



Better Immunization Data (BID) Initiative Tools Developer Summit Report



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List of acronyms

API	Application Programming Interfaces
BID	Better Immunization Data
BLN	Better Immunization Data Learning Network
CAE	Confirmed Adverse Events
CHW	Community Health Worker
DTP	Diphtheria, Tetanus, and Pertussis vaccine
eHealth	Electronic Health
HIE	Health Information Exchange
ICT	Information and Communication Technology
IVR	Interactive Voice Response
IW	Immunization Worker
GIT	Geographic Information Systems
LMIS	Logistics Management Information System
mHealth	Mobile Health
MIT	Massachusetts Institute of Technology
MOH	Ministry of Health
MPI	Master Patient Indices
POC	Point of Care
ROI	Return on Investment
SHR	Share Health Records
SMS	Short Message Service
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

Executive summary

In December 2013, the Better Immunization Data (BID) Initiative¹ hosted a Tools Developer Summit at the PATH office in Washington, DC. This meeting brought information and communication technology (ICT) developers together with the BID Initiative team, partners, and donors to explore the challenges in immunization systems in Africa. The participants focused on how ICT could be used to address three key challenges: beneficiary interfacing, patient identification, and supply chain management. Over the course of two days, participants shared their expertise and ideas, and discussed opportunities for ongoing collaboration in order to solve these problems. In attendance were representatives from:

- **Developers:** DataDyne, DHIS, Dimagi, Grameen Foundation, InSTEDD, IntraHealth, iRespond, Logistimo, Massachusetts Institute of Technology Little Devices Lab, Novel-T, Open Data Kit, Regenstrief Institute, University of California San Diego, VaxTrac, and VillageReach.
- **Global health partners:** EcGroup, John Snow, Inc. (JSI), Pan American Health Organization, PATH.
- **Donors:** Bill & Melinda Gates Foundation, US President's Emergency Plan for AIDS Relief (PEPFAR), and the US Agency for International Development (USAID).

Participants emerged from the meeting with a deeper understanding of the tools available to address country challenges, ideas on how to proceed, and a commitment from tools developers to collaborate and increase interoperability. All presentations and other meeting materials are available [here](#). A full list of participants and bios is included in Appendix 1.



The BID Initiative team appreciated the active participation of so many developers in this summit, and the analysis and insights provided by InSTEDD post-event. We hope the

¹ Led by PATH and funded by the Bill & Melinda Gates Foundation, the Better Immunization Data (BID) Initiative is grounded in the belief that better data, plus better decisions, will lead to better health outcomes. Its vision is to empower countries to enhance immunization and overall health service delivery through improved data collection, quality, and use. For more information about BID, please visit www.bidinitiative.org.

conversation around challenges and potential solutions for immunization data continues. Please join us at www.bidinitiative.org to stay engaged.

Event design concept

Goal: Identify interventions that would cover gaps in data and processes related to immunization.

PATH contracted InSTEDD to help design and facilitate the workshop, and synthesize outcomes from it. The workshop was organized so that experts in different areas would articulate key scenarios and workflows thereby exposing gaps and assumptions; implicit and explicit reliance on data, and challenges that resides with that data. The BID Initiative team asked for “there’s an app for that” opportunities —situations where new ideas, recombining existing ideas, and integrating existing systems would help improve data and processes related to immunization. These interventions and ideas would then be taken into consideration by the BID Initiative team to execute or recommend in the context of their implementations.

To achieve its goals, the workshop needed to:

- Set a frame of mind that “business as usual” was going to perpetuate existing challenges with both processes and data.
- Establish an environment where emphasis is placed on leveraging existing tools and solutions rather than creating new ones.
- Create a dialogue around workflows, challenges, and opportunities for digitally-enabled health services.

To achieve this, the agenda had the following building blocks:

- An introduction to get participants warmed up.
- A series of lightning talks to expose participants to their work.
- Breakout sessions with leaders clustered around three main immunization information system challenges.

Session highlights

Welcome

Liz Peloso, Better Immunization Data (BID) Initiative, PATH.

Ms. Peloso welcomed the participants and began the summit by introducing the hosts (the BID Initiative team members from PATH), other BID Initiative team members from John Snow, Inc., and the meeting facilitators from InSTEDD. She then provided an introduction to the BID Initiative and the purpose of this meeting: to get an idea of the possible products and solutions to country challenges, and foster collaboration among tools developers to solve big problems.

Little devices

Jose Gomez Marquez, Massachusetts Institute of Technology (MIT) Little Devices Lab

A guest speaker was brought in to set the opening tone for the event. Mr. Gomez-Marquez from the Massachusetts Institute of Technology (MIT) Little Devices Lab presented on the history of innovation in healthcare. He highlighted the role of empowered practitioners working on solutions to their own problems and how they have emerged as a driver to improve clinical practices.

Extreme cases for ingenuity—where most people would say “you shouldn’t try this”—are sometimes the source of great innovation in our healthcare systems. Some of the best inventions have come from those who didn’t ask permission to experiment. Innovators face challenges including social structures, regulation, intellectual property dynamics, entrenched players, and resource scarcity. By drawing a parallel to the challenges of the BID Initiative, Mr. Gomez-Marquez urged attendees to create systems that allowed and encouraged bottom up innovation, that supported the identification of these positive deviants, the measurement of impact of these small interventions, and the building of local communities of practice doing “participatory design” around the challenges relevant to BID.

Key takeaways

- Go to the countries and to the users—acquire their input and get them involved in the development of the solution so it is sure to fit their needs.
- Look at what solutions are already out there and combine old and new ideas for a better product.
- Try to work on what matters, what will have the most impact, and give experimentation a chance.

Lightning talks



Participating developers were invited to present 15-minute lightning talks—20 auto-advancing slides on their work. The purpose of this session was to give everyone a sense of the tools represented in the room. A very brief summary of key points made by each presenter is provided below:



Philippe Veltsos, Novel-T

Novel-T discussed the uses of geographic information systems (GIS) in tracking immunization programs and the challenges in obtaining such data.



Meredith Baker, VaxTrac

VaxTrac developed a simple immunization calendar and ID solution, and brought up common challenges in immunization data management.



Mary Jo Kochendorfer, MoTECH

Grameen Foundation discussed some of the challenges faced by immunization programs in having access to accurate immunization data.



Eduardo Jezierski, InSTEDD

InSTEDD gave an update on its mobile short message service (SMS) and voice-based systems, and gave a brief description of open source tools that may be useful for immunization.



Mitch Sundt, OpenDataKit

OpenDataKit (ODK) gave a deep dive into the technology design of ODK 2.0, which is used as a client or many smartphone data collection efforts.



Anup Akkihal, Logistimo

Logistimo discussed the importance of users and how they can inform the design process for immunization projects. Additionally, they highlighted core aspects of how they seek to scale their systems.



Dykki Settle, IntraHealth

IntraHealth explained the role of workforce information systems in the management and planning of successful immunization efforts; and the role of services-based architectures in helping simplify a health system's information and communication technology (ICT).



Jim Grace, DHIS 2

Showcased recent work on the District Health Information System (DHIS) tool, the evolution of their tools; specifically as it relates to improving Application Programming Interfaces (APIs) and managing medical records of individuals.



Joel Selanikio, DataDyne

Datadyne highlighted their ongoing efforts in improving data collection including their ODK/Android program and mobile data collection.



Peter Simpson, iRespond

iRespond drilled into the role of identity and biometrics in immunization campaigns and showed the capabilities of its multi-function devices for rapid infant and adult identification, stock tracking, and quality control.



Paul Biondich, OpenHIE

OpenHIE is focused on supporting national eHealth systems. The health information exchange (HIE) architecture contains four registries, creates a shared health record (amalgam of different data sources that is produced and accessible by all systems), and contains an interoperability layer. OpenHIE is focused on enabling and improving communication between systems.

