EHEALTH

EQUITY

GOVERNANCE

SYSTEMS INTEGRATION

An Evidence-Based Framework for Integrating eHealth into More Equitable Health Systems
eHealth Equity, Governance, and Health Systems Integration: An evidence-based framework for integrating eHealth into more equitable health systems

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The rapidly growing field of eHealth has the potential to impact the health and well-being of populations worldwide. Research surrounding eHealth policies, programs, and initiatives contributes to knowledge of how integration of health systems and technology affects health outcomes and impacts existing health inequities. Such is the fundamental purpose of SEARCH, a flagship project for the Governance for Equity in Health Systems.

In order to systematically address outcomes and impacts of eHealth implementation and utilization, an evidence-based framework was constructed. This framework enables eHealth innovators, implementers, researchers, and decision-makers to systematically and critically think through potential health inequalities, governance, and health-system integration issues affecting eHealth projects as well as the broader health systems context in which they are embedded. This framework was applied to current SEARCH projects based on a review of project proposal documents, conference calls with SEARCH project teams, testimony from experts, and relevant scholarly literature.

Recommendations for addressing eHealth equity, governance, and health systems integration within these initiatives are provided in this report, for the consideration of the IDRC. Each of the projects had impressive strengths, in terms of its potential to positively affect equity, governance, and health systems integration. However, we observed four trends across all projects in terms of issues that need to be addressed to improve outcomes and impacts. First, although most of the teams had considerable experience in global health program implementation, many are new to the particular challenges of designing, developing, and deploying integrated information systems. Second, the majority of the projects rely heavily on community health workers equipped with eHealth/mHealth tools, who provide critical communications linkages, data, and health services. Nevertheless, few teams have considered how to effectively, equitably, and sustainably support CHWs to achieve these objectives. Third, most of the proposals argue that governance will be improved by enhancing access to quality health data, though few provide advocacy strategies for encouraging a political culture of evidence-informed policymaking. Finally, several of these projects are likely to result in exciting outcomes/impacts, however projects will need to address issues of scientific rigor for these to findings to influence the global eHealth field.

The eHealth Equity, Governance, and Health Systems Integration evidence-based Framework provides a systematic approach to better integrate eHealth into equitable health systems. These fundamental principles are essential to future success of eHealth initiatives worldwide.
Introduction

Strengthening Equity through Applied Research Capacity building in eHealth (SEARCH) is a flagship project for the Governance for Equity in Health Systems program to grapple with the challenge of integrating the fields of health systems and eHealth. The overarching objective of SEARCH is to support researchers in low- and middle-income countries to conduct rigorous and useful research on how and when eHealth can influence the functioning of health systems to improve health outcomes, and ultimately, to contribute toward reducing health inequities.

Recently, seven grants have been selected for SEARCH as part of a competitive process. Five of these grants include the development, implementation and/or evaluation of eHealth (including mHealth) systems. Perhaps because of the nuance and promise of eHealth, these technology-oriented projects have a tendency to emphasize new systems, IT tools and apps, at times, at the expense of existing context, policies, structures, power dynamics, as well as the range of health demands that need to be addressed at the individual and community levels. SEARCH is committed to supporting eHealth, given its promise and increasingly demonstrated outcomes and impact. However, more than just innovation, the fundamental principles of equity, governance, and health systems integration must continue to be at the core of these initiatives. To ensure this, all SEARCH proposals will be assessed according to a new framework for eHealth equity, governance, and health systems integration.

Selected through a competitive process, the IDRC partnered with Martin Were, MD, MS and Caricia Catalani, DrPH, MPH to lead the creation of this framework, assess SEARCH proposals using the framework, and provide a range of recommendations to the SEARCH teams. As a new framework, Drs. Catalani and Were refined and finalized both the framework and project recommendations through the processes detailed in the methods section of this report.

Beyond assessing the SEARCH proposals, the framework is intended to help eHealth innovators, implementers, researchers, and decision-makers worldwide who are engaged in developing, implementing and evaluating eHealth projects. It encourages these eHealth leaders to consider how their project can be optimized for health equity, good governance and better integration of the health system, as depicted in the Figure 1. First, the framework uses key principles to elicit specific questions about a given eHealth initiative. Then, the framework leads users to examine potential outcomes and impacts that intended and unintended, to plan for particular mitigation strategies to address those that are unintended and negative, to identify specific methods to monitor mitigations, and to anticipate ways to disseminate results and recommendations.
Health researchers and practitioners utilise conceptual frameworks to form the basis of a project or serve as a guide for work to be done. Gemert-Pijnen, et. al., in their systematic review of eHealth frameworks, define a framework as a set of guiding principles (assumption, constructs, quality criteria, ideas guiding research and development) and strategies (hands-on guidelines, design heuristics, methods, and constructs). The framework sets the criteria for the design, implementation, and evaluation of eHealth technologies while accounting for human, technical, organizational, and environmental factors.
One example of a framework addressing health equity as related to eHealth implementations, is the Health Equity Impact Assessment (HEIA), developed and updated by the Ontario Ministry of Health and Long-Term Care, Public Health Ontario, Public Health Units, and others.¹ The HEIA functions as a tool “to encourage creative thinking, collaboration, and practical, actionable solutions on policies, programs, or initiatives impacting health outcomes.” Primary purposes for users of the HEIA include:

1. Identify unintended and intended positive and negative health impacts.
2. Develop recommendations as to what adjustments to the plan may mitigate negative impacts as well as maximize positive impacts.
3. Embed equity across an organization’s existing and prospective decision-making models.
4. Support equity-based improvements in program or service design.
5. Raise awareness about health equity as a catalyst for change.

The HEIA is intended as an evaluation conducted over a period of a few days to a few weeks using information gathered from existing information, data, resources, and community outreach. Five steps guide the user through the assessment addressing scope, potential impacts, mitigation, monitoring, and dissemination. The first step, scoping, identifies vulnerable or marginalized populations potentially impacted, either directly or indirectly, by the policy or program being implemented. Next, information collected is used to prospectively assess the unintended impacts of the initiative/program/policy on identified vulnerable or marginalized populations in relation to the population as a whole. Once impacts on identified groups are identified, evidence-based recommendations to minimize negative impacts and maximize positive impacts are developed. This step is to ensure that the initiative/program/policy does not inadvertently perpetuate or widen existing health disparities. Step four develops recommendations for monitoring mitigation strategies in terms of process and impact. Finally, plans for dissemination of outcomes, study findings, and lessons learned are outlined to ensure ongoing communication with stakeholders and other researchers, and implementers of health initiatives.

Special Note on “Outcome” and “Impact”:

Although the term ‘outcome’ and ‘impact’ tend to be used interchangeably, outcomes tend to be defined as changes in behavior, relationships, actions, activities, policies or practices of an individual, group, community organization or institution. Outcomes are generally observable during the short-term to medium-term timeframe. Further down the continuum of effects, impact tends to refer to more fundamental changes in social, economic, and health status. Impacts are generally observable long-term effects of a particular intervention. Of important note, the framework created for this particular study has been adapted from a Health Equity Impact Assessment (HEIA). “Impact assessment,” used in this sense, belong to a particular genre of evaluation, with roots in planning and development. Although the term “impact” is emphasized, these frameworks often examine effects along the continuum, including both outcomes and impacts.
Fundamental Concepts: Equity, Governance, & Systems Integration

Before describing the eHealth Framework for Equity, Governance, & Systems Integration and how it is to be used, we clarify our understanding of the fundamental concepts within the framework.

Health Equity

Health is a human right, and everyone has the right to enjoy the highest attainable standard of health in their society. Whitehead & Dahlgren describe equity in health care as being “about fair arrangements that allow equal geographic, economic and cultural access to available services for all in equal need of care.” To achieve equity in health, we need to understand (a) the social determinants of health, (b) vulnerable populations that are particularly disadvantaged by these determinants, and (c) the equity principles against which health systems should be evaluated.

Determinants of health are defined as:

“...the range of personal, social, economic and environmental factors that determine the health status of individuals or populations. The determinants of health can be grouped into seven broad categories: socio-economic environment; physical environments; early childhood development; personal health practices; individual capacity and coping skills; biology and genetic endowment; and health services.”

Some key determinants of health include:

- Income and Social Status
- Personal Health Practices and Coping Skills
- Social Support Networks
- Healthy Child Development
- Education and Literacy
- Biology and Genetic Endowment
- Employment/Working Conditions
- Health Services
- Social Environments
- Gender
- Physical Environments
- Culture

These determinants oftentimes adversely affect the health of the underserved, marginalized and vulnerable populations (Table below). Interventions like eHealth initiatives can adversely affect these vulnerable populations. As such, special attention should be paid to the interaction between the eHealth initiative and relevant determinants for each vulnerable population. Fundamentally, determination should be made on whether the eHealth initiative widens or narrows health disparities. This determination can only be comprehensively done by looking at intervention across all core equity principles. The equity principles with direct relevance to eHealth initiatives are outlined in the table below.
Underserved, Vulnerable, and Key Populations of Focus

<table>
<thead>
<tr>
<th>Indigenous communities</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Age-related groups</td>
<td>children, youth, seniors, etc.</td>
</tr>
<tr>
<td>Disability</td>
<td>physical, deaf, visual, intellectual/developmental, learning, mental illness, addictions/substance use, etc.</td>
</tr>
<tr>
<td>Race/ethnic communities</td>
<td></td>
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<tr>
<td>Immigrant, refugee, internally displaced communities</td>
<td></td>
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<tr>
<td>Slum or informal settlement communities</td>
<td></td>
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<tr>
<td>Homeless populations</td>
<td></td>
</tr>
<tr>
<td>Low income</td>
<td>unemployed, underemployed, etc.</td>
</tr>
<tr>
<td>Religious/faith communities</td>
<td></td>
</tr>
<tr>
<td>Rural/remote populations</td>
<td>geographical/social isolation, under-serviced areas, etc.</td>
</tr>
<tr>
<td>Sex/gender</td>
<td>male, female, transgender, transsexual, two-spirited, etc.</td>
</tr>
<tr>
<td>Sexual orientation</td>
<td>lesbian, gay, bisexual, etc.</td>
</tr>
<tr>
<td>Populations with socially stigmatizing conditions</td>
<td>HIV/AIDS, TB, etc.</td>
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</tbody>
</table>

Principles of Equity Relevant to eHealth

1) The initiative should strive to level up, not level down.
2) Where appropriate, the initiative should touch on the three main approaches to reducing social inequality: 1) improve status of those who are disadvantaged, 2) narrow the health divide, 3) reduce social inequalities throughout the whole population.
3) Health systems should be built on the following equity principles:
   - Public health services should not be driven by profit, and patients should never be exploited for profit.
   - Services should be provided according to need, not ability to pay.
4) Health systems should strive to provide primary health care to all.
5) The initiative should tackle the fundamental social determinants of health.
6) The initiative should provide voice to the voiceless.
7) Impacts of the initiative should be evaluated separately for men and women.
8) Assessment of the health impacts of the initiative should be done separately for differing race/ethnic, geographic, and socioeconomic communities.
9) The initiative should facilitate equal access to services and ensure that particular communities/populations do not systematically pay more to access services than others.

Adapted from Whitehead & Dahlgren’s Principles of Equity.4

Of particular note, among the principles of equity that our team considers relevant to eHealth, we have included the 1978 Alma Ata Declaration on “providing primary health care to all.” Although our team considered primary health care for all to be an essential principle for governance and health systems integration, we emphasize it here as a principle of equity.

