forward by deploying other data quality and use interventions in the first three districts while the new EIR was being developed in parallel. As these changes happened, more frequent communications occurred with both governments, the users, and the donor to ensure a critical path to success. We also

learned that without the EIR tool and its dashboards, it was difficult to show success due to lack of data accessibility to the Ministries of Health to show the progress.

Recommendations:

- Identify deal-breaker requirements such as lack of auditing and security issues. A good way to navigate this is to pull the more difficult requirements into earlier development sprints and milestones as a way to more quickly identify if the developers are capable of meeting these requirements.
- Continue ongoing testing with users and the Ministry of Health to assess system performance (see [User-centered design](#)). This clinical and data use expertise can also ensure in earlier stages whether development is on the correct track to meet the requirements and data needs of the country.
- Have a transition plan ready if system development fails. For example, in Zambia the data quality and use interventions were deployed in parallel to system development. This allowed the culture of data use to continue to mature so that when the EIR was ready, it was a tool to complement the strengthened data use by HCWs.