Health enterprise architecture

Derek Ritz, Principal, EcGroup

Mr. Ritz is an advisor to global public and private sector clients regarding m/eHealth architecture, strategy, implementation, and adoption. There are various viewpoints from which you can view your system: enterprise architecture, an information viewpoint (what information do you need, what will be produced), a computational viewpoint (patterns and actors), an engineering viewpoint, and a technical viewpoint.

To address the question of what infrastructure and standards are needed, we have to look back at what we are going to use it for (what's our user story?). Through looking at the user scenarios, we can understand who our users are, what they want and need, what their challenges are, as well as the information that flows in and out. All of the parts of the story give us the information we need and enable us to map data elements to a data model.

Mr. Ritz recommended one should not design for exceptions. Instead, design for what you expect to be systematic and account for the exceptions you know exist. Choose standards and specifications to be interoperable. Standards are specified in the engineering viewpoint. They are important because this system will work within a larger context of systems. Be wary of specifications that are only done in certain countries.

Lora Shimp (JSI) pointed out terminology issues that can arise between IT and immunization language. She also pointed out the issue of higher-level interoperability of data between immunization programs and national eHealth. We are not starting with a blank slate, so how do you design alongside with what already exists and people's strong opinions about data? Mr. Ritz says this is why enterprise architecture and standards are so important. They position you to embrace and extend what already exists and will work, so change management can be smoother.

Brian Taliesin asked the group how they felt about the recommendation to leverage pre-existing work, and the group nodded in agreement. Anup Akkihal (Logistimo) commented on how many of the standards are "top-down" while others have been developed and become adopted more organically. Mr. Ritz commented that he thinks the BID Initiative should be choosing mature and consistent standards and not just choosing standards for the sake of it because they aren't actually compatible.

Philippe Veltsos (Novel-T) added that participants should be open-minded to the tools countries are using that we may think are obsolete or inefficient, but they see value in. Participants need to understand the context, and standards should not complicate work. Mr. Ritz added that standards should not interfere with business needs, but rather be adapted to help those needs.

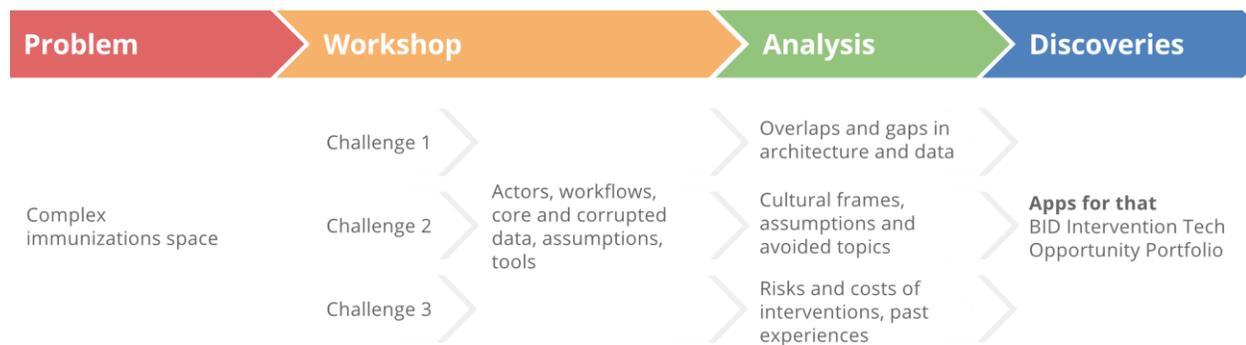
Challenges



PATH identified three participants to be “challenge ambassadors”: experts and representatives to present each of three key challenges in immunization systems posited to the attendees to brainstorm solutions. Each challenge’s discussion was planned to revolve around known areas and topics. From these discussions, assumptions and

opportunities would emerge that could be actionable for finding, creating and integrating technologies to solve each challenge. Figure 1. outlines the approach the facilitators took to the challenge breakout discussions.

Figure 1. Challenges discussion approach



The three immunization challenges selected by PATH for discussion were:

1. **Beneficiary interface:** planning and managing outreach efforts to attain full immunization coverage.
2. **Patient identification:** accurately identifying patients, tracking their health record, and improving defaulter tracing.
3. **Supply chain:** ensuring facilities have the right vaccines and materials at the right place at the right time to avoid stock-outs and reduce wastage.

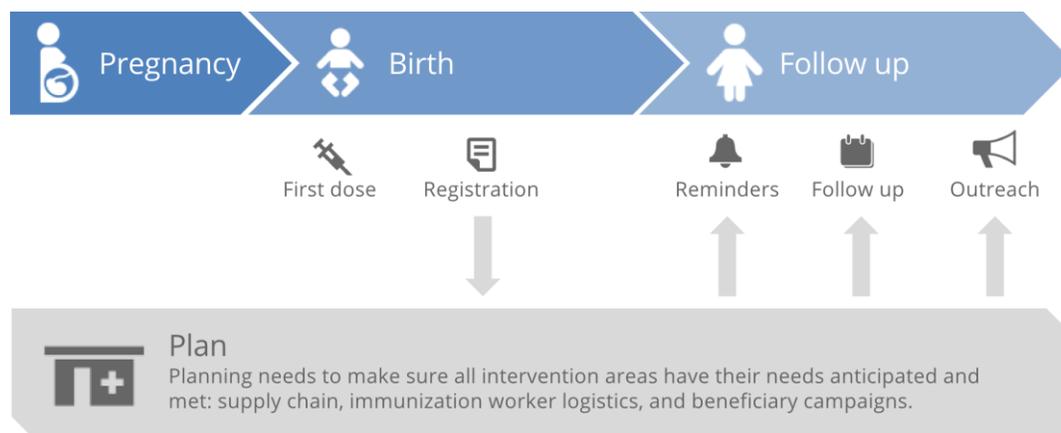
To address the three challenges, participants split into groups and met in separate rooms. The purpose of these breakout discussions was to clarify the challenges and identify root causes, opportunities for improvement, workflows, and metrics for success. Upon returning to plenary, each group presented a summary of their discussion. An overview of the challenges and outcomes of each discussion is provided below.

Challenge 1. Beneficiary interface: planning and managing outreach efforts to attain full immunization coverage.

Challenge ambassador: Lora Shimp, JSI.

In addition to generic messages about the importance of immunization and the need to have children fully vaccinated to protect them from diseases, caregivers need to know their child’s vaccination schedule and where and when to go for services. Data on catchment areas, target populations, outreach services, and drop-outs assist health workers to plan and organize services, including providing information to communities as well as to caregivers for individual children. If immunization registers are up-to-date and accurately track each child, data can be used to provide reminders for the next vaccination session. They can also generate due lists for community mobilizers or health staff to contact caregivers. If coverage data are maintained and trends are monitored monthly, sessions can be rearranged and/or outreach conducted to address under-vaccinated communities and children. Figure 2. displays the workflow diagram synthesized by the group working on the beneficiary interaction challenge.

Figure 2. Beneficiary Interaction Workflow



Key actors pertinent to this challenge were identified:

- Child
- Mother
- Community Health Worker (CHW)
- Facility and District Managers

Source and computed data relevant to the challenge

Informed by the challenge workflow and key actors, the group documented core source data and secondary computed data necessary to solve this challenge. Table 1. Summarizes the data elements important to this challenge.