More than just idealistic statements, this focus on key determinants of health and principles of equity are critical lenses for identifying potential negative equity impacts of any eHealth project.
Once flagged, these negative equity impacts must be mitigated, while positive impacts are promoted. More details on the process for doing so are included in the eHealth Framework Workbook.

**Governance**

The impact of eHealth policies, programs and initiatives on governance is often overlooked. In its simplest form, governance can be defined as “the process of decision-making and the process by which decisions are implemented (or not implemented)” [UNESCAP](https://www.unescap.org). Good governance incorporates several key principles, among them being: (a) Legitimacy of voice (participation, consensus orientation), (b) Direction (strategic vision), (c) Performance (responsiveness, effectiveness/efficiency), (d) Accountability (plus transparency), and (e) Fairness (equity, rule of law)(Table X).³

<table>
<thead>
<tr>
<th>Governance Principles³</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Legitimacy and Voice</strong></td>
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<tr>
<td>Participation</td>
<td>All men and women should have a voice in decision-making, either directly or through legitimate intermediate institutions that represent their intention. Such broad participation is built on freedom of association and speech, as well as capacities to participate constructively.</td>
</tr>
<tr>
<td>Consensus orientation</td>
<td>Good governance mediates differing interests to reach a broad consensus on what is in the best interest of the group and, where possible, on policies and procedures.</td>
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<tr>
<td><strong>2. Direction</strong></td>
<td></td>
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<tr>
<td>Strategic vision</td>
<td>Leaders and the public have a broad and long-term perspective on good governance and human development, along with a sense of what is needed for such development. There is also an understanding of the historical, cultural and social complexities in which that perspective is grounded.</td>
</tr>
<tr>
<td><strong>3. Performance</strong></td>
<td></td>
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<tr>
<td>Responsiveness</td>
<td>Institutions and processes try to serve all stakeholders.</td>
</tr>
<tr>
<td>Effectiveness and efficiency</td>
<td>Processes and institutions produce results that meet needs while making the best use of resources.</td>
</tr>
<tr>
<td><strong>4. Accountability</strong></td>
<td></td>
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<tr>
<td>Accountability</td>
<td>Decision-makers in government, the private sector and civil society organizations are accountable to the public, as well as to institutional stakeholders. This accountability differs depending on the organizations and whether the decision is internal or external.</td>
</tr>
<tr>
<td>Transparency</td>
<td>Transparency is built on the free flow of information. Processes, institutions and information are directly accessible to those concerned with them, and enough information is provided to understand and monitor them.</td>
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</tbody>
</table>
To understand impact of an initiative on governance, one has to look at each principle across various levels within the society. In particular, impact of an initiative at the national, regional government, organizational, institutional and business levels should be evaluated. Furthermore, impact on governance for citizens, media and civil society should also be considered. More details on the process for doing assessing outcomes and impacts are included in the eHealth Framework Workbook.

Health Systems Integration

The IDRC describes health systems as “the policies, activities, and institutions put in place to improve health.” Because health systems are rooted in people, they are fluid, complex, and often change in ways that are difficult to foresee. The integration of these systems has become something of a buzz word in global health. Health system integration, as Grone, et al. describe it, entails “the organization and management of health services so that people get the care they need, when they need it, in ways that are user friendly, achieve the desired results and provide value for money.” It’s a simple proposition, meaning in its essence that managing health services through a series of isolated policies, activities, and institutions is expensive and ineffective. Understanding how our systems are structured and what strategies facilitate their integration, however, are both challenging endeavors.

Using the neoclassical economic concept of market composition, we can examine the intersection of supply and demand to understand why those in need do not benefit from the health system. Demand-side factors might include demographic changes, epidemiological transitions, rising expectations, and human and patients’ rights. Supply-side factors might include medical technologies, information systems, economic pressures, and health workforce. When demand is fully aligned with available supply then the system is in equilibrium. The most common state of disequilibrium in health systems that are the focus of eHealth intervention, is when demand is much higher than supply. Health economists have identified several proxy measures of disequilibrium in a health system, such as wait time, overcrowding, stock-outs, and under-staffing, for example.
Development of the framework

Two dominant approaches to developing a framework exist. One involves creating the framework from scratch informed by existing literature. An alternative approach involves adapting an existing framework found most relevant to the area under evaluation. After extensive review of the literature, we found that the Health Equity Impact Assessment (HEIA) created by the Ontario Ministry of Health and Long-Term Care (MOHLTC) provided comprehensive guidance on how to evaluate the equity impacts of any health policy, project or initiative.\(^1\) For this project, we adapted the HEIA framework for evaluating equity impact of the proposed eHealth initiatives.

To adapt the HEIA framework to the eHealth landscape and meet the broader goals of assessing governance and health systems integration, our team underwent an iterative design and development process in partnership with IDRC. With Chaitali Sinha of the IDRC, our team iterated ideas and prototype frameworks, elucidated key concepts and their definitions, and honed the project recommendations that emerged to be actionable and meaningful for the purposes of the IDRC.

The final framework involves five steps, each looking at equity, governance and health systems integration. These steps include: (1) Scoping, (2) Evaluating Potential Impacts, (3) Mitigation Strategy, (4) Monitoring, and (5) Dissemination. Below we describe in some detail, the application of these steps for each of the three dimensions (equity, governance and health systems integration).

Applying the Framework

To apply the framework to SEARCH proposals, our team followed the following procedures. First, we started with clarifying the details of the eHealth initiatives we evaluated. This included understanding: the software applications to be used or developed; the database systems; the implementation approaches and support capacity to be made available; the intended target populations; the services to be offered; the level of involvement by various stakeholders; and the system sustainability model if one is available.

Next, we ensured that all team members shared the same essential definitions of key concepts and principles across the domains of equity, governance and health systems strengthening. These concepts are defined in the Background section, above. Taking one domain at a time, we then moved one row at a time, filling out the matrix cells to include project details and analysis of “scope”, “impacts”, “mitigation strategies”, “monitoring”, and “dissemination”.

As our team progressed across domains and cells in the matrix, we discovered additional questions and information needs for the project teams. Noting these, framework-based questions became the backbone of ensuing project team interviews. After interviews, we refined the comments within each cell and emerged with key recommendations for improving equity, governance, and integration across the projects.
Framework Limitations

There are two main limitations to consider in applying this eHealth framework. First, this framework is focused on providing guidance and recommendations to eHealth project leaders, managers, and funders. Although it may be of use to beneficiaries and communities themselves, it is not explicitly focused on supporting these target groups. Second, this new framework has, thus far, only been validated through its application to SEARCH proposals. These proposals do not represent a representative range of eHealth implementations and so the usefulness of the framework among other eHealth proposals is yet to be determined.
Introduction to Recommendation Findings

Using the eHealth equity, governance, and systems integration framework, our team developed a set of recommendations for each SEARCH project. Recommendations are categorized along a continuum, from status quo to significant changes:

For each recommendations, we include a suggested timeframe in which to implement each particular recommendation. These time frames are broken down into 3 stages:

**Stage 1:** Recommendation should be implemented during early planning and design stages, before any major project activities have taken place such as procurement.

**Stage 2:** Recommendation should be implemented during development, refinement of prototype, and finalization of operations plans, before any major deployment activities have taken place.

**Stage 3:** Recommendation should be implemented during deployment stages, as the eHealth solution is being rolled out.
findings 1

Burkina Faso Recommendations
Project Title

Amélioration de la gouvernance et de l’équité par l’utilisation des Technologies de l’Information et de la Communication (TIC) : Cas pratique appliqué aux soins de santé maternelle et infantile, et à la prise en charge des personnes vivant avec le VIH (PvVIH) dans le District sanitaire de Nouna (DSN).

Country

Burkina Faso

Summary of project

Overview of the initiative

This study will use voice and text messages as reminders to community volunteers to improve the care of pregnant women, children and people living with HIV (PLWH) in rural areas. The CRSN (Nouna Center of Health Research), in collaboration with the Nouna Health District, is an experimental tool to improve coverage of basic health interventions in a rural setting. At the end of the project, better interactions between communities, beneficiaries and health services is expected.

Overview of the eHealth solution

As depicted below and described in the proposal, the health information system to be deployed includes 5 components:

- Mobile internet connection (GSM Gateway SIM cards)
- Web server: hosts the database and the computer application
- Central database for storing data
- Communication service: voice mail and short messages (SMS), email to and from the server via the system devices
- Communication devices: mobile phone, PDA, computer: sending and receiving data

To overcome the potential problems of Internet access, a database will be installed in each Centre de santé et de promotion sociale (CSPS) will sync with the web-based database. The team intends to develop the platform in Java, based on the J2EE technology framework JSP / Servlet, and standard Web services technologies to interact with external components, the underlying DBMS is MySQL. A service communication management will implement an SMS gateway and the SMTP protocol to provide SMS and email alerts to stakeholders.
Project Framework Analysis

As a part of the development, refinement, and final validation of the eHealth Framework for Equity, Governance, and Health Systems Integration, details about this project from proposal documents and team interview were applied to the framework. This application resulted in the recommendations described below. See appendix for the completed framework matrix.

Project Recommendations

The recommendations listed below are focused on four areas of improvement that fundamentally address equity, governance, and systems integration. First, although some members of this team have experience implementing integrated mHealth and eHealth (meHealth) solutions, they and other Burkina Faso-based innovators are relatively new to this field. This stage requires more comprehensive thinking and planning, using practices recommended from senior meHealth practitioners, advocates, and researchers. Second, although this project relies heavily on participation and buy-in from community health workers (CHWs) and pregnant women from rural communities, there are scant plans to facilitate their engagement and capacity-building. Third, although the proposal argues that governance will be improved through improved access to data, there are few articulated strategies or tools for encouraging evidence-informed policymaking.

