Integrating Technology in Global Health

Lessons for Healthcare Organizations and Funders from the Pfizer Foundation’s Global Health Innovation Grants Program

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WHITE PAPER
ABOUT INNOVATIONS IN HEALTHCARE


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Executive Summary

The Global Health Innovation Grants (GHIG) Program, launched in 2016 by the Pfizer Foundation, aims to improve access to high-quality healthcare in low- and middle-income countries (LMICs) by providing one-year grant funding to support proven solutions to critical health challenges.

In the third year of the GHIG program (GHIG3, 2018-2019), the Pfizer Foundation supported 20 projects spanning a wide range of health topics. Health technology emerged as a leading theme across the 20 grantees, with nine grantees specifically taking on development or integration of new technologies as the central component of their projects.

This paper describes the processes, challenges, and learnings of select grantees who worked on incorporating new technologies into their work during GHIG3. These grantees’ experiences provide valuable insights to other global health innovators seeking to integrate new technologies into their work and to funders looking to catalyze technology innovations in the healthcare sector.

These experiences guide our recommendations, which are twofold: to global health organizations who are considering incorporating new technologies in their work and to funders of such health organizations.

Recommendations for Health-focused Social Enterprises

BUILD A TEAM THAT HAS THE SKILLS YOU NEED.
When taking on a project in an area that is new to your organization, assess the skills that your team already possesses and add new team members where gaps exist.

SET CLEAR EXPECTATIONS, BOTH INTERNALLY AND EXTERNALLY.
Clear communication of expectations will help mitigate difficulties and misaligned priorities that may emerge as the project progresses.

PRIORITIZE INTEROPERABILITY, WITH FUTURE EXPANSION IN MIND.
Investing in interoperability from the initial stages of development creates greater potential for expanded, scaled, and sustainable implementation in the future.

FAIL FAST.
Do not delay implementation and roll-out until you have a perfect product.
Recommendations for Funders of Health-focused Social Enterprises

ESTABLISH FLEXIBLE REPORTING REQUIREMENTS.
Implementing flexible reporting requirements empowers innovators to pursue new and disruptive solutions to problems as technology-based solutions may not generate quick results in the short-term.

EXPECT INNOVATORS TO REQUIRE VARYING LEVELS OF SUPPORT.
The challenges that innovators face when implementing new technologies vary greatly, so expect different innovators to experience a variety of situations.

BE REALISTIC ABOUT WHAT CAN BE ACHIEVED IN LOW-RESOURCE SETTINGS.
Funders should recognize the myriad external factors and constraints inherent to working in low-resource settings and with bottom-of-the-pyramid populations and understand innovators' work in the context of their low-resource settings.
Introduction

The Global Health Innovation Grants (GHIG) Program, launched in 2016 by the Pfizer Foundation, aims to improve access to high-quality healthcare in low- and middle-income countries (LMICs) by providing one-year grant funding to support proven solutions to critical health challenges. Since 2016, the GHIG program has invested 7.5 million USD in health-focused social enterprises across sub-Saharan Africa, Latin America, and South and Southeast Asia. Innovations in Healthcare (iiH) partners with the Pfizer Foundation to monitor grantee progress, collect key project metrics, synthesize findings, and evaluate the program as a whole.

In the third year of the Global Health Innovations Grants program (GHIG3, 2018-2019), the Pfizer Foundation supported 20 projects spanning a wide range of topics within primary healthcare and maternal and child health. With GHIG funding, grantees worked in areas ranging from eye care to diabetes, and they integrated diverse approaches across levels, from frontline healthcare workers to country-wide health information systems. Health technology emerged as a leading theme across the 20 grantees, with nine grantees specifically taking on development or integration of new technologies as the central component of their projects. Many of these grantees are not specifically focused on health technology as their primary area of work, but rather took on technology-based projects with the goal of enhancing, updating, or scaling their existing services.