Table 1. Beneficiary Interaction Core and Computed Data

Source data	Computed and reference data
Denominator Data <ul style="list-style-type: none"> ➔ Admin and catchment boundaries ➔ Quality and coverage estimation 	Defaulters by population age group.
Immunization Schedule	Know about dropouts in timely way. <ul style="list-style-type: none"> ➔ Plan to do outreach or reminders.
Facility Registry	Tally Sheets
Health and Immunization Worker (IW) Registries	
Client Registry/ID <ul style="list-style-type: none"> ➔ Health record events for immunizations. ➔ Observations where/when. ➔ Where is the mother from (in or out of catchment). 	Monthly vaccination coverage by facility and district.
Shared Health Record	Stocks <ul style="list-style-type: none"> ➔ Vaccines ➔ Ancillary supplies (gas for outreach and fridges). ➔ Forms, cards, other paper-based beneficiary interactions. ➔ Usage/wastage rates.
Insurance registrars	
Content—reminders & personalized messages. <ul style="list-style-type: none"> ➔ Personalization style depends on region, culture. e.g. urban/rural, pastoralist/settled etc. 	
Stock-outs and Complaint Events <ul style="list-style-type: none"> ➔ Stock-outs (population line). ➔ No fuel, issue for CHWs/districts. 	
Denominator Data <ul style="list-style-type: none"> ➔ Admin and catchment boundaries. ➔ Quality and coverage estimation. 	Defaulters by population age group.
Immunization Schedule	Know about defaulters in timely way. <ul style="list-style-type: none"> ➔ Plan to do outreach or reminders.

Source data	Computed and reference data
Facility Registry	Tally Sheets
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Data needs

Data needs—where current sources need to be improved or new sources created—were identified:

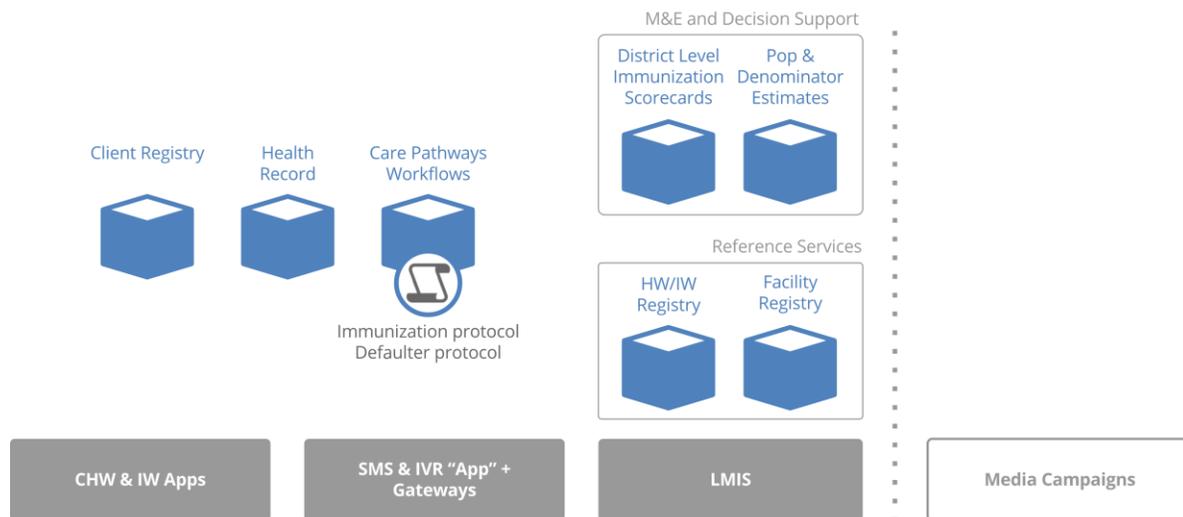
- Improvements to denominator data.
 - Data to perform correction of estimates.
 - Mobile/displaced population.
- Alternate channel for stock-outs and complaint events.
 - Stock-outs (population/immunization worker call-in or reporting lines).
 - Long lines reporting.
 - No fuel, forms (for CHWs and districts).
- Know about dropouts in complete and timely way.
 - To be able to plan to do outreach or reminders.
- Improved CHW Logs of behavior (data collection frequency, completeness, and efficacy).

- Channel for Suspect and Confirmed Adverse Events (CAE).

Technology viewpoint

Figure 3. Depicts the application building blocks and possible application interfaces relevant to beneficiary interfacing.

Figure 3. Beneficiary Interface Mini Architecture



*IW: Immunization Worker; SMS: Short Message Service; IVR: Interactive Voice Response; LMIS: Logistics Management Information System.

Challenges

General challenges were also identified during the session. For beneficiary interfacing, the group identified the following:

- Behavior change: how to overcome cultural and knowledge barriers preventing children being immunized.
- Literacy and reach: many of the intended recipients may not be able to read/write or have access to a mobile device.
- Poor coordination between CHW's and immunization facilities.
- Costs of poorly managed beneficiary campaigns.

Risk assumptions

In dialogues with the challenge team, the facilitators identified the following assumptions that can be risky as they do not match success patterns of other beneficiary-centric programs:

- Beneficiaries are hard to influence: evidence of behavior change to increase immunization is not well established.
- Media campaigns and groups do not need to be included in discussion: SMS message campaigns are often created without involving the intended users.

Opportunities

The facilitators identified opportunities for the BID Initiative to improve immunization programs, including:

- Proactive inclusion of beneficiaries and workers in design efforts.
- Use empirical baseline/denominator calibration techniques to better estimate coverage and defaults.
- Work with media channels: The "App for That" in behavior change is radio and TV.

Challenge 2. Patient identification: accurately identifying patients, tracking their health record, and improving defaulter tracing.

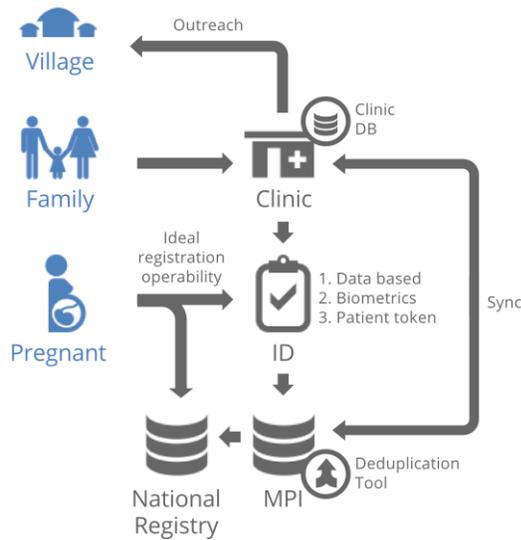
Challenge ambassador: Kate Wilson, PATH.

While a country may have a system for the unique identification of adults, this type of tracking seldom extends to children. A caregiver is often given a child health card to track the child's growth and vaccine history. Whether the card accompanies a child to an immunization session varies. It is difficult, if not impossible, to determine the identity of a child who is brought in for immunization and match it to health facility records. At the health facility, there may be an individual record of a child's vaccination history within a register that could be cross-referenced. However, this process can be time consuming when there is a large lineup of children waiting for services. Furthermore, if the family moves outside of the district, it is nearly impossible to see the longitudinal record of care. Who is this particular child? Did the child receive the full regimen of Diphtheria, Tetanus, and Pertussis (DTP)? Of the polio vaccine? Which children are expected at the clinic this month?

This challenge is centered on the goal of giving the correct immunizations to the correct individuals; with a design premise that identifying individuals was a requirement, given the current state of the art of molecular diagnostics and immunization. Much of the discussion revolved around the cost, completeness, and quality tradeoff of different paradigms of identification: demographic, biometric, and token-based (e.g., ID Cards).

The group discussed the lack of exploration of hybrid or combined efforts, and the assumption that identification needed to be universally applied. As the challenge often has confounding factors and larger governance implications, there has not been much research to explore where incremental effort on identification would yield positive impact for targeted communities. Figure 4- depicts the workflow for the beneficiary identification challenge.

Figure 4. Beneficiary identification workflow



Key actors were identified that are pertinent to this challenge. They included these types of individuals:

- Baby
- Mother
- Primary caretaker
- CHW
- IT

Source and computed data relevant to the challenge

The group documented core source data and secondary computed data important to solving this challenge. Table 2 summarizes the data elements important to this challenge.