Scenario 1: Status Quo

**Description**: For this "status quo" circumstance, we suggest no changes to the project’s existing design, development, & deployment plans, but provide some recommendations about issues to monitor and discuss throughout the span of the project.
1. **Protect identification of HIV-status**: Send only generic messages to women living with HIV, never mentioning their HIV status. **Stage 1.**

2. **Provide referrals**: Although providing comprehensive services to the holistic health needs of communities and individuals may be beyond the scope of this project, it will still be important to create a referral procedure for linking to services beyond the current prevue. Referral procedures will include a list of resources, providers, and clinical services that are available for other health and social needs. Beyond just giving people in need the name of a resource, an effective referral system provides a bridge to services through education, promotion, and direct linkages to people who can help. As such, we recommend that this project clarify their referral system for facilitating access to health services that are beyond your current scope. **Stage 1.**

3. **Measure equity**: Measure the equity within project outcomes/impacts by segmenting findings according to distance from clinic, age, religion, income, access to mobile phone, literacy/education, language, race/ethnicity/tribal group, and others. **Stage 3.**

4. **Track messages**: As in any communications system, some messages will not be received by the intended beneficiary. Reasons for this can vary from technical challenges to social challenges. We recommend that this project monitor undeliverable messages and, to the degree possible, identify the main reasons for message failure. **Stage 3.**

5. **Assess use & usability**: Assess use/usability of data among regional/national decision-makers, if you do intend for them to access data and actively respond. **Stage 3.**

6. **Monitor facility performance**: As a result of efforts to enhance the demand for services, some facilities may experience higher than normal volume of patient visits. To ensure that facilities can provide quality care to more patients, we recommend that the project monitor patient volume and any unforeseen negative consequences for the quality of patient care. **Stage 3.**

7. **Engage users (policymakers)**: Partner with local/regional/national decision-makers to identify how data might be usable (easy to access and understandable) and useful (influential and actionable) in setting the national agenda, developing strategic direction, monitoring performance, and advocating for policy change around rural maternal and child health. **Stage 1.**

**Scenario 2: Minor Changes**

**Description**: For this “minor changes” circumstance, we provide some recommendations about minor changes to the project’s existing design, development, & deployment plans as well as issues to monitor and discuss throughout the span of the project with these changes assumed.
1. **Implement a comprehensive design process:** Envelop the formative research methods already planned into a more comprehensive human-centered design plan. Human-centered design is a process and set of techniques has been used since the early 1970s to create new solutions for industrial design, digital innovation, and process improvement ([IDEO](https://www.ideo.com)). Most importantly for this initiative, human-centered design processes and techniques will facilitate a better understanding and connection to the ethnic minority women that eHealth solutions intend to serve. Additionally, this proposal is currently unclear about any plans to use early and iterative prototyping and usability testing before launching the pilot, processes and techniques that are common to more comprehensive design thinking. As a part of this recommendation, project leaders will clarify how they intend to manage the stages in between ideation (we have an idea for a desirable, feasible, & viable solution) and delivery of a new solution (we know how to start, maintain, and sustain this new solution). **Stage 1.**

2. **Expand community outreach:** In addition to the efforts currently planned, engage in a more robust campaign to identify and outreach to pregnant women who may encounter major barriers in accessing the benefits of this eHealth intervention. Some barriers may include residing outside of the intended catchment area of community health workers (godmothers) and not having access to a mobile phone, speaking none of the intended outreach languages French/Dioula/Bwamu Mooré, or being a member of a religious/tribal/cultural community that is resistant to the intervention as planned. This campaign might rely on the leadership of diverse community members and godmothers to think critically through which underserved, vulnerable, and key populations may be most likely to NOT benefit from this eHealth initiative. By identifying these most-underserved communities, the project may consider altering plans for CHW catchment areas, providing/lending mobile phones, and/or addressing other key barriers to access. **Stage 1.**

3. **Monitor intervention:** Develop a strategy to assess whether or not intended beneficiaries are receiving health messages. This might involve several inputs and activities such as a two-way communication system, in which recipients reply to messages (for free, ie by replying to a free mobile short-code) with a special code to indicate that the message has been received; surveying participants to assess message recall, increased health knowledge on topics related to messages, and satisfaction with messages; and/or, spot-checking a small group of randomly-selected participants after a message has been sent to ask if they received it and what they recall. **Stage 1.**

4. **Provide effective communication to oral communities:** Develop a strategy to provide participants with the option to either receive health messages via SMS text or via Interactive Voice Response (IVR). IVR messages are not asynchronous, and so this will involve identifying an appropriate time/day to call participants and plans for calling back until the intended recipient gets the voice message. **Stage 1.**
5. **Protect identification of HIV-status**: Develop a strategy to protect the privacy of women living with HIV. This might involve requiring the mobile phone user to enter a passcode in order to access messages; sending only generic messages that make no mention of HIV status; and providing a range of opt-in options to allow patients to determine the level of disclosure that they are comfortable with. **Stage 1.**

6. **Engage underserved communities (godmothers, animators) equitably**: Develop a strategy to further support the work of CHWs. This might include the following: reasonable pay and benefits, maximums on allowable work hours, CHW feedback/complaint procedures, training, supervision, mentorship, workers’ compensation for on-the-job injuries and illness, and reimbursement for all work-related expenses. **Stage 1.**

7. **Engage underserved communities (intended beneficiaries) equitably**: Further develop a strategy for engaging diverse community leaders and representatives in the process of informing project objectives, identifying challenges and opportunities, selecting CHWs within their communities (as planned), and advocating for improvements in access to health care and in local/national governance. In doing so, facilitate the empowerment of their voices, provide opportunities for them to directly influence this eHealth project, and work to help them directly influence the local/regional/national agenda for rural health. CHWs may, for these purposes, help to facilitate community engagement but cannot be considered to fully represent rural and underserved communities by themselves. These strategies for engagement need to address barriers to participation, including social and gender norms, cost of transportation, need for childcare, and need to balance other household/work responsibilities. **Stage 1.**

8. **Use strategic open source approach**: Refine the project's open source strategy by critically examining how best practices in open source development and architecture might be integrated into this project. Some of these strategies might involve: adapting existing open source tools instead of designing this eHealth solution from scratch or based on proprietary platforms; carefully documenting and sharing code and architectural details with developer communities worldwide; and, engaging developers around the world in coding, quality assurance, refinement, and testing. **Stage 1.**

Some existing open source tools that might be strategically used include:

- **Verboice**: A free and open-source IVR tool by InSTEDD that makes it easy for anyone to create and run applications that interact via voice, allowing users to listen and record messages in their own languages and dialect or answer questions with a phone keypad. Verboice is used to provide healthy pregnancy advice and linkage to care for underserved women in Kenya through the BabyMonitor project.

- **Remindem**: A free and open-source SMS tool by InSTEDD that allows you to set up a list of tips, reminders, alerts, and advice that people can subscribe to via text messages. Remindem sends important text reminders when subscribers need them,
based on a defined schedule. Remindem is used to send medical appointment reminders and medication reminders to people living with HIV in Cambodia.

- **OpenMRS**: A free and open-source electronic medical record built by the OpenMRS community (originated and led by the Regenstrief Institute). As one of the world’s leading enterprise electronic medical record systems, OpenMRS has been implemented and tested in dozens of low-resource settings around the world and is built to integrate well with other leading mHealth tools. Currently, the country of Rwanda is rolling out a nationwide health information system using OpenMRS as its clinical interface and integrated electronic medical record system.

- **RapidSMS**: A free and open-source tool by Dimagi and others that allows any mobile phone to interact with the web via SMS text messages for data collection, logistics coordination and communication. RapidSMS is used in Rwanda to coordinate with community health workers around the care and monitoring of maternal and child health and prevention of maternal to child transmission of HIV.

- **ResourceMap**: A free and open-source tool by InSTEDD that can help patients, providers, or other leaders to make better decisions by providing insights into the location and distribution of key resources such as clinics, trained medical staff, medications, and other medical supplies. With Resource Map, teams can collaboratively record, track, and analyze resources at a glance using a live map. Resource Map works with any computer or cell phone with text messaging capability. ResourceMap was used for tracking medical supplies during the aftermath of the Haiti earthquake.

10. **Be transparent about governance objectives**: Being transparent with community participants (mostly CHWs), share the governance objectives of this project. Identify early project outputs, outcomes, and impacts that might be indicative of success and share these successes regularly with community. When the project encounters barriers and challenges, work with community participants to strategize around ways to cope with setbacks and continue to advance objectives. **Stage 2**.

11. **Prepare for increased demand**: Identify clinics that might struggle the most with increased demand for services and work closely with them to prepare for stock-outs, understaffing, and other deficiencies. **Stage 2**.

12. **Be transparent about data limitations**: In communicating project data, clearly and fairly articulate its limitations and biases. **Stage 3**.

**Scenario 3: Significant Changes**

**Description**: For this “significant changes” circumstance, we provide some recommendations about major changes to the project’s existing design, development, & deployment plans as well as issues to monitor and discuss throughout the span of the project with these changes assumed.
1. **Expand population focus**: Ensure that this intervention provides benefits to others who are important contributors to MCH and prevention of mother-to-child transmission of HIV (PMTCT) as appropriate, such as fathers, mother-in-law and mother of the pregnant woman, and entire families. **Beyond stage 3.**

2. **Expand maternal health focus**: Future expansions of this project should adapt a lifecourse approach to maternal and child health. This approach involves the careful consideration of the interplay of risk and protective factors, such as socioeconomic status, toxic environmental exposures, health behaviors, stress, and nutrition, that influence health throughout a woman's lifetime. **Beyond stage 3.**

3. **Expand health issue focus**: Expand this messaging and bridging service beyond MCH and PMTCT to include other critical health issues identified by the MOH, local health providers, and communities themselves. Although it is not within the scope of this project to provide primary care or comprehensive care for all, a future scale-up of this project might offer health messaging across a wider range of health issues and populations. For example, adherence reminders for all major treatment programs, adolescent health, educational messages, and appointment reminders for all patients. **Beyond stage 3.**

**Relevant Resources**
The following resources might be helpful in providing the background information and practical advice needed to address the recommendations described above.

<table>
<thead>
<tr>
<th>Resource</th>
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<tbody>
<tr>
<td>Human Centered Design</td>
<td>Human Centered Design process &amp; toolkit. <a href="http://www.hcdconnect.org">http://www.hcdconnect.org</a></td>
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Data standards, data dictionaries, and integration resources


People to Contact

The following experts, advisors, and supporters might be helpful in providing the background information and practical advice needed to address the recommendations described above.

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<th>Person</th>
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<tr>
<td>Andrew Kanter, MD, MPH</td>
<td>Earth Institute, Columbia University</td>
<td>Andy is a specialist in data standards, data mapping, and data dictionaries for interoperability. He leads several efforts to standardize and link data around maternal and child health worldwide.</td>
</tr>
<tr>
<td>Eduardo Jezierski, MsC</td>
<td>InSTEDD</td>
<td>Ed is a specialist in integration and interoperability of national health information systems. He understands the technical, political, legal, and social challenges involved in these complex systems. Additionally helpful, he is also quite familiar with MAMA and other similar eHealth initiatives and might be an excellent guide to existing open source communities, tools, and approaches.</td>
</tr>
<tr>
<td>Meredith Minkler, DrPH</td>
<td>University of California, Berkeley</td>
<td>Merry is an expert in the field of community organizing and community-based participatory research for health. She has worked worldwide to facilitate the engagement, partnership, and shared ownership of health projects between governments, health institutions, and underserved communities.</td>
</tr>
<tr>
<td>Name</td>
<td>Institution</td>
<td>Experience/Expertise</td>
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<tr>
<td>Eric Green, PhD</td>
<td>Duke University, Baby Monitor Project</td>
<td>Eric is the founder of Baby Monitor, an interactive voice-response mHealth tool that provides healthy pregnancy educational messaging and risk assessment to underserved women in Kenya. Through the Baby Monitor tool, CHWs are alerted about priority patient visits and pregnant women are linked directly to emergency services, depending on their needs. Eric is especially knowledgeable about tools for IVR communication with oral communities.</td>
</tr>
<tr>
<td>Chris Seebregts, PhD</td>
<td>Jembi Health Systems</td>
<td>Chris is a founding member and the executive director of Jembi. He has led the development and integration of health information systems across the African continent. Chris is an excellent resource for discussing the challenges and opportunities around integrated health systems and is well-connected to teams of developers across the continent.</td>
</tr>
<tr>
<td>Martin Were, MD, MS</td>
<td>Regenstrief</td>
<td>Martin has extensive experience with developing, implementing, and evaluating eHealth and mHealth systems that are currently in use in East Africa. He is also CMIO for a large program implementing mobile technologies for Community Health Workers in Western Kenya for over 2 million people (AMPATH).</td>
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<td>Caricia’s expertise in engaging communities/CHWs in mHealth solutions and mHealth innovations for HIV/PMTCT may be particularly relevant to this initiative. She has worked extensively in East and West Africa and is currently a co-investigator of two studies evaluating the national roll-out of an integrated health information systems to improve MCH/PMTCT in Rwanda.</td>
</tr>
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findings

Ethiopia
Recommendations
**Project Title**

Applied research on Health Extension Workers using e-health to strengthen equitable health systems in Southern Ethiopia

**Country**

Ethiopia

**Summary of project**

**Overview of the initiative**

Ethiopia has established a Health Extension Program (HEP) which trains female health extension workers (HEWs) and deploys them into local communities to improve access to primary health services. This SEARCH project aims to implement and evaluate a mobile phone-based data collection system for use by HEWs during (a) the care of individuals with tuberculosis and (b) for maternal and child health (MCH). These two care packages are among 16 areas usually assessed by HEWs during home visits. The SEARCH project will be implemented in the Sidama Zone area of Southern Ethiopia.