This paper draws on the experiences of four GHIG3 grant recipients who worked on incorporating new technologies into their healthcare delivery models. The paper is organized into two parts. Part I describes the processes that the grantees followed to develop and integrate technology, the challenges they faced, and the lessons learned through four case studies. Part II highlights common challenges, key success factors, and practical recommendations for other global health innovators seeking to integrate new technologies into their work and to funders looking to catalyze technology innovations in the healthcare sector.
Background

Healthcare providers in LMICs face many challenges in providing efficient, high-quality care to target populations. Dependence on paper-based records can create inefficiencies in accessing patient data, hinder communication among providers, and cost providers valuable time that could otherwise be used more efficiently to treat patients. Physical distance from providers and a low provider-patient ratio can hinder healthcare access for many people. A lack of aggregated health data in some countries can also make it difficult to use population-level data in decision-making.

Worldwide, healthcare providers are using various digital technologies to solve the challenges of inefficient processes, systems, and communications, all of which result in increased costs.

A growing number of healthcare providers are incorporating electronic medical record (EMR) systems into their existing structures to improve the quality and efficiency of data collection and retrieval, ensure better continuity of care, and inform better decision-making (Orton et al., 2018). Providers use mobile phone applications to facilitate communication with patients through text messages to educate and influence behavior change (Orton et al., 2018). Providers also harness digital health technology to increase access in rural populations through task-shifting from facility-based healthcare providers to community health workers (CHWs), thereby reducing program costs (Long et al., 2018; Orton et al., 2018). Increasingly, providers use mobile devices to train CHWs, enhance communication between CHWs and healthcare providers, and provide an avenue for supervision and feedback (Long et al., 2018).

Digital health strategies, if designed and utilized properly, can help healthcare providers deliver higher-quality, more efficient care to more people, which can in turn improve health outcomes for otherwise underserved populations in LMICs (Orton et al., 2018). Underlying the complex process of designing and implementing a new technology is the difficult decision that innovators must make between buying an existing solution or building a new solution to meet their needs. If a product exists that meets an organization’s requirements or needs minimal modification and is affordable to purchase, then the buy decision is greatly simplified. However, it is rare that an existing product perfectly suits an organization’s specific needs. Building a new product may, in some cases, be the best or only option if the technology needed does not already exist on the market. However, building a product may require more time and could cost more than buying, especially when considering the long-term maintenance of a custom solution. A careful analysis of the organization’s needs, technical capacity, options available in the market, and the costs associated is necessary before embarking on the design and development of a technological solution (Kreuter et al., 2011).
Methods and Limitations

To learn more about the processes and challenges of incorporating technology into healthcare, the GHIG evaluation team at Innovations in Healthcare conducted semi-structured interviews with four GHIG3 grantees that completed technology-focused GHIG projects. The four grantees were purposively selected based on their diverse experiences with incorporating technology into their projects. Though their experiences do not necessarily represent the GHIG3 cohort or global health innovators in general, they offer key takeaways and lessons for other innovators and funders of such organizations.

The team developed an interview guide with questions about how grantees developed the idea and design for their technologies, how they integrated them into their work, key results, and what recommendations they might have for funders and other innovators. Using the interview guide, the team conducted one-hour, semi-structured interviews with each selected grantee. Interviews were transcribed, and two team members independently coded the transcripts with codes they developed inductively from the interviews. They then compared notes and came to a consensus on which codes to use and how to apply them. Based on the transcripts, the team wrote case studies on the four GHIG projects, sorting the codes into four broad themes: processes, challenges, successes, and recommendations. They then used these themes to guide the writing of this brief.
Case Studies

Possible Health: Data Visualization for Population Health

Possible Health is a non-profit organization that partners with local municipalities and governments in Nepal to provide integrated care from hospital to home.

**Problem**

Electronic health record (EHR) systems often focus on data entry and display information at the individual level but do not provide trends in data or high-level views of population health.

**Proposed Solution**

Data dashboards aggregating data from NepalEHR (Possible Health’s EHR platform) did not yet exist, and Possible Health possessed the specific expertise and capacity needed to develop and maintain its technology solution. Since there was no “buy” option, Possible Health decided to fill the gap they faced by creating a data visualization platform using DHIS2 (District Health Information System, a web-based open-source software platform for health data management) to create dashboards to present aggregated data for the health services they offer. This open-source platform is used nationally by the government in Nepal, and all data from every health facility pass through the platform.