Table 2. Beneficiary Identification Core and Computed Data

Source data	Computed and reference data
Minimum Data Record → Assigned Identifiers (numbers, tokens). → Name → Date of Birth or approximation. → Bio graphics (gender, color eyes, hair). → Relationships & Names. → Geographic Area & Time.	→ Id token: patient card, RFID, QR code, etc. → Densities, some demographics capture & release frequency per location/time. → Predictive evaluation of risk of identity ambiguity given name, location, etc. → For household/outreach: pictures of houses, GPS tracks. → Costs models of different positive and negative events per population, immunization, child, etc.
Immunization Events	

Data needs

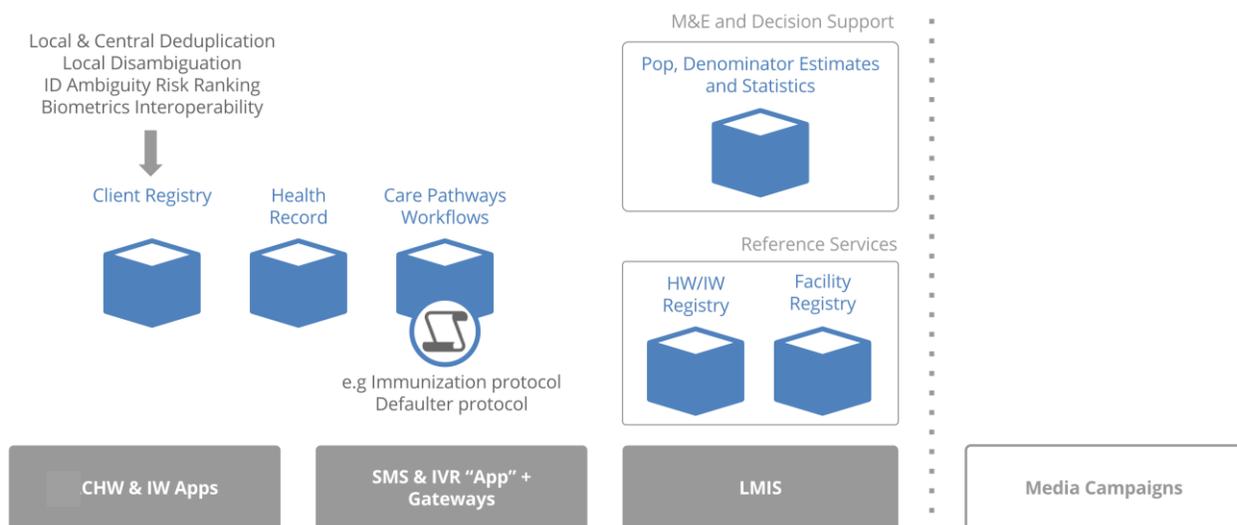
Data needs were also identified—where current sources need to be improved or new sources created. The subsequent points below highlights these pending areas of need:

- Improved, localized statistics of demographics.
- Better defaulter tracking.
- Better registration of immunization events into shared health record and persistent digital infrastructure.

Technology viewpoint

Figure 5. Builds on the mini architecture in Figure 3., depicting the aspects a client registry would include to support beneficiary identification.

Figure 5. Beneficiary Identification Mini Architecture



Challenges

General challenges were identified during the session. For beneficiary identification, the group prioritized the following:

- The pregnancy record often contains the birth dose of vaccines for the child, but the information does not get transferred into a newborn record without a manual process.
- The identification of pregnant women can be culturally challenging, whereas expectant mothers may travel distances to receive antenatal care outside of their catchment area.
- The identification system is not designed to account for common occurrences like babies that have not been named yet and/or whose caregivers do not know their specific date of birth.
- There are concerns about encryption/security of biometrics (the actual technology as well as perceptions).
- Gaps between catchment areas exist and sometimes are not clearly known.

- Lack of trust of foreign programs makes ad-hoc complex technology and tokens hard to introduce.
- Duplicates in disconnected applications are not resolved early enough or by people with local knowledge.
- Dealing with patients of other areas, migrant populations.
- Speed of patient identification—long queues of patients waiting to be identified (needs to be balanced with speed/parallelism of immunization itself).
- Reluctance to be identified using biometrics in some populations.
- Lost ID tokens.
- No complete or accurate census data implies there is no accurate coverage or default estimate.

Risk assumptions

The facilitators analyzed the conversations and artifacts of the challenge discussion and identified a large number of assumptions—either explicitly mentioned or tacitly supported by the dialogue—that may be worth analyzing further:

- Token, biometric, and demographic IDs are exclusive.
- Assuming solutions that rely on a costly or dedicated device at point of care (POC) have a positive return on investment (ROI) and can scale.
- Efforts to establish master patient indices (MPIs) and shared health records (SHRs) can be significant infrastructure investments.
- National registries can be queried in real time.
- Identification speed is an issue that needs to be addressed independently of immunization speed. We suggest doing a queue model (e.g., there is only collateral benefits in identifying faster than you can dispense immunization, which basically would just shift the queue).
- Universal ID (e.g., universally disambiguating systems) are more effective than localized IDs.

Opportunities

The participants identified opportunities both during the team event and after an analysis of the event:

- In small villages, patients can already be identified by CHW without any formal method.
- Better immunization products design (e.g., one dose, no cold chain, etc.).
- Additional data from CHWs can be used to calibrate denominator.
- Population size estimation techniques (e.g., mark and recapture) and other census approaches.
- Providing non-traditional tokens (e.g., from clothing to temporary tattoos).
- Rapid testing of what immunizations are needed: expensive investment in biotechnology, but renders obsolete the need for central identification.
- Load balancing: certain groups on certain days, by name or date of birth, for example.
- Model to choose optimal distribution/size of events.

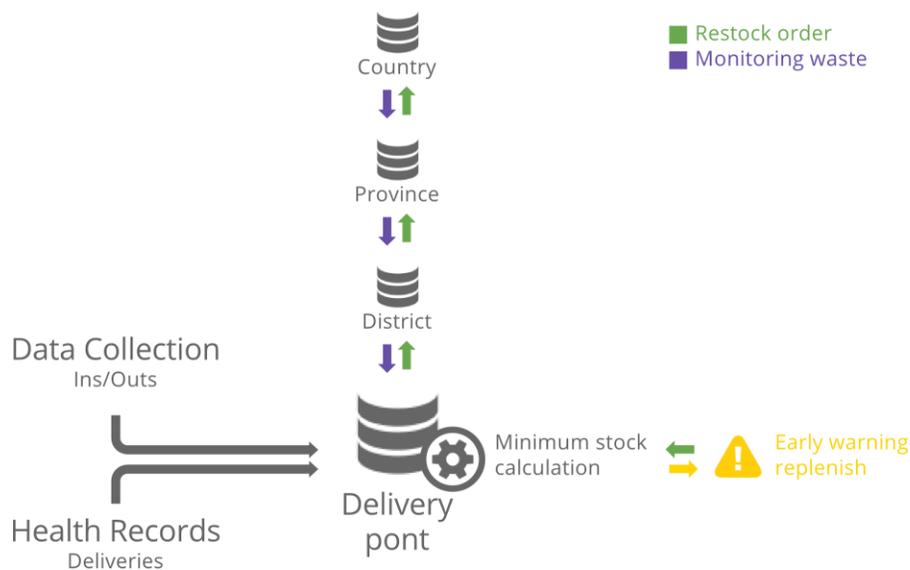
Challenge 3. Supply chain and logistics: ensuring facilities have the right vaccines and materials at the right place at the right time to avoid stock-outs and reduce wastage.

Challenge ambassador: Henry Mwanyika, PATH.