**Overview of the eHealth solution**

The project team states that they have not completely settled on the system to be used, and that their meHealth approaches have not been finalized. The basic plan is to introduce a mobile health solution that will be used by HEWs to collect data for the two care packages of interest during home visits. Essentially, the system will convert the current paper-based data collection approach into electronic formats. This data will then be transmitted to a storage system and requisite reports generated as needed.

The project team has not outlined the types of mobile devices, operating systems and data transmission infrastructure to be used. They are currently leaning towards using the Minoxsys system ([www.minoxsys.com](http://www.minoxsys.com)) (Figure 1) but admit that additional development is required. Minoxsys is a proprietary system, which uses software as a service approach, where the data is stored remotely (cloud) and accessed via a network. Figures 1 & 2 below represent the proposed e-system design. The project team expressed an intention to integrate their system with the Health Management Information System (HMIS) by the Federal Ministry of Health. Details of how this integration will be done are not outlined.
Figure 1: Systematic data flow from Health Extension Workers to the health system

Figure 2: Initial technical design of the e-health system
Project Framework Analysis

As a part of the development, refinement, and final validation of the eHealth Framework for Equity, Governance, and Health Systems Integration, details about this project from proposal documents and team interview were applied to the framework. This application resulted in the recommendations described below. See Ethiopia Framework Matrix for the completed framework matrix.

Project Recommendations

Scenario 1: Status Quo

Description: For this “status quo” circumstance, we suggest no changes to the project’s existing design, development, & deployment plans, but provide some recommendations about issues to monitor and discuss throughout the span of the project.

1. Connect with and learn from others with experience working with Community Health Workers: There is extensive experience in developing and implementing scalable solutions for community health workers (CHW). The project team could benefit greatly by connecting with the relevant groups in this space. Would recommend that they connect with ICT4CHW, the Health IT arm of GHDOnline, and the mHealth Health Working Group. They can post questions to these groups and ask for recommendations about approaches. In addition, they can work with groups that have experience with CHW applications, including Dimagi (CommCare) and InSTEDD (Verboice, Remindem). Stage 1.

   It would also greatly help the team to connect especially with teams working in the mHealth space in Ethiopia. In particular, the Bill and Melinda Gates Foundation, Columbia University (Andy Kanter), and VitalWave consulting. It would be particularly important to closely align any project with folks at the Ministry of Health, to ensure continued support and future integration of systems. From these groups and teams, the project team should objectively consider the pros and cons of using Minoxsys system against other systems. Stage 1.

2. Build local capacity to support system: The eventual success of the developed system will depend greatly on the support services available for system implementation, training, and system maintenance. During the project period, the team should make a concerted effort to develop local capacity to conduct these activities. Stage 1.

3. Outline what it would take to link your system to the HMIS: Through conversations with the MoH and other partners, the project team should outline exactly how they will eventually integrate with HMIS, and get the relevant buy in to guide how the system should proceed at this stage. Stage 1.

4. Engage stakeholders comprehensively: The project team should comprehensively engage all stakeholders at all steps of the process. This includes the community, through
sensitization meetings, and working with community gatekeepers. In addition, close engagement with MoH and the application developers should happen. Mechanisms for reaching consensus, fairly adjudicating differences, and assuring transparency and accountability should be determined in advance. In line with this should be discussions about planning for scale, data ownership and security, and issues about secondary data re-use. **Stage 1.**

5. **Develop standard operating procedures:** A core part of a successful implementation involves having approaches and processes to assure reliable system performance and responsiveness. It often greatly helps the team to have standard operating procedures (SOPs) for multiple things. Among the SOPs would be (a) device ownership, use and management, (b) data access, use and re-use criteria, (c) data backup and transmission protocols, (d) failover protocols, etc. Dr. Martin Were is happy to provide you with some examples of real world standard operating procedures that might be relevant to your use case. **Stage 2.**

**Scenario 2: Minor Changes**

**Description:** For this “minor changes” circumstance, we provide some recommendations about minor changes to the project’s existing design, development, & deployment plans as well as issues to monitor and discuss throughout the span of the project with these changes assumed.

1. **Track cost of developing, implementing and maintaining the system:** The project team should evaluate the costs associated with the system. A good first pass would be to evaluate the direct cost of the project. This can be adapted from Appendix A below to ensure that no costing component is missed. The team should use findings for this costing evaluation to determine opportunities to optimize use of financial resources during the planned scale up. **Stage 3.**

2. **Monitor impact of system on workflow and adapt system accordingly:** The developed system will lead to two parallel systems being used at the same time i.e. electronic for the two modules of interest, and paper for the other two modules. In addition, introduction of the system will like change time use by HEWs. Monitoring of impact of the system and adjustments to improve provider efficiency as needed should be conducted. **Stage 3.**

3. **Monitor process breakdowns introduced by your system:** Success of the developed system largely hinges on ability to get clients of interest effectively referred and linked into the relevant care system. The team should come up with a system to identify success of these referrals made during the home visits, and identify where breakdowns are occurring in this process. In addition, monitoring the effectiveness of referrals for the other 14 paper-based packages should be evaluated to determine if disproportionate attention is being paid to a particular group of clients. If possible, consideration should be given to using the developed system to link patients to care - i.e. tracking whether appointments were missed. **Stage 3.**
4. **Improve local and government capacity to own and run the system:** The ultimate sustainability of the system will involve having ownership by the community and the relevant MoH groups. While it might take some effort to get this done, it would be a worthwhile approach to strengthening the capacity to eventually support and maintain the system. **Stage 3.**

5. **Implement backup strategies:** Electronic systems fail, networks are sometimes inaccessible, drives die, and files get corrupted. A comprehensive mechanism to backup data and to have failover mechanisms implemented (in addition to SOPs) would greatly help assure reliability of the system. **Stage 2.**

6. **Implement internal and external oversight mechanisms:** To assure equity and good governance, there needs to be good oversight of the project. The project team would be well advised to implement an advisory and steering committee internally, and basic independent external oversight to assure accountability. **Stage 1.**

**Scenario 3: Significant Changes**

**Description:** For this “significant changes” circumstance, we provide some recommendations about major changes to the project’s existing design, development, & deployment plans as well as issues to monitor and discuss throughout the span of the project with these changes assumed.

1. **Implement robust security on mobile devices and system:** Most mHealth implementations currently overlook security aspects of the system. These include encryption of the data within mobile devices, automatic timeouts, user authentication, secure data transmission, limiting what providers can do on the devices, implementing capabilities to remotely wipe data or lock a device among others. It would help to have many of these functionalities in the system that will be deployed to help protect the highly sensitive patient data. **Stage 1.**

2. **Expand focus both vertically and horizontally using standards-based approaches:** Ideally, all 16 care packages need to be done in one format (electronic). In addition, the system should be able to seamlessly integrate with other systems being used for the care of patients. From a vertical integration standpoint, the system should be integrated with the HMIS if possible.

3. It would be highly advisable to develop or use a system that allows for easy incorporation of other care domains, and interoperability with other systems. This can be achieved by implementing disease or domain independent systems, and abstracting form development mechanisms from the main application. Interoperability would likely demand implementing mechanisms for exposing aspects of the systems to allow secure interaction with other systems - this could include use of (a) webservices or Application Programming Interfaces (APIs); (b) using clinical messaging standards like HL7 when appropriate - opensource HL7
applications like MIRTH or HAPI are often used for this purpose, (c ) using standard terminology to allow semantic interoperability. This could be done through a concept dictionary, that uses or maps to terminology standards such as ICD10 (Diseases) SNOMED (clinical terms), LOINC (Laboratory and clinical observations), CPT (Procedures) among others. Please note that multiple systems that are used by CHWs, including the MOTECH suite already employ these approaches. The Open Concept Lab and Maternal Concept Lab are currently in use by several countries in the region (Kenya & Rwanda) for their concept dictionaries. Stage 1.

4. **Expand to use proven open-source systems for CHWs:** Related to recommendation #1 above, this project would benefit greatly from re-using proven applications for community health workers. Such systems, already largely proven, include CommCare and Open Data Kit among others. It should be noted that open-source does not necessarily mean free, and the true cost of implementing these systems has to be considered, including the required ‘Consulting fees’. Stage 1.

5. **Use technology to identify the groups that are not being reached:** Analyzing the electronically collected data against the targeted community, and appropriately incorporating GPS-based technologies into the application and data collection processes, can help identify groups who often do not have access to the provided services. This should help inform approaches to improve the equity of services provided and identify barriers to care. Stage 1.

6. **Standardize patient identification and registration across the system:** A major component of horizontal and vertical linkage of patient data is having a standard way of uniquely identifying an individual and registering them. Priority should be placed to working with the MoH to come up or comply with an existing patient identification system. This is an often-overlooked challenge that can create major problems to systems integration, monitoring and evaluation, and for reporting. Stage 1.