“We see the platform as being more than just a data entry tool... we’re trying to build a culture of data both in the organization and as part of the platform as it scales [so that] other facilities that use this [platform] also see the product in that way.”

Anant Raut, Possible Health

**Process**

A team of two implementation engineers created the dashboards. After gaining a baseline understanding of the DHIS2 system, the team engaged with the frontline clinical workers – the end users of the data visualization system – to assess their specific needs and determine useful, user-informed indicators. Once they finalized the indicators and design, the team went live with the dashboards in an online, open-access format that pulls data from NepalEHR on the facility side and CommCare (a mobile data collection platform) on the community health side.

Healthcare workers training on the metrics dashboard at Bayalpata Hospital in Achham.

Photo: Possible Health
Currently, the dashboards are fully configured and available online at http://dhis2.nepalehr.org/. Possible Health continues to work across all staff levels to encourage use of the dashboards. Many users are beginning to incorporate the data into their decision-making. The dashboards have sparked new conversations and learnings about the utility of data and have enabled clinicians to have a high-level view of patient outcomes. For example, a visual comparison of actual and recommended C-section rates displayed on the dashboard allowed physicians to take note of increased rates and begin to explore potential causes.

During development, Possible Health faced difficulties in training staff to use the dashboards, which led the organization to hire an employee dedicated to managing training and implementation. Additionally, since the database was built on an open-source platform, structured technical support was not available for the team to troubleshoot technical questions or challenges. As a result, the team needed to invest substantial time into learning the system and addressing technical challenges on their own. A few months after roll-out, Possible Health noticed that fewer individuals than anticipated were accessing the dashboards and that they were receiving requests from users for information already displayed. To address these issues, Possible Health assigned one liaison from each of their regional teams to work with the technical team towards an increased adoption rate. Possible Health continues to improve uptake and face related challenges, such as clinicians requesting individual-level data (e.g., the result of a particular procedure) rather than using the aggregate-level data displayed on the dashboards. They are also working to generate interest in the platform among front-line healthcare workers. This has been met with some resistance due to the additional time needed each day to review the database.
Next, Possible Health aims to increase visibility of health trends at the municipal level. Encouraging expanded use of the platform will allow municipalities to stay updated with population health month-by-month, rather than waiting until the end of each year to get a full report.

Case Studies

Screen capture of Possible Health’s data dashboards. Image: Possible/Nyaya Health Nepal
PurpleSource was using a paper-based system to track patient visits and other health data, which hindered its ability to gather data in real time, inform decision making, and provide improved care for patients. Finding data was time-consuming and inefficient. The organization needed to be more responsive to patient and clinic needs.

PurpleSource first identified the key processes that required digitization through detailed process-mapping. Initially, PurpleSource planned to develop the EMR system in-house, but quickly realized that doing so would make the system difficult to maintain and scale. Investing in the staff and resources needed to support such a system would require continuous management and updates, diverting from the organization’s mission and effectively transforming it into a technology company. Thus, PurpleSource decided to work with a vendor, collaborating to modify an off-the-shelf product to fit the organization’s needs. During this process, the vendor abruptly ceased contact, and PurpleSource was forced to select another vendor to begin the process anew. After the system was developed, integration into existing workflows was straightforward since the organization had already defined workflow processes, and the staff was computer literate. The vendor supplied a technician who worked with the clinics for three months to train staff on the system.

PurpleSource chose to purchase and modify an existing EMR and patient messaging system to save costs on maintenance. They wanted a medical record system that would support a task-shifting model for nurses to reduce patient wait times. Such a system needed to integrate different aspects of clinic management, from back office operations to usability for the nurses and health workers. Although a fully customized system was their ideal solution, they realized that they would not have the capacity to provide the level of technical support and maintenance that would be needed as the organization scaled its operations.

"IF WE WERE TO DO THIS AGAIN, WE WOULD OPERATE IN A MORE AGILE MANNER. OUR TIMELINE AND GOALPOST FOR PULLING THE TRIGGER WOULD BE MUCH SHORTER. WE WOULD START WITH THE MINIMUM REQUIREMENTS TO FUNCTION SAFELY, LAYER ON IMPROVEMENTS FROM THERE WHILE KEEPING OUR CUSTOMERS INFORMED OF OUR PLANS AND PROGRESS EVERY STEP OF THE WAY."