How do we ensure the vaccine makes it to the correct child, at the correct time, in the correct condition? Beyond the district level of the health system, there is limited visibility into the interdependencies of the cold chain necessary for viable vaccines. Often, vaccines are pushed to the outlying facilities, tracked on paper registers, and re-supplied through inefficient processes in the event of a stock-out, with a seeming data disconnect between what vaccines have been administered and what has been supplied. Unfortunately, immunization officers often do not have the data to help guide efficient flows of vaccines when there are overstocks, when vaccines are nearing their expiry dates, when growing population trends predict near future shortages in supply, or when problems with the refrigeration foretell a need for immediate maintenance.

This challenge centered on getting the material supplies needed to perform the immunization efforts. Pieces of the puzzle included planning, packing, ordering, preventing expired vaccines from being used, and refrigerator storage. The supply chain session produced the following workflow provided in Figure 6.

Figure 6. Supply Chain Workflow



Key actors pertinent to this challenge include these types of individuals:

- Health Worker
- Store Keeper
- Logistician (Immunization and Vaccine Development)

- Vaccine Manufacturer
- World Health Organization (WHO)
- United Nations International Children's Emergency Fund (UNICEF)
- Service delivery point

Source and computed data relevant to the challenge

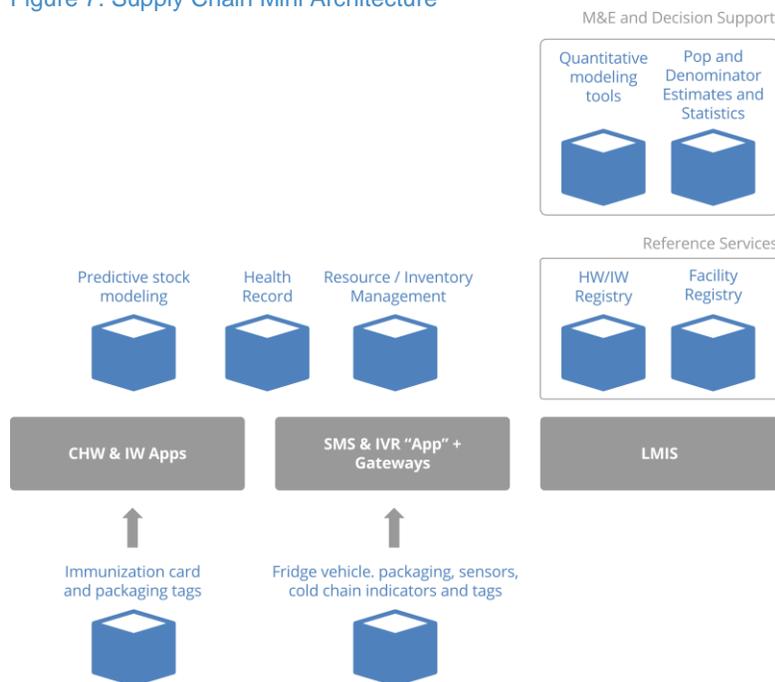
Informed by the challenge session, the core source data and secondary computed data necessary to solving this challenge were identified. Table 3. Summarizes the data elements important to this challenge.

Table 3. Supply Chain Core and Computed Data

Source data	Computed and reference data
<ul style="list-style-type: none"> ➔ Facility registry ➔ Refrigerator location, status. ➔ Stock tracking (e.g., Logistimo, OpenLMIS). ➔ Minimum stock calculations. ➔ Barcodes of specific items/types. ➔ Expiration dates of vaccine vials & boxes. ➔ Tracking and logistics metadata. 	<ul style="list-style-type: none"> ➔ Refrigerator telemetry (temperature, maintenance, door usage). ➔ Vaccine stocks, expected and inferred. ➔ Wastage information

Technology viewpoint

Figure 7. Supply Chain Mini Architecture



Challenges

For the supply chain session, the group identified the following challenges:

- No trusted wastage reporting due to direct incentives to reduce it.
- Cold chain
- Maintenance of fridges.
- Complications to estimate storage volume at service delivery points.
- Taking into account road conditions to plan distribution.
- Stock transfer between close service delivery points does not get tracked.
- Political cost of immunizations expiring.

Risk assumptions

The risks identified by the participants, with some additions by the facilitators post-analysis, include:

- Purely hierarchical delivery systems should match health administration hierarchy.
- Push or pull models for stocks versus considering both simultaneously at all levels.
- Users are often collecting data that require additional calculations or analysis to take action (e.g., determining minimum stock levels or vaccines nearing expiry date).
- Single channel of data vs. multiple for each core piece of data. There often seems to be data errors that are replicated and somewhat hidden by summarizing the data for reporting, yet gathering multiple sources to improve accuracy also places extra demands on the data collector.

Opportunities

The following opportunities for improving the immunization supply chain identified during the event and those derived in a further analysis:

- Review current incentive systems to influence better data or behaviors.
- Improve management approaches that are more focused on analyzing and acting on data.
- Model the data to enable reporting and analysis, supporting larger system improvements (e.g., transport, fridge placement, delivery routes, etc.).

Fishbowl panel

The summit also featured a fishbowl panel—an interactive panel in which participants self-select themselves to ask questions and serve as panelists to answer them.

Topics discussed included:

General priority areas for PATH: Ensuring the BID Initiative is country-driven and getting the countries to specify what their challenges are.

Country-driven solutions: How can we promote a country-driven process? Through coordination and facilitation, not management. Dr. Mwanyika was the only person in the room representing Tanzania. More country representatives need to be involved. We should also

remember that every country is not a separate “mountain”. We can have solutions that can be adapted to specific country situations. We don’t have to reinvent things each time— modular components can be used to start a conversation with countries, presenting flexible schema.

Capacity building: What activities is the BID Initiative planning to do to increase IT literacy for Ministry of Health (MOH) officials and improve data management skills at the mid-level? PATH had mentioned the peer BID Learning Network (BLN), which is specifically designed for this purpose, and involving them in the design. There is a similar mechanism in Southeast Asia (Asia eHealth Informatics Network)—we’re looking at building a similar model for Africa. We are also looking at how to build deeper-level university partnerships. We need to look at what pedagogical models would work best and challenge our assumptions. Real-time, on-the-job training, where the trainees immediately get to use their new skills will help them retain their new knowledge. Level of interest and environment is important for learning. Different people learn in different ways, and not all peers are effective at teaching others. It is important to train the trainers effectively.

Patient identification: Which patient identification issues would not be solved with a national ID system? What are the larger implications of patient identification (e.g., HIV status, ethnic conflict)? This is a particular issue in border settings where people cross into different countries to receive care. Countries need to figure out how to incorporate individuals into the system and track treatment, perhaps separately. It also depends on what information is tied to the national identifier. It can contain limited, unambiguous information solely to identify a person for health care purposes. The challenges come from fear that an identifier contains information that identifies you for purposes other than health service delivery.

Tools already connected: Which of the existing apps in the room already work together? DHIS2 and iHRIS. Commcare and MoTECH. Logistimo and MoTECH. Several connect to the facility registry. Solutions can become interoperable by adapting their specifications, not just by specifically connecting with one other tool. Several participants expressed commitment to collaboration. We need to get those institutions and national-level governments open to this; it won’t work if they’re not ready. Competition, interoperability, and transparency are very important.

Sharing resources: How can we better share this knowledge with the organizations that could benefit from it? A Q&A site for BID. HINGx was originally created as a repository for information, but openHIE is collaborating with HINGx to build more of a collaborative community for individuals, organizations, projects, and countries. It would allow people to register and discover others who may be able to support their work. There’s way more information out there than our users can consume. Innovation will continue; what are the appropriate filters to identify where the value is? By increasing the scope of how you collaborate, you run the risk of diluting your efforts. Diffusion and adoption is a big challenge.

Devices and access: Mobile phone devices and access are changing quickly around the world. More and more people are gaining access to varying levels of devices, but there is inequitable

access in some places due to a variety of factors (e.g., gender). We should presume for the network that most people where we work will live somewhere with access. For example, they could use a paper-based system most of the time and then upload data once a week. However, there are always challenges to network connectivity and supply chain has to have an offline mode. The key is working with the people on the ground in the communities who understand the possibilities, resources, and challenges.