**Relevant Resources**
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<tr>
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<td><a href="https://groups.google.com/forum/#!forum/ict4chw">https://groups.google.com/forum/#!forum/ict4chw</a></td>
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<tr>
<td>mHealth Health Working Group</td>
<td><a href="http://www.mhealthworkinggroup.org">http://www.mhealthworkinggroup.org</a></td>
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<tr>
<td>Dimagi</td>
<td><a href="http://www.dimagi.com">http://www.dimagi.com</a></td>
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<tr>
<td>InSTEDD</td>
<td><a href="http://instedd.org">http://instedd.org</a></td>
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<td><strong>Verboice</strong></td>
<td>A free and open-source IVR tool by InSTEDD that makes it easy for anyone to create and run applications that interact via voice, allowing users to listen and record messages in their own languages and dialect or answer questions with a phone keypad. Verboice is used to provide healthy pregnancy advice and linkage to care for underserved women in Kenya through the BabyMonitor project.</td>
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<td><strong>Remindem</strong></td>
<td>A free and open-source SMS tool by InSTEDD that allows you to set up a list of tips, reminders, alerts, and advice that people can subscribe to via text messages. Remindem sends important text reminders when subscribers need them, based on a defined schedule. Remindem is used to send medical appointment reminders and medication reminders to people living with HIV in Cambodia.</td>
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<td>Open Data Kit</td>
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<td>Maternal Concept Lab</td>
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<td><strong>Data standards, data dictionaries, and integration resources</strong></td>
<td>InSTEDD, &quot;Standards for Health Information Systems&quot;, Bill and Melinda Gates Foundation, 2013.</td>
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<td></td>
<td>HL7. <a href="http://www.hl7.org">http://www.hl7.org</a></td>
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<td>HAPI. <a href="http://hl7api.sourceforge.net">http://hl7api.sourceforge.net</a></td>
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<td>ICD10. <a href="http://www.who.int/whosis/icd10">http://www.who.int/whosis/icd10</a></td>
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<td>SNOMED. <a href="http://www.ihtsdo.org/snomed-ct">http://www.ihtsdo.org/snomed-ct</a></td>
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<tr>
<td>Andrew Kanter</td>
<td>Columbia University</td>
<td>Andy is faculty at Columbia University and has extensive experience working with mobile technologies in Ethiopia and other African countries. He oversaw the Ethiopia BMGF mHealth initiative in Ethiopia.</td>
</tr>
<tr>
<td>Neal Lesh</td>
<td>Dimagi</td>
<td>Neal is the chief strategy officer for Dimagi and has extensive experience with implementing mobile health systems in developing country settings.</td>
</tr>
<tr>
<td>Martin Were</td>
<td>Regenstrief</td>
<td>Martin has extensive experience with developing, implementing, and evaluating eHealth and mHealth systems that are currently in use in East Africa. He is also CMIO for a large program implementing mobile technologies for Community Health Workers in Western Kenya for over 2 million people (AMPATH).</td>
</tr>
<tr>
<td>Yaw Anokwa</td>
<td>ODK</td>
<td>Yaw is the primary developer of the Open Data Kit platform. He has extensive experience in developing and implementing mHealth systems for developing countries.</td>
</tr>
<tr>
<td>Ken Warman</td>
<td>Bill &amp; Melinda Gates Foundation</td>
<td>Ken is the senior program officer at BMGF who led Ethiopia formative and pilot efforts. Along with BMGF, he continues to wait for leadership from the Ethiopian team on direction for the future national health information systems that might be integrated into MoTECH.</td>
</tr>
<tr>
<td>Eduardo Jezierski</td>
<td>InSTEDD</td>
<td>Ed is a specialist in integration and interoperability of national health information systems. He understands the technical, political, legal, and social challenges involved in health information exchange systems and other complex eHealth systems. Additionally helpful, he is a key architect and developer for the Rwanda Health Information Architecture.</td>
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<td>Caricia’s expertise in engaging communities/CHWs in mHealth solutions and mHealth innovations for HIV/PMTCT may be particularly relevant to this initiative. She has worked extensively in East and West Africa and is currently a co-investigator of two studies evaluating the national roll-out of an integrated health information systems to improve MCH/PMTCT in Rwanda.</td>
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Proposal Title

Employing eHealth to Enhance Equity in Access to and Quality of Chronic Care Services in Primary Health Care in Lebanon

Country

Lebanon

Summary of project

Overview of the initiative

This project will use eHealth as a cornerstone strategy in an intervention that couples a proactive health systems approach with community-based health interventions. The proposed eHealth interventions have two components outlined below:

1. Primary Health Care (PHC)-based intervention:
   This will consist of a (a) provider-side eHealth intervention incorporating online modules on clinical guidelines and patient-provider communication strategies. In addition, these modules will be used to gather feedback from providers. Another aspect of the provider-side of the PHC-based intervention will include online forums and FAQs for peer-to-peer knowledge sharing by providers. There will also be a (b) patient-facing aspect of the PHC intervention that will consist of sending SMS-based messages to patients or to approved household members about a patient’s disease condition, appointments, and adherence. SMS messages will be based on data in the PHC Information system.

2. Community-based intervention:
   The eHealth aspect of the community-based intervention will include a data collection system. In the community-based intervention, hired health professionals (nurses or medical technologists) will visit households and conduct screening for diabetes, hypertension and obesity. They will use a netbook-based application to collect data on the following: (a) blood glucose level, (b) blood pressure, (c) waist circumference, and (d) body mass index. This data will be transmitted to the PHC. Providers will be able to schedule appointments for patients and to gather survey data through the system.

Overview of the eHealth solution

In Lebanon, there currently exists a PHC information system (PHCIS) that was designed to manage activities in the primary care centers including family and patients’ registration, visits, drug warehouse, financial data, etc. This system is installed at PHCs with each center having its own standalone databases, but no communication between the centers. While the PHCIS acts as an
electronic health record, it does not have educational modules to help providers (physicians and nurses) manage conditions like diabetes and hypertension.

The proposed system intends to fill gaps in the PHCIS. The modules within the clinics will be web-based or web-enabled, though details are not yet outlined. It is not clear which system will be adopted for SMS or whether this will be developed from scratch. Specifics of how the SMS system will integrate with the PHCIS are also not outlined. The exact database system to be used is not detailed in the proposal, and it is also not very clear how the various systems will be interconnected or made interoperable. Most of these details are still under discussion by the project team.

**Project Framework Analysis**

As a part of the development, refinement, and final validation of the eHealth Framework for Equity, Governance, and Health Systems Integration, details about this project from proposal documents and team interview were applied to the framework. This application resulted in the recommendations described below. See appendix for the completed framework matrix.

**Project Recommendations**

**Scenario 1: Status Quo**

**Description:** For this “status quo” circumstance, we suggest no changes to the project’s existing design, development, & deployment plans, but provide some recommendations about issues to monitor and discuss throughout the span of the project.

1. **Understand power dynamics and Gender Issues:** It would greatly help the project team to better understand and take into great consideration the power dynamics and gender issues within families and the communities in the project. These issues should inform the development and implementation of the SMS and netbook-based data collection systems. In particular, attention should be paid to how vulnerable members of a family unit can get access to SMS services without negative consequences. **Stage 1.**

2. **Ensure broad coverage of services and monitor impact on workflow:** The project team should also pay close attention to how the systems impact other care services provided. As an example, does it take longer to complete forms on a netbook? This could arise in situations where some providers, for various reasons, end up completing paper-based forms first before transferring these into the electronic format. Monitoring of system performance should also include an examination of whether the system introduces ambiguity on who should be responsible for particular tasks. As an example, does the community-based screening program make providers less attentive to screening for the same conditions within clinics?
If possible, the team should have mechanisms in place to accommodate groups that cannot get access to particular e/mHealth services. As an example, if a woman or their family members do not have a phone, messages could be delivered to them through a health worker conducting home visits. **Stage 3 and beyond.**

3. **Curate messages in a culturally sensitive way, and using experience from others on behavior change:** There is a science to developing messages that can lead to behavior change. The project team should adopt the best and most relevant guidelines to help curate culturally sensitive messages (see references provided). **Stage 1.**

4. **Collaborate with relevant stakeholders and learn from systems similar to yours:** It is very important to align closely with existing systems and with key stakeholders. Attention to Lebanon’s eHealth strategy is also quite important. You should comprehensively involve community members and community-gatekeepers to help ensure that they can take ownership of the system, and provide input that would be relevant to the program.

Given that similar systems to the one proposed are already in existence, it would greatly help the project team to work with others to ensure that you are not repeating well-known mistakes, and that you can derive from the collective wisdom of the eHealth and mHealth communities. In particular, you should learn from and consider using successful SMS tools like FrontlineSMS ([www.frontlinesms.com](http://www.frontlinesms.com)) or RapidSMS ([http://www.rapidsms.org](http://www.rapidsms.org)). **Stage 1.**

5. **Adopt Standard Operating Procedures (SOPs):** To ensure reliability of the operational processes, it would be advisable that the team develop standard operating procedures (SOPs) for multiple aspects of the project including patient registration (which includes unique identifiers, training, record keeping etc.), referral mechanisms, device ownership, security, software update mechanisms, and data backup strategy among others. **Stage 2.**

6. **Build local capacity to support system:** The eventual success of the developed system will depend greatly on the support services available for system implementation, training, and system maintenance. During the project period, the team should make a concerted effort to develop local capacity to conduct the various levels of activities from development, implementation and user support. **Stage 1.**

**Scenario 2: Minor Changes**

**Description:** For this “minor changes” circumstance, we provide some recommendations about minor changes to the project’s existing design, development, & deployment plans as well as issues to monitor and discuss throughout the span of the project with these changes assumed.

1. **Update content and provide adequate user support:** The team would find it helpful to have comprehensive mechanisms to (a) keep guidelines in the online modules updated, (b) track and update changes in client phone numbers, and (c) keep content of SMS messages
relevant and updated. Given that there could be inadvertent errors in the types of SMS messages sent to clients (as these rely on electronic health record data that often have quality and completeness issues), it is suggested that the team monitor these through continuous feedback from end users. In addition, the team should ensure that the systems can be accessed in an offline fashion, as connectivity might sometimes be unavailable. It would also greatly help the team to monitor effectiveness of referrals for those identified by the program so as to identify areas of process breakdown and the impact of referrals on demand for care. **Stage 3.**

2. **Use Open-source resources where appropriate:** Where possible, use open source resources including databases, electronic record systems, and SMS-messaging systems. There are numerous such systems already implemented in similar settings and these could inform the ultimate choices for this project. **Stage 1.**

3. **Build for scale:** Each of the systems being developed, including the online content, forums and SMS system, can be built in a way to allow expansion to other domains in the future. As such, the team should think strategically about how this can be done. Working with your development team, you should settle on (a) a relevant and opensource content management system for the online resources, (b) a social networking site or opensource forum software for the forum, and (a) an opensource SMS platform. These will allow you to build extensible systems without much financial overhead. **Stage 1.**

4. **Implement backup strategies:** Electronic systems fail, networks are sometimes inaccessible, drives die, and files get corrupted. A comprehensive mechanism to backup data and to have failover mechanisms implemented (in addition to SOPs) would greatly help assure reliability of the system. In addition, technologically-assisted mechanisms to monitor system use and system uptime rates should be strongly considered - you could for example use the opensource Nagios system ([www.nagios.org](http://www.nagios.org)) for this. **Beyond Stage 3.**

**Scenario 3: Significant Changes**

**Description:** For this “significant changes” circumstance, we provide some recommendations about major changes to the project’s existing design, development, & deployment plans as well as issues to monitor and discuss throughout the span of the project with these changes assumed.

1. **Standardize patient identification and registration across the system:** A major component of horizontal and vertical linkage of patient data is having a standard way of uniquely identifying an individual and registering them. Priority should be placed to working with the relevant stakeholders to come up or comply with an existing patient identification system. This is an often overlooked challenge that can create major problems to systems integration, monitoring and evaluation, and for reporting. It might help to work with the MoH on a Master Patient Index approach. **Stage 1.**
2. **Implement Health Information Exchange:** Given that there will be multiple sources of data including the PHCIS, the netbook-based data collection, and SMS messages among others, it helps to think about having robust health information sharing and exchange mechanism from the outset. This will determine interoperability approaches that get used by the team. **Beyond Stage 3.**

3. **Use technology to identify the groups that are not being reached:** Analyzing the electronically collected data against the targeted community, and appropriately incorporating GPS-based technologies into the application and data collection processes, can help identify groups who often do not have access to the provided services. This should inform approaches to improve the equity of services provided and identify barriers to care. **Stage 1.**

**Relevant Resources**
The following resources might be helpful in providing the background information and practical advice needed to address the recommendations described above.