Olufemi Sunmonu, PurpleSource
A major challenge PurpleSource faced was the unreliability of the first vendor. The organization learned that it is crucial to have backup vendors as a risk-mitigation strategy to avoid major delays.

PurpleSource also noted that EMR solutions are underdeveloped and features are limited in low-resource settings because vendors do not fully understand the value that EMR brings to a clinic. To support operation when power is unreliable, PurpleSource needed to acquire additional resources, including backup internet providers, an inverter system to ensure uninterrupted power, solar panels to charge the inverters, and laptops to replace desktop computers.

At the end of its GHIG3 project, PurpleSource is able to use data from its EMR system to make management decisions, though they are still working to perfect the system. Through their experiences modifying an existing product, PurpleSource learned the importance of being open to rolling out a new system even if it is not perfect and iterating based on real results rather than sinking time and effort into developing an ideal product.

PurpleSource is working to streamline the EMR system to promote ease of scaling the solution to new clinics as the organization expands its network of clinics. Continuing to scale will also enable PurpleSource to perform population health surveillance for the government by tracking information about health trends and disease outbreaks to support timely, responsive public health initiatives.
Salauno: Linking Primary Care Physicians to Specialists for Easy Referrals

Salauno is a for-profit company operating an ophthalmologic care system that provides eye care services and surgical procedures in Mexico with the goal of eliminating preventable blindness.

**PROBLEM**

In Mexico, there is a fragmented system of care and limited access to specialized healthcare, exemplified by the inefficient modes of referral between primary care physicians and eye care specialists. Primary care physicians lack an easy way to refer patients to specialty care and track their progress.

**PROPOSED SOLUTION**

Salauno aimed to address this weak link in their delivery model by developing a new mobile application (app) to connect primary care physicians and ophthalmologists. This app, available for both iOS and Android, was best suited to in-house development since Salauno aimed to integrate it with their existing EMR system and patient-facing app. The app allows primary care physicians to easily make referrals to Salauno's network of ophthalmologic clinics, keep track of their referred patients' diagnoses and treatments, and access an information-sharing community.

**PROCESS**

Salauno first interviewed primary care physicians to understand their needs and identify priority features for a minimum viable version of the app. These included a referral mechanism and a displayable list of referred patients and their statuses. The organization then worked with a consulting firm to develop a prototype. Salauno found that the app needed to be linked to the organization's existing EMR system to ensure that referrals were fully integrated in the usual processes for managing a patient's records. To build on the prototype, an internal team of four undertook development. Three focused on developing the app and one worked on integration with existing systems. Throughout the entire process of design and development, the team convened with doctors to conduct user validation, collect feedback on the user interface, and add or modify features based on that feedback. For example, a feature displaying a map of Salauno's clinics was added so physicians could easily visualize the network and refer a patient to the closest point of care. Initial feedback after rollout of the app indicated that the log-in process was confusing, so Salauno streamlined the process by reducing the number of fields a physician was required to fill in and adding a feature to remember user credentials across different sessions.
Salauno faced some difficulties in developing the app for the Apple App Store. The process was new to the organization and the team initially had only one Apple computer, making it difficult to distribute tasks across the technical team. To remedy this, they obtained more computers to make working on the iOS version of the app more collaborative across the team. Working to add features that enhanced ease-of-use for physicians while simultaneously maximizing functionality by increasing complexity on the back end was also challenging for the development team, but they were able to develop several features that accomplished this. For example, the team added options to use a more streamlined “Express Referral” or to save a referral and send it at a later time when internet connectivity is better.

Salauno continues to work on challenges related to app usage, such as gathering data to analyze physician engagement and sending notifications to those physicians to remind them to use the app.

Salauno has successfully rolled out its app, with 2,337 doctors affiliated through the app and 30% of those doctors making referrals through the app. One salient learning for Salauno was that meeting directly with app users was an invaluable part of the development process. Doing so gave team members insights into ways to make the app more useful, functional, and efficient.