Conclusion

Insights from the summit facilitators

InSTEDD provided analysis and recommendations to the BID Initiative team based on what was discussed during the summit. A summary is provided below.

Data quality risks for BID Initiative

Following the event discussions and systems analysis, the facilitators discovered four risk areas for the BID Initiative relative to data management and decision making. Below, InSTEDD describes the risks and their recommended mitigation actions.



Data and programs not designed with feedback loops or data calibration channels.

Risk: Most systems discussed—supply chain and identification especially—are relying on having only one measure of important values and data. This makes the immunization program vulnerable to regional, district, and local distortions of that information with no backup or wide cover of quality assurance processes.

Mitigation: Design feedback loops for key information that use both operational and data validation from other sources.



Unattainable, perfect data are being sought instead of attainable, good-enough data.

Risk: Programs to capture better information are not performing a tradeoff based on ROI. “Diminishing returns” effects around improving data quantity and quality are brushed aside in conversations.

Mitigation: The BID Initiative can design with key questions in mind: How good (or how much better) does this data need to be in order to improve action? Is it easier to attain? For example, by using feedback loops, algorithmic approximations, locally relevant approximations, and historical

interpolations, good enough data can be derived by less expensive means than trying to acquire real-time, 100 percent complete, error-free information. Investments in information quality should be based on a loss-cascade analysis of how final outcomes would actually be influenced by use of the improved data.



Data are not being interpreted in light of the incentives that generate it.

Risk: By trying to reduce performance goals to a few metrics and only having one channel of data for key measures, the system is vulnerable to local, district, and national-level biases and disincentives for true reporting.

Mitigation: The mitigation approach is similar to the first risk area listed. The design should allow for ease of operation feedback loops for key information but with careful thought put into creating sources of information with different reporting biases. For example, who would want to report more stock-outs and why? Who would one want to report less stock-outs and why?



Countries lack quantitative models to make decisions and evaluate ROI.

Risk: Decisions are made inconsistently—favoring local optimums and not favoring wider tradeoffs, over time, with qualitative and subjective arguments being the tool of persuasion. Specialists in each challenge exhibited different optimization criteria, “sacred cows”, and perceptions of what is hard and what is different.

Mitigation: Considering resource constraints, an improved framework is needed to make tradeoffs at the national level. If sought-after events can be given a quantitative “value” and events to be avoided a certain “cost”, programs can make better decisions. What is the “value” of a full set of measles vaccines being given? What is the “cost” of injecting expired vaccines? What denominators could be used to compare value and cost (by child, by facility, by dollar, etc.)?

Even simple scoring approaches can help countries explore simultaneous centralized and distributed approaches to optimizing program design; identify when/how priorities can change, and have evaluable interventions.

Some of these challenges are results of the trajectory of past immunization campaigns and efforts in developing countries. They have created expectations about what could be done but

potentially putting a perceived “glass ceiling” on efforts to change the status quo. The social contexts of MOH, large non-governmental organizations, and large foundations have their own established cultures and norms that build over time on assumptions of the status quo. In business management terms, one of the BID Initiative’s largest overall challenges is to improve planning data that in turn leads to the efficient use of operational funds, thus changing the current social norm.

Architecture opportunities

The challenges showed a highly cohesive set of problems and solutions that rely on same core data. It is clear that with certain good datasets and standard operating procedures to keep them updated, the quality of immunization effort execution and evaluation can be improved. The opportunities here include:

Individual information:

- Master patient indices: to register and index individuals (e.g., mothers and children).
- Shared health records: to store immunization events consistently.

Health system information:

- Health workforce registry
- Facility registry
- Inventory registries

Supply chain information:

- Logistics (e.g., orders, shipping, and stock counts)
- Telemetry and tracking

Country information:

- Population density (by administrative area, urban area, or geographical area).
- Road networks and topography.
- Seasonal or geographical population variations (due to pastoralist movement, displacement, etc.).

Some of the needs of the BID Initiative may not be directly met by these services, but rather by analyzing or processing information from them; or by extrapolating useful information from historical trends and correlations.

In terms of technology architecture, it is not possible for one system to fulfill all of these roles to every user in a satisfactory way. It will be a good investment to assist countries in incrementally adopting new applications and services or integrating existing systems via standards and application programming interfaces that could, in the future, be replicated by others. This

approach improves country ownership, maintainability, and sets a stronger foundation for a combination of domestic and international technology efforts.

Appendix 1: Attendee Bios

Mr. Anup Akkihal

CEO, Logistimo

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Anup Akkihal is founder of Logistimo—an organization conducting R&D in supply chain management and information technology for immunization programs around the world. Believing that connectivity is a major obstacle to development, he initially explored how to enhance Base-of-Pyramid access to essential commodities, and improve market linkages for village producers. This effort evolved into the development of "robust mobile supply chain tools" that are now changing landscapes in Africa and India across healthcare, agriculture, construction, livelihoods and waste management. Anup intends for Logistimo to generate positive externalities in rural emerging markets, tangibly impacting the condition of the world's poorest citizens. Anup previously spent 15 years working in supply chain strategy across a range of industries – including consumer goods, automotive manufacturing, retail, defense and pharmaceuticals – in North America, Europe and Africa. He has enjoyed the privilege of designing tactical logistics systems with the United States Army, managing SAP enterprise software projects, working with JSI, and advising WHO, USAID, UNFPA and World Bank on supply chain management & technology. Anup earned degrees from Johns Hopkins University and MIT.

Mr. Facundo Alberdi

Business development, DataDyne Group

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Facundo Alberdi is leading social enterprise focused on innovative data collection technology within international development, global health, agriculture, energy, education and other sectors. He has a demonstrated record of achievement, management, and responsibility working with direct and indirect sales organizations and partners globally (Europe, Africa, Asia, Middle East, Latin America and the Caribbean). Mr. Alberdi has specific knowledge of global marketing and sales strategies to position, market and sell solutions globally.

Mrs. Breese McIlvaine Arenth

Portfolio Coordinator, Health Management Information Systems, PATH

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Breese McIlvaine Arenth has 5+ years of experience in international development, working in project management, new business development, communications and outreach, and research and advocacy. She has worked for international companies and non-profits in the United States and abroad. She joined PATH in June 2012 as the portfolio coordinator for the Health Management Information Systems team in Technology Solutions. Breese holds a B.A. in International Relations and Political Science from Tufts University, a certificate in project management from the University of Washington (UW), and is pursuing a master's of public administration program at the UW Evans School for Public Affairs. She speaks Spanish, as well as basic Portuguese and French, and has lived and worked in Africa and Latin America.

Mr. Tariq Azim

Health Information System Specialist, John Snow, Inc. (JSI)

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Tariq Azim has over 29 years history of working in the fields of reproductive health and family planning, health management information system, health systems monitoring and health system strengthening. He has worked in varied cultural settings in countries like Bangladesh, Pakistan, Afghanistan, Iran and Ethiopia. Tariq provided the technical lead in the reform of HMIS in Bangladesh and Pakistan, and was the Chief of Party of the USAID-funded Health Management Information System (HMIS) Scale-up Project in Ethiopia (2009-13). He has served as a clinical practitioner in rural hospitals, as an operations researcher in International Center for Diarrheal Diseases Research, as M&E expert and as team leader/project manager in various projects funded by USAID, Asian Development Bank, Japanese International Cooperation Agency, World Health Organization and UNICEF.

Ms. Meredith Baker

Project Manager, VaxTrac

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Meredith Baker is the Project Manager for VaxTrac, a US-based NGO that implements biometric-based mobile vaccine registry systems in developing countries. Before joining the team, Meredith served as a Health Education Volunteer with Peace Corps in Mali, West Africa. After being evacuated due to political upheaval, Meredith became the Stomp Out Malaria Coordinator with Peace Corps in Burkina Faso where she had the opportunity to sharpen her international development, cross-cultural, and program management skills by working with the local Ministry of Health and several International NGOs to implement national public health strategies. Meredith is a proud graduate of New York University where she earned a BA in Politics and French. She is currently based at the VaxTrac office in Washington, DC.