<table>
<thead>
<tr>
<th>Resource</th>
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</tr>
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</table>
Data standards, data dictionaries, and integration resources


**Nagios - The Industry Standard in IT Infrastructure Monitoring** System infrastructure monitoring.

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### People to Contact

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<table>
<thead>
<tr>
<th>Person</th>
<th>Affiliation</th>
<th>Why might they be helpful?</th>
</tr>
</thead>
<tbody>
<tr>
<td>mHealth Working</td>
<td>Kelly Kiesling (contact)</td>
<td>Groups with extensive experience implementing mobile solutions. (<a href="mailto:mhealth@my.ibpinitiative.org">mhealth@my.ibpinitiative.org</a>)</td>
</tr>
<tr>
<td>ICT4CHW</td>
<td>Neal Lesh (contact)</td>
<td>You can post any question you have on mobile health for community health workers to this forum (<a href="mailto:ict4chw@googlegroups.com">ict4chw@googlegroups.com</a>) This is to emphasize importance of joining a community and sharing your experience and questions, as other groups are already thinking through the same issues.</td>
</tr>
<tr>
<td>Richard Lester</td>
<td>University of Manitoba</td>
<td>Extensive experience evaluating SMS reminder systems.</td>
</tr>
<tr>
<td>Heather Cole-Lewis, PhD</td>
<td>Columbia University</td>
<td>Behavior change specialist in mobile health.</td>
</tr>
</tbody>
</table>
findings
Project Title
WawaRed Peru: Improving health information systems for better Maternal Health

Country
Peru

Summary of project

Overview of the initiative

Reducing health inequities and improving maternal care, by improving health information systems, proposes to develop a model of integration-interaction of maternal health information in Peru and to measure the feasibility, utility and impact on health policy and governance issues. Health providers collect the data in the electronic health record (EHR), but they need to print many forms to send the information on paper to different offices of the Ministry of Health. We propose to create a model for integration and interaction among information systems, by applying interoperability principles and engaging with key stakeholders. The goal is to improve health processes and outcomes through higher quality, timely data to support better health policy decisions and in turn contribute to decreasing health equity challenges for Peruvian women and, potentially, women in other developing countries. We plan to create an Advisory Committee with key stakeholders and national and international experts in the areas of health systems, informatics and information, interoperability, policies and laws. Further, we will evaluate, before and after implementation, the sources, types and quality of data used by decision-makers from different levels of the Ministry of Health and the Comprehensive National Health Insurance System and used by national policymakers to formulate policies and make decisions related to maternal-child health.

Overview of the eHealth solution

This eHealth solution intends to build upon an existing maternal and child health electronic medical record (EMR) system, called WawaRed (“wawa” means baby in local Quechua and “red” means network or system in Spanish). Although this well established and tested EMR has been useful in clinical environments, it has limited benefit to outside stakeholders. In fact, information gathered through this EMR is still recorded and shared via paper records, a process that results in inaccurate, slow, and incomplete data. As such, the team aims to create and pilot a national health information system that shares quality (fast, accurate, complete) maternal health data that is gathered at the clinical-level with stakeholders and decision-makers at the regional- and national-levels. This system will be built using known standards, such as ICD10, and with the intention of integration with HMIS and other national data systems. In terms of hardware, it is the assumption that the system intends to take advantage of existing laptop and desktop computers and networks.

The existing WawaRed system architecture is depicted below.
Project Framework Analysis

As a part of the development, refinement, and final validation of the eHealth Framework for Equity, Governance, and Health Systems Integration, details about this project from proposal documents and team interview were applied to the framework. This application resulted in the recommendations described below. See appendix for the completed framework matrix.

Project Recommendations

Scenario 1: Status Quo

Description: For this “status quo” circumstance, we suggest no changes to the project’s existing design, development, & deployment plans, but provide some recommendations about issues to monitor and discuss throughout the span of the project.

We have no status quo recommendations. This initiative has been planned with excellent attention to basic aims.
Scenario 2: Minor Changes

Description: For this “minor changes” circumstance, we provide some recommendations about minor changes to the project’s existing design, development, & deployment plans as well as issues to monitor and discuss throughout the span of the project with these changes assumed.

1. **Address data accuracy, duplication, and completeness**: In the process of examining data flow and data use, it is recommended that the team carefully assess data quality challenges in terms of accuracy, duplication, and completeness. Like Schopenhauer’s Law of Entropy tells us: “If you put a spoonful of wine in a barrel full of sewage, you get sewage. If you put a spoonful of sewage in a barrel full of wine, you get sewage.” If data accuracy and completeness remain poor, then better and faster access to data may negatively influence policy-making. **Stage 1.**

2. **Expand access to data**: Develop a strategy for providing data access at other levels of the health system, including among local clinical sites, providers, community health workers and midwives, and patients themselves. Enabling local access to data may have positive impacts on several aspects of the study:
   a. Equity outcomes may be enhanced by improving local understanding of women’s health and thereby facilitating local response from individual behavior change to provider standards of care to clinical resource allocation and policies;
   b. Governance outcomes may be enhanced by providing local leaders and patients themselves with the data they need to use their own voices to advocate for response, monitor inefficiencies and poor performance, and develop their own direction and strategic agenda; and,
   c. Health systems integration may be enhanced by ensuring that all key stakeholders along the care continuum have access to essential health data.

For WawaRed project leaders, the challenge will be designing a system that might make data accessible at multiple levels, regardless of social status and ability to pay. **Stage 1.**

3. **Refine open source strategy**: Refine the project’s open source strategy by critically examining how best practices in open development, standards, and architecture might be integrated into this project. Some of these strategies might involve: adapting existing open source tools instead of designing this eHealth solution from scratch or based on proprietary platforms; carefully documenting and sharing code and architectural details with developer communities worldwide; and, engaging developers around the world in coding, quality assurance, refinement, and testing. It may also benefit this project to determine which other open national health information system projects might inform WawaRed’s design, development, and evaluation. For example, the health informatics public-private partnership (funded by PEPFAR) has launched the Open Health Information Exchange. The Rwanda Health Information Exchange (RHIE) project, a flagship effort by this partnership, is particularly relevant to WawaRed. **Stage 1.**
4. **Build community capacity**: Develop a strategy to build capacity among underserved communities themselves (i.e., community leaders, midwives, and local providers). The aim of this strategy is to ensure that communities have the capacity to contribute to this eHealth effort and to lead future efforts to address their own needs through their own solutions. Unless communities stand to directly benefit from this eHealth effort, however, it will be difficult to recruit community leaders to join capacity-building and other leadership activities. And, so, altering the current project plan to include community-level access to useful data will also help in achieving these ends. **Stage 1 or 2.**

**Scenario 3: Significant Changes**

**Description**: For this “significant changes” circumstance, we provide some recommendations about major changes to the project’s existing design, development, & deployment plans as well as issues to monitor and discuss throughout the span of the project with these changes assumed.

1. **Expand population focus**: Ensure that this intervention provides benefits to other population groups and key beneficiaries who are important contributors to MCH as appropriate, such as fathers, mother-in-law and mother of the pregnant woman, and entire families. **Beyond stage 3.**

2. **Expand maternal health focus**: Future expansions of this project should adapt a lifecourse approach to maternal and child health. This approach involves the careful consideration of the interplay of risk and protective factors, such as socioeconomic status, toxic environmental exposures, health behaviors, stress, and nutrition, that influence health throughout a woman’s lifetime. **Beyond stage 3.**

3. **Expand health issue focus**: Expand this information system beyond MCH to include other critical health issues prioritized by the national MOH, provincial health leaders, local health providers, and communities themselves. Although it is not within the scope of this project to provide primary care or comprehensive care for all, a future scale-up of this project might facilitate access to quality health information across a wider range of health issues and populations. **Beyond stage 3.**

4. **Increase demand for services among underserved communities**: Once impacts of this project are realized, there may need to be efforts to increase demand for services alongside the intended supply-side increases in the services that are accessible to Peruvian women. Although this is outside of the current time frame of this project, we recommend that project partners work closely with local clinical leadership now to inform them of the intention to increase supply of health services through regional and national leadership. These leaders may need to anticipate initiating new campaigns to increase demand for maternal health services among the most underserved communities. **Beyond stage 3.**

**Relevant Resources**
The following resources might be helpful in providing the background information and practical advice needed to address the recommendations described above.

<table>
<thead>
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<tr>
<td>Open Health Information Exchange website</td>
<td><a href="http://ohie.org">http://ohie.org</a></td>
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<tr>
<td>Rwanda Health Information Exchange website (by Jembi)</td>
<td><a href="http://www.jembi.org/project/rwanda-health-enterprise-architecture-rhea">http://www.jembi.org/project/rwanda-health-enterprise-architecture-rhea</a></td>
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<tbody>
<tr>
<td>Eduardo Jezierski, MsC</td>
<td>InSTEDD</td>
<td>Ed is a specialist in integration and interoperability of national health information systems. He understands the technical, political, legal, and social challenges involved in health information exchange systems and other complex eHealth systems. A native Argentinian, Ed is especially knowledgeable of implementation challenges and opportunities in Latin America. Additionally helpful, he is a key architect and developer for the Rwanda Health Information Architecture.</td>
</tr>
<tr>
<td>Richard Gakuba, MD</td>
<td>Rwanda Ministry of Health &amp; the Rwanda Health Information Exchange</td>
<td>Richard leads the Rwanda Health Information Exchange and is an expert on both the technical requirements and sociopolitical challenges relevant to implementing a national health information system in a low-resource setting.</td>
</tr>
<tr>
<td>Joaquin Blaya, PhD</td>
<td>eHealth Systems (Chile)</td>
<td>Joaquin is an expert in eHealth interventions in Latin America with a special emphasis on Peru. Working with Partners in Health in rural regions of Peru for several years, Joaquin has intensive experience in implementing and rigorously evaluating clinical health information systems.</td>
</tr>
<tr>
<td>Heather Zornetzer, MS, MPH</td>
<td>Sustainable Sciences Institute (USA, Nicaragua)</td>
<td>Heather has been the program coordinator of ICT for Health, a program of the Sustainable Sciences Institute, for 5 years. Her expertise is in developing scientific capacity and sustainable ICT solutions for health in Latin America.</td>
</tr>
</tbody>
</table>
findings

Vietnam

Recommendations
Project Title
Improving maternal and perinatal care for ethnic minorities in Thai Nguyen, Vietnam through an integrated eHealth and user-provider interaction model.

Country
Vietnam

Summary of project
Overview of the initiative

The proposed project will examine a cost-effective solution to a problem of long-standing concern in Vietnam: how to improve the maternal and child health (MCH) of ethnic minority (EM) people living in mountainous and difficult-to-reach areas of Vietnam. Given this context and the expansion of low-cost mobile phone service in Vietnam, mHealth holds great potential to mitigate these barriers by applying technology in improving reproductive health service delivery and building demand for quality natal care. Capitalizing on these benefits, the current project will determine whether integrated use of a newly available Health Management Information System (HMIS), low-cost mobile technology, and a user-provider interaction model can lower infant mortality and improve health among EM women (EMW) and their newborns.