Salauno will continue to improve the app based on feedback from users and plans to integrate the app into its telemedicine platform to reach more patients. Salauno also hopes to increase the number of physicians referring through the app. In the next phase of development, the team will integrate all the benefits and services offered by Salauno into the app. As Salauno continues to expand its partnerships, there is great potential for the app to enhance communication and information flows between patients, providers, payers, and other actors across the healthcare sector.
North Star Alliance is a non-profit organization operating a network of Blue Box clinics across sub-Saharan Africa, bringing healthcare to hard-to-reach populations such as long-distance truck drivers and sex workers.

**PROBLEM**
Mobile populations, such as long-distance truck drivers and sex workers, are both underserved and hard to reach. Furthermore, the mobile nature of their work makes it difficult to ensure continuity of care and up-to-date medical records. North Star Alliance had been providing high-quality care to these patients but lacked a comprehensive EMR system with standardized implementation across its network of clinics.

**PROPOSED SOLUTION**
North Star Alliance found that buying and modifying an existing EMR system to fulfill all their functional needs would be financially infeasible. After weighing the options, the organization decided to develop an EMR system instead of working with an existing system; they wanted their solution to be robust, proprietary, and interoperable. This system would need to output data in formats compatible with reporting requirements from funders, governments, and partner organizations, and that would be useful to health workers on the ground.

**PROCESS**
North Star Alliance began by conducting a gap analysis to determine what was needed from an EMR system. The team directly observed processes at various clinics to confirm the needs for the system. They found that to have impact, their system would need to be functional in areas with low connectivity, be able to convert currencies automatically based on location, and be built with a very user-friendly interface. North Star Alliance found a developer through a selection process that required candidates to demonstrate the functionality of their systems in rural areas.

**CHALLENGES**
North Star Alliance faced a key challenge in accounting for low and unreliable internet connectivity in sub-Saharan Africa. Additionally, the organization discovered that tablet functionality is crucial for capturing important work during outreach activities. To address these challenges, the team devised a smart-syncing architecture to ensure that data captured in a tablet-compatible version of the EMR system will sync only when a health worker has returned to a physical clinic space with connectivity. Within clinics, the system will be able to operate completely offline in the case of poor connectivity and sync at night or during low bandwidth consumption periods. Another challenge that emerged was low computer literacy of health workers. North Star Alliance decided that its system must be user-friendly and intuitive within its context and for the specific user base.
Now that the system is planned and the specification engineering has been performed, the next step is the development of the software. North Star Alliance plans to develop its EMR system while also training health workers on the importance of data so that when it is rolled out into their clinics, the system will be immediately useful.

**KEY RESULTS**

The organization highlighted the importance of securing sufficient resources when undertaking a technology-based project. North Star Alliance also found that it is essential to be wary of hype and make sure that the solution fits the organization’s mission and needs.

The team also notes that it is particularly important to solicit user feedback and build according to your specific cultural context. North Star Alliance has not yet seen results from the system since it has yet to be rolled out into the clinics.

**FUTURE DIRECTIONS**

Now that the system is planned and the specification engineering has been performed, the next step is the development of the software. North Star Alliance plans to develop its EMR system while also training health workers on the importance of data so that when it is rolled out into their clinics, the system will be immediately useful.
Integrating Technology: Challenges

- Although not exhaustive, the experiences of the innovators highlighted in the case studies present common challenges and critical success factors that other innovators should be cognizant of when implementing new technologies. Below, we highlight the two key common challenges that grantees faced in developing and integrating a technology solution for their organization.

Developing and deploying new technology within the constraints of unreliable or insufficient infrastructure.

In low-resource settings, electricity and internet connectivity can be unreliable, hindering efforts to integrate new technologies into operations (Duclos et al., 2017; Laar et al., 2019; Labrique et al., 2018; Ngabo et al., 2012). Not only does this insufficient infrastructure impact the process of developing technologies, but it also limits the potential applications of technology. Innovators should account for unreliable internet connectivity by building offline functionality into their systems. Similarly, whereas cloud-based systems are commonplace in high-income countries, such remote data storage and retrieval functionality is usually impractical in most low-resource settings.

Securing buy-in from users and stakeholders through structured training.