Mr. Paul Biondich

Associate Professor of Pediatrics/Informatics, Regenstrief Institute

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Mr. David Boone

Epidemiologist, JSI

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Mr. Brian Cardiff

Software Developer, InSTEDD

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Brian is a lead software developer and researcher working with InSTEDD team. He has significant expertise in both agile software development and information visualization. Brian has over 7 years of professional experience in software development and a master's degree in

Computer Science. Currently, he resides in Buenos Aires where he is a core member of InSTEDD's iLab Latin America team.

Dr. Carolina Danovaro

Regional Immunization Advisor, Pan American Health Organization

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Dr. Danovaro (aka Danovaro-Holliday) has over 15 years of experience working in different immunization-related activities in the United States, Asia and Latin America. Since 2004, she has been working at the Immunization Program of the Pan American Health Organization/ World Health Organization (PAHO/WHO). As a Regional Immunization Advisor, she is responsible for immunization data quality and strategic information. Since 2008, Dr. Danovaro also coordinates the monitoring and evaluation (M&E) team of PAHO's Department of Family, Gender and Life Course.

Mr. Michael Gehron

Health Information Systems Coordinator, PEPFAR

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Mr. Gehron is the Health Information Systems Coordinator for the Department of State's Office of the Global AIDS Coordinator which oversees the nation's \$7 billion annual investment in the President's Emergency Plan for AIDS Relief. He has an extensive information systems background, including co-founding and directing a 400 person firm which was acquired by SRA International. He was subsequently made Vice President at SRA responsible for USAID's global systems before returning to Africa in 2004 where he joined USAID in Tanzania as a Senior Advisor assigned to the PEPFAR program. Mr. Gehron has spent twelve of the past 30 years living and working in Africa. He has held faculty positions in information technology in the University of Maryland system and has lectured regularly in the School of Business at the University of Dar es Salaam. He has a Master of Science in Technology and Management.

Ms. Skye Gilbert

Program Officer, Vaccine Delivery, Bill & Melinda Gates Foundation

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In her current role, Ms. Gilbert focuses on improving the quality, availability and use of immunization data to inform decision-making at all levels of the health system. In support of that goal, she manages the BID Initiative and recently launched a contest to improve the child health record. She also participates in two WHO working groups related to data and contributes to the development of two internal strategies with ties to immunization: ICT and Disease Surveillance.

Mr. Jim Grace

Software Developer, DHIS2

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Jim Grace is a member of the DHIS2 core software development team where has recently extended DHIS2 for monitoring and surveillance. He worked for five years in Kenya for the University of California San Francisco in their PEPFAR-funded program to support HIV/AIDS

care and treatment, using OpenMRS medical records software. Jim's experience includes developing three-tier web applications for healthcare and insurance as well as networking protocol, database engine, and operating system research and development.

Ms. Mary Jo Kochendorfer

Program Manager, Grameen Foundation

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Mary Jo Kochendorfer is the Program Manager for the Mobile Health Innovations team at Grameen Foundation. She supports organizations in using the open Source MOTECH (Mobile Technology for Community Health) Platform that is currently serving pregnant women, children under five, HIV/AIDS patients, tuberculosis patients, and CHWs in more than 15 countries including Ghana, India, Sierra Leone, Tanzania, Uganda, and Zambia. She has been with Grameen Foundation for over six years and holds a degree in International Business and Marketing.

Ms. Amanda Makulec

Monitoring and Evaluation Associate, JSI

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Amanda Makulec works as the JSI Program Manager & Technical Officer on BID. In addition to her work on BID, Amanda is one of the research, monitoring and evaluation advisors for the Innovations for Maternal, Newborn and Child Health Initiative's Care Community Hub project in Ghana and contributes to the overall initiative's research on social innovation in public health programs. Amanda's areas of expertise include data quality, monitoring and evaluation, and communications. She holds a BA from Miami University in Zoology & Sociology and an MPH from Boston University School of Public Health, and loves cooking and SCUBA diving in her free time.

Ms. Claudia Ortiz

Pan American Health Organization (PAHO)

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Dr. Henry Mwanyika

Program Officer, Health Management Information Systems, PATH

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Dr. Mwanyika, based in Dar es Salaam, Tanzania, has more than 12 years of experience in the commercial ICT and public sectors as well with health NGOs. Henry leads PATH's HMIS work in Africa. He currently leads PATH's work in Zambia and Tanzania to complete development of the first version of the open-source supply chain platform called Open LMIS. In addition, he leads the adaptation of DHIS2 to support community service monitoring and evaluation for APHIA plus in Kenya.

Mr. Ron Pankiewicz

Technology Director and Group Lead, Information Systems Group, VillageReach

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As the Technology Director and Group Lead, Information Systems Group, Ron is responsible for the vision and implementation of VillageReach's information communications technology work, including VillageReach's participation in the recently launched OpenLMIS initiative. Ron has over twenty years of experience in information technology, encompassing software development, databases ranging from the workstation to very large scale enterprise level, and web-based systems and cloud-based services. Ron has been responsible for leading teams of software developers and managing software projects in entrepreneurial startups, for-profit corporations, and nonprofit biotech and medical research organizations. Most recently, Ron has worked with a number of research and public health organizations, including the Institute for Human Virology (IHV), IHV Nigeria, Samford Consortium for Regenerative Medicine and SightLife., with projects including patient medical records systems, and cloud-based systems for operating corneal eye banks in middle- and low-income countries. Ron has an MS in Management Science from the Sloan School of Management at MIT, an MS in Computer Science from MIT, and a BS in Applied Mathematics from the University of Washington.

Ms. Liz Peloso

Strategic Advisor, BID Initiative, PATH

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Liz Peloso has over two decades of experience in a variety of healthcare settings, which includes a broad and varied background that has enabled her to develop a diverse set of skills and experience in a wide variety of health system roles. In addition to tactical experience, she is a Registered Nurse (with over 10 years of clinical experience and a specialty in International Medicine), holds a BA in Information Systems and Human Behavior and a MSc in Health Informatics with a focus on broad-scale change management related to health information system implementations and adoption. She will lead the work of the BID Initiative once the work begins in Africa.

Mr. Derek Ritz

Principal, EcGroup

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Derek Ritz is a trusted advisor to global public and private sector clients regarding m/eHealth architecture, strategy, implementation and adoption. His specialties include: eHealth technology and strategy, health enterprise architecture, big data analytics, health informatics standards, lean healthcare, patient safety and quality of care, EHR implementation, security, privacy, supply chain management (SCM), BPR, IT systems analysis, and SOA.

Mr. Shawn Sarwar

Director of Technology, Biometrac

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A former biomedical engineer at a surgical navigation company, Shawn co-founded Biometrac in 2010. He currently oversees design and production of mobile biometric tools created for last-mile impact. In addition, he serves as Research Director at VaxTrac.

Dr. Joel Selanikio

CEO, DataDyne

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Dr. Joel Selanikio leads DataDyne's efforts to develop and promote new technologies and business models for health and international development, including multiple-award-winning Magpi mobile data collection software (formerly EpiSurveyor)—the most widely scaled mobile technology ever created for international development, with more than 24,000 users in more than 170 countries. Dr. Selanikio is a frequent speaker and consultant in the fields of social entrepreneurship, innovation, public health, and the use of technology for development ("ICT4D"). He is a judge for the GSMA Global Mobile Awards and for Health Datapalooza, was named by Forbes as one of the most powerful innovators of 2009, and is a winner of the \$100,000 Lemelson-MIT Award for Sustainability and the Wall Street Journal Technology Innovation Award. He has been profiled by the Guardian, Wired, Forbes, The Economist, The Wall Street Journal, the BBC, and the Washington Post, among many others. His public speaking includes presentations at The World Economic Forum in Davos, TEDx Austin, Foo Camp, Google, the Clinton Global Initiative, the Royal Society of Medicine, SciFoo & many other venues. Dr. Selanikio is a practicing pediatrician, as well as a former Wall Street computer consultant, and former CDC epidemiologist.