The project includes a pilot intervention and a feasibility cum impact study. The intervention will develop a smart Reproductive Health Information Center (RHIC) aiming to provide timely RH information-education-communication (IEC) and reminding messages to EMW via either short message service (SMS) or phone calls. Input data to the RHIC will come from a newly available computerized HMIS in Thai Nguyen. The RHIC will notify EMW of appropriate actions to be taken, aiming to encourage their use of RH services, increase their awareness of potential risk factors, or to seek emergency care if necessary. Simultaneously, commune health center (CHC) staff will be reminded by SMS to communicate with EMW and to take action if responses from EMW are unsatisfactory or to warn about high-risk cases. These messages and reminders, as well as the strengthened interactions between EMW and CHC staff, will help to build demand for safe and quality natal care, while increasing the active participation of EMW in seeking RH care at the CHC. The study will explore effective ways to implement the intervention, evaluate project impacts, document implementation and lessons learned, and assess potential for scale up if the project is feasible and effective. Lastly, the project will do policy advocacy and training for the mHealth application.

Overview of the eHealth solution

The team proposes to use mobile phones to enhance communication between pregnant women in rural areas with commune health centers. This will be achieved through educational messaging to pregnant women and care alerts for patients who miss appointments to commune health center providers. Although the system will build mostly off of existing infrastructure of mobile phones and
cellular networks, they are prepared to purchase additional laptops for providers and lend mobile phones to women during pregnancy and early infancy. Standards are minimally mentioned and open source practices are not detailed, however the team does intend on integrating their system with national HMIS and (soon to be implemented) HMIS2.

**Project Framework Analysis**

As a part of the development, refinement, and final validation of the eHealth Framework for Equity, Governance, and Health Systems Integration, details about this project from proposal documents and team interview were applied to the framework. This application resulted in the recommendations described below. See [appendix](#) for the completed framework matrix.

**Project Recommendations**

The recommendations listed below are focused on four areas of improvement that fundamentally address equity, governance, and systems integration. First, although this team has some experience implementing mHealth solutions, they and other Vietnam-based innovators are relatively new to designing, developing, and deploying integrated information systems. This stage requires more comprehensive thinking and planning, using practices recommended by senior mHealth practitioners, advocates, and researchers. Second, although this project relies heavily on participation and buy-in from community health workers (CHWs) and pregnant women from ethnic minority communities, there are scant plans to facilitate their engagement and capacity-building. Third, although the proposal argues that governance will improved through improved access to data, there are few articulated strategies or tools for encouraging evidence-informed policymaking.

**Scenario 1: Status Quo**

**Description:** For this “status quo” circumstance, we suggest no changes to the project's existing design, development, & deployment plans, but provide some recommendations about issues to monitor and discuss throughout the span of the project.

1. **Provide referrals:** Although providing comprehensive services to the holistic health needs of communities and individuals may be beyond the scope of this project, it will still be important to create a referral procedure for linking to services beyond the current prevue. Referral procedures will include a list of resources, providers, and clinical services that are available for other health and social needs. Beyond just giving people in need the name of a resource, an effective referral system provides a bridge to services through education, promotion, and direct linkages to people who can help. As such, we recommend that this project clarify their referral system for facilitating access to health services that are beyond your current scope. *Stage 1.*

2. **Measure equity:** Measure equity within project outcomes/impacts by segmenting findings according to distance from clinic, age, income, access to mobile phone and digital literacy,
literacy/education, race/ethnicity/tribal group, engagement in migrant work, and others. 

Stage 3.

3. **Track messages:** As in any communications system, some messages will not be received by the intended beneficiary. Reasons for this can vary from technical challenges to social challenges. We recommend that this project monitor undeliverable messages and, to the degree possible, identify the main reasons for message failure. **Stage 3.**

4. **Assess use & usability:** Assess the use and usability of data among regional/national decision-makers, if you do intend for them to access data and actively respond. **Stage 3.**

5. **Monitor facility performance:** Monitor which health facilities appear to be struggling with increased demand for services. **Stage 3.**

Scenario 2: Minor Changes

**Description:** For this “minor changes” circumstance, we provide some recommendations about minor changes to the project’s existing design, development, & deployment plans as well as issues to monitor and discuss throughout the span of the project with these changes assumed.

1. **Implement a comprehensive design process:** Envelop the formative research methods already planned into a more comprehensive human-centered design plan. Human-centered design is a process and set of techniques that has been used since the early 1970s to create new solutions for industrial design, digital innovation, and process improvement (IDEO, http://www.ideo.com). Most importantly for this initiative, human-centered design processes and techniques will facilitate a better understanding and connection to the ethnic minority women that eHealth solutions intend to serve. Additionally, this proposal is currently unclear about any plans to use early and iterative prototyping and usability testing before launching the pilot, processes and techniques that are common to more comprehensive design thinking. IDEO’s [Human-Centered Design Toolkit](http://www.ideo.com) is particularly insightful and practical in guiding this process. As a part of this recommendation, project leaders will clarify how they intend to manage the stages in between ideation (we have an idea for a desirable, feasible, & viable solution) and delivery of a new solution (we know how to start, maintain, and sustain this new solution). **Stage 1.**

2. **Expand community outreach:** In addition to the efforts currently planned, engage in a more robust campaign to identify outreach to pregnant women who may encounter major barriers in accessing the benefits of this eHealth intervention. Some barriers may include residing outside of the intended catchment area of village health workers, not having reliable and consistent access to a mobile phone, not being registered within the existing HMIS database, and/or not having a national ID number. This campaign might rely on the leadership of diverse community members to think critically through which underserved, vulnerable, and key populations may be most likely to NOT benefit or benefit as fully from this eHealth initiative. By identifying these most-underserved communities, the project may
consider further engagement of village health workers as conduits of the health messages, providing more training to village women who have low "digital literacy", and/or addressing other key barriers to access. Additionally, although the proposal explains that services will be offered in Kinh language and one other dominant ethnic minority language, the details on linguistic access need to be determined. As a project that hopes to especially benefit ethnic minority women, their language(s) of choice will be key. It is likely that some ethnic minority languages will be primarily oral, with little cultural and historical emphasis on written communication. **Stage 1.**

3. **Monitor intervention:** Develop a strategy to assess whether or not intended beneficiaries are receiving health messages. This might involve several inputs and activities such as a two-way communication system, in which recipients reply to messages (for free, i.e. by replying to a free mobile short-code) with a special code to indicate that the message has been received; surveying participants to assess message recall, increased health knowledge on topics related to messages, and satisfaction with messages; and/or, spot-checking a small group of randomly-selected participants after a message has been sent to ask if they received it and what they recall. **Stage 1.**

4. **Provide effective communication to oral communities:** Develop a strategy to provide participants with the option to either receive health messages via SMS text or via interactive voice recognition (IVR). As opposed to offering a potentially staff-intensive hotline, an IVR system would deliver a similar standard of care as SMS text messaging. IVR voice message communication needs to be synchronous (in other words, unlike asynchronous text messages that can be sent at one time and read at another time), and so this will involve identifying an appropriate time/day to call participants, automating redial at other times/days until the intended recipient gets the voice message, and or allowing recipients to indicate when they would like to be redialed. Both SMS and IVR systems might allow users to be connected for free to a hotline with a trained and live operator. **Stage 1.**

5. **Engage underserved communities (village health workers) equitably:** Develop a strategy to further support the engagement of existing or additional village health workers. This might include the following: pay and benefits (perhaps supplementing), maximums on allowable work hours, community health worker (CHW) feedback/complaint procedures, training, supervision, mentorship, workers’ compensation for on-the-job injuries and illness, and reimbursement for all work-related expenses. **Stage 1.**

6. **Engage underserved communities (intended beneficiaries) equitably:** Further develop a strategy for engaging diverse community leaders and representatives in the process of informing project objectives, identifying challenges and opportunities, and advocating for improvements in access to health care and in local/national governance. Doing so has implications for equity, governance, and health systems integration, as reflected in the eHealth impact assessment matrix. Strategies should include several aims:
To provide “voice” to rural and ethnic minority women as they directly communicate the needs and strengths of their community to bodies of governance (the project itself, commune health centers, provincial health ministries, and national ministries of health).

To provide needed knowledge and expertise on the holistic and maternal/child health needs of ethnic minority women.

To engage users in the design, development, and testing of educational health messages that might effectively be accessed by, communicated to, and inspire health seeking behavior among ethnic minority women.

To elicit understanding of the other key barriers to accessing maternal/child health services, aside from patient education.

These strategies for engagement need to address barriers to participation, including social and gender norms, cost of transportation, need for childcare, and need to balance other household/work responsibilities. **Stage 1.**

7. **Use strategic open source approach:** Refine the project’s open source strategy by critically examining how best practices in open source development and architecture might be integrated into this project. Some of these strategies might involve: adapting existing open source tools instead of designing this eHealth solution from scratch or based on proprietary platforms; carefully documenting and sharing code and architectural details with developer communities worldwide; and, engaging developers around the world in coding, quality assurance, refinement, and testing. **Stage 1.**

Some existing open source tools that might be strategically used include:

- **Verboice:** A free and open-source IVR tool by InSTEDD that makes it easy for anyone to create and run applications that interact via voice, allowing users to listen and record messages in their own languages and dialect or answer questions with a phone keypad. Verboice is used to provide healthy pregnancy advice and linkage to care for underserved women in Kenya through the BabyMonitor project.

- **Remindem:** A free and open-source SMS tool by InSTEDD that allows you to set up a list of tips, reminders, alerts, and advice that people can subscribe to via text messages. Remindem sends important text reminders when subscribers need them, based on a defined schedule. Remindem is used to send medical appointment reminders and medication reminders to people living with HIV in Cambodia.

- **OpenMRS:** A free and open-source electronic medical record built by the OpenMRS community (originated and led by the Regenstrief Institute). As one of the world’s leading enterprise electronic medical record systems, OpenMRS has been implemented and tested in dozens of low-resource settings around the world and is built to integrate well with other leading mHealth tools. Currently, the country of Rwanda is rolling out a nationwide health information system using OpenMRS as its clinical interface and integrated electronic medical record system.

- **RapidSMS:** A free and open-source tool by Dimagi and others that allows any mobile phone to interact with the web via SMS text messages for data collection, logistics
coordination and communication. RapidSMS is used in Rwanda to coordinate with community health workers around the care and monitoring of maternal and child health and prevention of maternal to child transmission of HIV.

- **ResourceMap**: A free and open-source tool by InSTEDD that can help patients, providers, or other leaders to make better decisions by providing insights into the location and distribution of key resources such as clinics, trained medical staff, medications, and other medical supplies. With Resource Map, teams can collaboratively record, track, and analyze resources at a glance using a live map. Resource Map works with any computer or cell phone with text messaging capability. ResourceMap was used for tracking medical supplies during the aftermath of the Haiti earthquake.

8. **Refine system architecture**: Clarify the eHealth system's information architecture. Details that are essential to include are: key stakeholders/institutions within the health system that will have access to data; key stakeholders/institutions within the health system that will collect, enter, and/or share data; means and standards for communication across the information system; and, shared repositories for data, meta-data, etc. Project leaders must further clarify details on the protection and security of private patient data within the proposed information system. Although this may be outside the scope of this project, to optimize the impact of this intervention in terms of equity, governance, and systems integration, data should be shared bi-directionally with patients, village health workers, providers, commune health centers, provincial ministries of health, national ministries of health, and perhaps others. **Stage 1**.

9. **Engage users (policymakers)**: Partner with local/regional/national decision-makers to identify how data might be usable (easy to access and understandable) and useful (influential and actionable) in setting the national agenda, developing strategic direction, monitoring performance, and advocating for policy change around rural maternal and child health. **Stage 1**.

10. **Prepare for increased demand**: Identify clinics that might struggle the most with increased demand for services and work closely with them to prepare for stock-outs, understaffing, and other deficiencies. **Stage 2**.