Integration of a new technology solution into existing systems and workflows requires buy-in across all levels, from frontline healthcare workers to senior administrators. However, it can be difficult to demonstrate the value of technology to all individuals due to resistance to change and varying levels of capacity to take on new tasks and skills in addition to performing primary services (Labrique et al., 2018; Livet & Fixsen, 2019; Orton et al., 2018). To generate maximum buy-in and engagement, organizations must develop training materials and provide structured training to internal and external users with varying levels of technical literacy. In addition, organizations must demonstrate the value of introducing new technology to individual workstreams as well as to the larger organization.
• Our analysis also shed light on the two key success factors that can contribute to the sustained success of technology initiatives to enhance service delivery of global health organizations.

Co-designing with users throughout the process of development, starting from the initial planning stages, is crucial to ensuring that a technology innovation is needed, useful, and practical in design.

This involves meeting directly with users to gather input and mapping out the processes that they regularly carry out to inform the design of new systems and processes. Investing in human-centered design early on reduces later challenges in uptake and facilitates the development of technologies that are not only functional, but practical and helpful to those who will be using the technologies.

Linking the technology platform to aggregate data structures and systems to help create lasting impact.

Beyond the immediate efficiency and continuity-of-care benefits of integrating EMR systems into operations, these systems also create the opportunity for future expansion to monitor system performance, population-level health indicators, and health outcomes (Labrique et al., 2018). This monitoring capacity is often a long-term goal for both healthcare innovators and country-wide health systems.
This brief identifies clear recommendations for both global health organizations seeking to integrate technology into their service delivery and funders who provide the wherewithal to such organizations to create and deliver impact.

**Recommendations for Health-focused Social Enterprises**

- **BUILD A TEAM THAT HAS THE SKILLS YOU NEED.** When taking on a project in an area that is new to your organization, assess the skills that your team already possesses and add new team members where gaps exist. Plan from the outset to make these new hires rather than addressing these gaps once they become problematic. Team members dedicated to technical support, training users, and overseeing implementation on the ground are particularly important.

- **SET CLEAR EXPECTATIONS, BOTH INTERNALLY AND EXTERNALLY.** The scope of work, expected milestones, and working relationships should be established with the internal team, external partners or contractors, and funders. Clear communication of expectations will help mitigate difficulties and misaligned priorities that may emerge as the project progresses.

- **PRIORITIZE INTEROPERABILITY, WITH FUTURE EXPANSION IN MIND.** As innovations scale, their technologies must be able to scale with them. Technologies should be built with interoperability across languages, currencies, and systems so that they are prepared to seamlessly scale to new settings. Investing in interoperability from the initial stages of development creates greater potential for expanded, scaled, and sustainable implementation in the future.

- **FAIL FAST.** Do not delay implementation and roll-out until you have a perfect product. It is better to continuously learn, modify, and iterate based on real feedback than to keep working on an ideal version that may take much longer to perfect.

**Recommendations for Funders**

- **ESTABLISH FLEXIBLE REPORTING REQUIREMENTS.** Technology-based solutions may not generate clear, measurable results during the development and implementation stages, which often require extensive back-end processes that do not directly translate into health outputs. Impact on indicators such as number of patients served or expansion to new locations might not be observed until well after full roll-out of a technology. Acknowledging this difference and implementing flexible reporting requirements empowers innovators to pursue new and disruptive solutions to problems.

- **EXPECT INNOVATORS TO REQUIRE VARYING LEVELS OF SUPPORT.** The challenges that innovators face when implementing new technologies vary greatly, so expect different innovators to experience a variety of situations. Some organizations may request a higher level of technical support or more connections to technical experts than will others. Similarly, throughout the process of roll-out and implementation, a single organization may experience varying degrees of difficulty and may, as a result, require greater involvement and support at some points but relatively low-touch support at other times.

- **BE REALISTIC ABOUT WHAT CAN BE ACHIEVED IN LOW-RESOURCE SETTINGS.** There are many external factors and constraints inherent to working in low-resource settings and with bottom-of-the-pyramid populations, and innovators often encounter unexpected delays and challenges. Additionally, the magnitude of the back-end work needed to develop technologies is not always clear to those outside of the process, potentially giving the false impression that little has been achieved. Funders should recognize these constraints and understand innovators’ work in the context of their low-resource settings.
References