Mr. Dykki Settle

Director, Health Workforce Informatics, IntraHealth/CapacityPlus

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Dykki Settle has more than 20 years of experience leading the design and development of innovative technology solutions and has spent the last decade applying this expertise to global health challenges. With a particular interest in open source and health-worker centered solutions, Settle leads the development of innovative open source solutions for the health workforce. The largest of these is iHRIS—the open source human resources information system software that provides the information health sector leaders need to assess, plan, and support the health workforce in their countries. Currently the software is supporting more than half a million health worker records in 15 countries. Settle has worked with leaders in more than 20 countries to develop human resources for health information solutions, build absorptive capacity for new health technologies, and support local and regional organizations to utilize the power of open source for global health.

Ms. Lora Shimp

Senior Technical Officer, JSI

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Ms. Shimp has over 18 years of experience in international development and maternal and child health, particularly with programs focused in Africa and through a variety of US government and United Nations organizations. She has worked directly on USAID-funded child health projects, including REACH II, BASICS I and II, IMMUNIZATION basics and MCHIP.

Mr. Peter Simpson

Executive Director, iRespond

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Dr. Eli Spencer

Co-Director, Distributed Health Labs, University of California San Diego

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The goal of Dr. Spencer's research is to develop informatics and diagnostic solutions for medical care in resource-limited settings. In San Diego he coordinates the informatics component of the UCSD/UEM Medical Education Partnership Initiative (MEPI); a collaborative effort between the divisions of Infectious Diseases and Bioinformatics at UCSD and the University Eduardo Mondlane, Maputo Mozambique, to improve medical education and laboratory capacity in Mozambique(mepimoz.org, id.ucsd.edu). Research in his own lab includes yeast based diagnostics, MEMS and portable “lab-in-a-box” technologies integrated via mobile devices.

Mr. Mitch Sundt

Software Engineer, OpenDataKit (ODK)—University of Washington

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Mitch Sundt is a software architect and developer with a wide range of Java and C++ experience. 16+ years of his career have been focused on server software development on Linux, Unix and Windows systems. He worked for more than two years as manager and software architect for a shrink-wrapped client software application on Windows. He spent three years in full, end-to-end software development, from Android phone apps, heavy Javascript programming, setting up web hosting, on through to the server and database layers that I am most familiar with. His specialties include multithreaded systems, software architecture, SQL, Java, and C++.

Mr. Brian Taliesin

Senior Program Officer and System Analyst, Health Management Information Systems, PATH

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Mr. Taliesin has over 20 years of experience in software design, application development, and implementation, including projects with WHO, NGOs, and multinational firms such as United Airlines and Microsoft Corporation. As part of his commercial sector experience he has directed multiple global development teams, data center operations, and help desks.

Mr. Scott Teesdale

Project Manager, InSTEDD

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Scott is a Public Health Epidemiologist who has extensive experience working on disease surveillance and monitoring and evaluation systems throughout Africa and the Middle East. He has worked as a Regional Epidemiologist and Team Lead for Data Management with the US Centers for Disease Control, Global Disease Detection and Response Program in Cairo, Egypt.

Additionally, Scott has worked as the Monitoring and Evaluation Manager for Medical Care Development International where he helped implement multiple USAID malarial control programs in Sub-Saharan Africa. Scott received a Masters in Public Health Epidemiology from Tulane University in addition to a Bachelor of Arts in Biology from the University of Iowa. In 2012, Scott joined InSTEDD as a Project Manager for the Bill and Melinda Gates mHealth Surveillance project.

Mr. Steven Uggowitzer

Founder, eSHIFT Partner Network

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Steven Uggowitzer specialises in information management and technologies in the areas of public health and international development. As the lead technical designer and implementation manager for many large IT infrastructure projects, he has both broad and deep technical knowledge across a range of information systems and IT disciplines. Most recently in the role as Architect for the Health Metrics Network Secretariat, World Health Organization, Mr. Uggowitzer introduced enterprise architecture to develop a solutions framework for health information systems. He adopts a practical and holistic view to standards, monitoring and evaluation, human resources and capacity development in proposing sustainable approaches to information systems. Beyond the international health and development sector, his 20 over years of experience includes service to government research centers, and a range of technology and aerospace organizations. Steven is a graduate of McGill University with degrees in Electrical Engineering.

Mr. Philippe Veltsos

Co-founder and Solutions Engineer, Novel-T Sàrl

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Philippe Veltsos is a co-founder and solutions engineer at Novel-T Sàrl in Geneva Switzerland. He has worked for the World Health Organization as a Health Information Systems project manager for close to 10 years, helping the organization and its departments with their data and information management needs. He is a technology enthusiast looking at how the latest advances in information systems and technologies can bring efficiency to current business processes and solve actual problems. Current Health Information System projects involve work with the WHO headquarters office in Geneva related to the Global Polio Information System as well as work with Bill and Melinda Gates Foundation, WHO and the Nigerian Ministry of Health on the Nigerian Polio Vaccination Tracking System. Philippe is a graduate of the University of Louisiana at Lafayette, with an MBA and MS in Telecommunications where he also taught in the Business Systems Analysis and Technology department.

Mr. Martin Verzilli

Software Developer, InSTEDD

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Martin is a lead software developer and user experience expert on InSTEDD's iLab Latin America Team. He is adept with user centered design and agile software development with a

particular focus in technological applications to medicine, public health, humanitarian aid and disaster response. Martin has over 8 years of professional software development experience and a Master's degree in Computer Science and currently resides in Buenos Aires where he is a core member of InSTEDD's iLab team.

Mr. Stéphane Vouillamoz

Co-founder and Solutions Engineer, Novel-T Sàrl

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Stéphane Vouillamoz is a co-founder and solutions engineer at Novel-T Sàrl in Geneva Switzerland. He has worked for the World Health Organization as a Software Engineer on Health Information Systems and Geographical Information Systems for close to 10 years, helping the organization and its departments with their data and information management needs. Stéphane's current projects at Novel-T involve work with the Bill and Melinda Gates Foundation, WHO and the Nigerian Ministry of Health on the Nigerian Polio Vaccination Tracking System as well as work with the WHO headquarters office in Geneva related to the Global Polio Information System. Stéphane is a graduate of the High School of Management of Geneva where he studied Computer Science applied to management. He is also a graduate of the Business School of Lausanne where he received the 2009 MBA Prize.

Ms. Laurie Werner

Operations Lead, BID Initiative, PATH

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Ms. Werner has worked in a variety of areas of international development, including holistic community development, global health, land ownership, agriculture, microfinance, and gender issues. Before joining PATH, served in the leadership of Agros International for eight years, coordinating and administering a multi-faceted program across multiple countries in Central America and Mexico. Most recently she worked on the Decade of Vaccines Collaboration Secretariat that facilitated the development of the Global Vaccine Action Plan.

Ms. Kate Wilson

Senior Program Officer, Health Management Information Systems, PATH

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Ms. Wilson brings more than 20 years of experience in international commercial and nongovernmental organizations, with over 10 years focused on ICT new product development and launch, and strategic planning and business development for companies such as Microsoft, Intel, and General Electric. Her relevant work in the commercial sector included: leading new product development planning, strategy and design of software and hardware products at Microsoft; developing launch strategy and managing an international product launch team with international subsidiaries across fourteen countries in Europe, as well as heading a business development group that designed replicable business models and negotiated commercial deals with broadband providers in over 24 markets worldwide.