11. **Learn from other South Asian Implementations**: Network closely with other Asia eHealth initiatives, especially those emphasizing national and regional integration and interoperability efforts. To do so, this team might take advantage of Asia eHealth Information Network (AeHIN) resources, events, networks, and more at www.aehin.org. Dr. Alvin Marcelo (listed in resources below) is the chair of this network and an invaluable resource for regional activities and experts. **Stage 1, 2, or 3**.

Scenario 3: Significant Changes
For this "significant changes" circumstance, we provide some recommendations about major changes to the project's existing design, development, & deployment plans as well as issues to monitor and discuss throughout the span of the project with these changes assumed.

1. **Expand population focus**: Ensure that this intervention provides benefits to other population groups and key beneficiaries who are important contributors to MCH as appropriate, such as fathers, mother-in-law and mother of the pregnant woman, and entire families. **Beyond stage 3.**

2. **Expand maternal health focus**: Future expansions of this project should adopt a life course approach to maternal and child health. The [MCH Life Course Toolkit](#) might be particularly helpful in learning about this approach. Overall, this involves the careful consideration of the interplay of risk and protective factors, such as socioeconomic status, toxic environmental exposures, health behaviors, stress, and nutrition, that influence health throughout a woman’s lifetime. **Beyond stage 3.**

3. **Expand health issue focus**: Expand this messaging and bridging service beyond MCH to include other critical health issues prioritized by the national MOH, provincial health leaders, local health providers, and communities themselves. Although it is not within the scope of this project to provide primary care or comprehensive care for all, a future scale-up of this project might offer health messaging across a wider range of health issues and populations. For example, a wider range of reproductive health issues (ie family planning, STIs, and safe sex), women’s health (cancers, intimate partner violence), youth and adolescent health, infectious disease management, etc. **Beyond stage 3.**

**Relevant Resources**
The following resources might be helpful in providing the background information and practical advice needed to address the recommendations described above.

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<td><a href="http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3702267/">http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3702267/</a></td>
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### Data standards, data dictionaries, and integration resources

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<tr>
<td>Human Centered Design toolkit. <a href="http://www.hcdconnect.org">http://www.hcdconnect.org</a></td>
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<tbody>
<tr>
<td>Andrew Kanter, MD, MPH</td>
<td>Earth Institute, Columbia University</td>
<td>Andy is a specialist in data standards, data mapping, and data dictionaries for interoperability. He leads several efforts to standardize and link data around maternal and child health worldwide.</td>
</tr>
<tr>
<td>Eduardo Jezierski, MsC,</td>
<td>InSTEDD</td>
<td>Ed is a specialist in integration and interoperability of national health information systems. He understands the technical, political, legal, and social challenges involved in these complex systems. Additionally helpful, he is also quite familiar with MAMA and other similar eHealth initiatives and might be an excellent guide to existing open source communities, tools (such as the InSTEDD tools mentioned in recommendations above), and approaches.</td>
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<tr>
<td>Name</td>
<td>Organization</td>
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<tr>
<td>Jonathan Jackson</td>
<td>Dimagi</td>
<td>Jonathan is a founder and chief executive officer of Dimagi, very experienced in the deployment of mHealth solutions that engage community health workers and other on-the-ground medical staff such as Dimagi’s RapidSMS and CommCare. Jonathan’s work emphasizes the importance of integration and interoperability of these tools and he has worked extensively with Gates’ MoTECH to achieve these goals in Bihar and elsewhere.</td>
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<tr>
<td>Alvin Marcelo, MD, MD</td>
<td>Asia eHealth Information Network</td>
<td>Alvin is the chair of the Asia eHealth Information Network, manager of the International Open Source Network for ASEAN+3 (a centre of excellence in free and/or open source software established by UNDP), and manager of the Community Health Information Tracking System. Although his expertise has been focused on efforts in the Philippines he is considered one of the foremost champions of integrated eHealth solution in Asia.</td>
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<tr>
<td>Meredith Minkler, DrPH</td>
<td>University of California, Berkeley</td>
<td>Merry is an expert in the field of community organizing and community-based participatory research for health. She has worked worldwide to facilitate the engagement, partnership, and shared ownership of health projects between governments, health institutions, and underserved communities.</td>
</tr>
<tr>
<td>Caricia Catalani, DrPH, MPH</td>
<td>University of California, Berkeley InstEDD</td>
<td>Caricia’s expertise in engaging communities/CHWs in mHealth solutions and mHealth innovations MCH may be particularly relevant to this initiative. She has worked extensively in Southeast Asia and is currently an investigator in studies evaluating the national roll-out of an eHealth solution to address loss-to-follow-up among HIV patients in Cambodia and an mHealth solution to improve access to birth control and safe abortion services in Indonesia.</td>
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Trends Across Proposals: Needs

Standing back from the individual analysis of each project, we observed several trends across all projects in terms of needs and assets. As far as needs are concerned, we identified four critical insights across this cohort of SEARCH grantees.

First, although most of the teams had considerable experience in global health program implementation, many are new to the particular challenges of designing, developing, and deploying integrated information systems. Several teams have impressive expertise and experience around using research methods, such as ethnographic field methods and key informant interviews, to inform system design. Nevertheless, few provided a comprehensive plan on how these methods or other approaches might be used in designing digital innovations. None of the proposals mentioned ideation, prototyping, or targeted usability testing. In this way, most teams would benefit from more training and consideration for common practices in design thinking, specifically human-centered design.  

Few teams had adequate expertise on development practices that might facilitate current or future integration, interoperability, and optimal functionality. Some of these practices include: open source development, open architecture, open standards, standard-based development, agile development, and building upon existing open source systems that have been implemented and tested in similar contexts. Most of the proposals lacked details on how the eHealth technology would actually be deployed, maintained, and sustained. This is likely due to the fact that many of the solutions proposed were only to be tested within a limited pilot. However, if pilots prove immediately successful, then teams must consider how the system and hardware equipment will continue to be maintained, updated, and debugged into the future. No proposals included business or funding plans for financial sustainability. As such, teams may require technical support and capacity building around eHealth sustainability and scale-up.

Second, the majority of the projects rely heavily on community health workers (CHWs), equipped with eHealth/mHealth tools, who provide critical communications linkages, data, and health services. Without the full buy-in and commitment from CHWs, these projects will not be successful. Still, few teams have considered what CHWs may require to achieve the project objectives. Teams must consider CHWs’ need for reasonable compensation, mentorship, supervision, training, and social support. Furthermore, CHWs are often selected because they are of the communities whom they serve. They are mostly women from the world’s most underserved communities. Providing them little or no compensation in exchange for their expertise and time, offering them little or no job support, and exposing them to on-the-job health risks is an affront to equity. The quantity of CHW-supported mHealth projects is growing worldwide. And, with this expansion, there growing knowledge about best practices, promising outcomes, and effective mHealth tools (See Annex: Inventory of mHealth Tools).
Third, most of the proposals argue that governance will be improved through access to quality health data. However, few provide strategies for encouraging evidence-informed policymaking. Policymakers balance multiple priorities in setting in their efforts to build consensus and participation, set strategic agendas, monitor performance and respond, and demand the rule of law. Project leaders must consider how multiple stakeholders within the policymaking arena might be introduced into a culture of evidence-informed decisionmaking, be able to access data in an easily understandable medium, and provide feedback for continuous improvement of the information system.

Fourth, several of these projects are likely to result in exciting improvements in health equity, governance, and systems integration. However, for these outcomes/impacts and the best practices to influence global eHealth thinkers, practitioners, and advocates around the world, the project will need to produce relevant and rigorous evidence. It may not be necessary, feasible, or even ethical to build this evidence base through experimental studies such as randomized clinical trials. However, each of these projects require some enhancements in the rigor of their non-experimental and quasi-experimental designs, most of which are inadequately described in project proposal and include several critical limitations as reported. As this is not the focus of our report, recommendations for research rigor will not discussed here but may require future emphasis.

**Trends Across Proposals: Assets**

Although this report focuses on risks and mitigations, it is important to mention that each of the projects also has impressive strengths. These strengths not only serve individual projects but might also result in a collaborative knowledge network between SEARCH grantees. To provide a few examples:

- The Ethiopia team exhibited impressive experience with health extension workers, an expertise missing from other CHW-focused projects such as Burkina Faso and Vietnam;

- The Peru team has considerable knowledge of strategies for integration & interoperability of national health information systems, an expertise missing from all other groups;

- The Vietnam team is one of the few that planned to use sociological & anthropological field methods for assessing feasibility, a process which might especially benefit the Burkina Faso and Lebanon initiatives; and,

- The Lebanon team is working closely with various stakeholders to ensure easy transition to scalable and sustainable systems.
Capacity Building Priorities & Recommended Approaches

To implement recommendations that are deemed desirable, feasible, and viable, the IDRC and SEARCH grantees may want to consider the following five capacity-building activities: consultancy, working meetings, international workshops, midcourse reframe, and team exchanges. Activities might form a package of supportive services, with synergies across each one, to energize and strengthen this cohort of SEARCH grantees. For each suggested activity, we give a general indication of the funding (scale: $-$$$$$) and staff time (T-TTTT) required.

Consultancy with Technical Advisors

Several projects might benefit from one-on-one consultancy with technical advisor(s). Advisors might be selected by considering our lists of experts to contact (included within each project recommendation), through IDRC expert networks, and through grantee expert networks. Although the bulk of consultancy time might be spent during the early planning and design stages of each project, ongoing consultation may also be critical for troubleshooting throughout implementation and for analyzing and reporting findings at the close of each initiative. Consultancy funding might include both staff time and travel, since a well-planned 2-3 day meeting with key project staff might accomplish far more than months of conference calls. Given the trends of needs and recommendations across projects, SEARCH might consider bringing on a consultant who can advise on several projects.

**Funding:** $-$$. **Staff time:** T-TT.

**Specific suggestions:**
- An advisor on mHealth and CHWs might work with Lebanon, Ethiopia, Burkina Faso, and Vietnam teams
- Advisors with particular understanding of the country’s direction in m/eHealth technologies
- An advisor with an expertise in standards-based development, interoperability, and integration might work with all teams
- An advisor with expertise in human-centered design might work with all teams; and,
- An expert on evidence-based policy advocacy might work

National & Regional Working Meetings
Several of the projects take place in geographical regions where, although regional m/eHealth efforts might be in their relatively nascent stages, engaging closely with networks of local developers and implementers might significantly improve chances of local leadership, capacity building, and integration. IDRC might consider sponsoring national and regional meetings, strategically selecting participants and creating an agenda that emphasizes capacity-building and action. These “working meetings” might take place as add-ons to existing regional events or as a stand-alone event.

**Funding:** $-$$.  **Staff time:** T-TT.

**Specific suggestions:**

- The [Asia eHealth Information Network](https://www.aehin.org) is planning its next regional conference Sept 23-24 and 25-27. This event or future AEHIN events might be especially important for the Vietnam and Bangladesh teams. IDRC might plan an additional 1-3 days of more targeted working meetings as an add-on to this event.
- Although Burkina Faso, as a country, is in its early years of m/eHealth innovation, the African continent (especially East Africa) is home to the majority of m/eHealth implementations around the globe. IDRC might plan a 1-2 day regional meeting with other experts and institutions with experience implementing similar initiatives. Invitees might include representatives from the Baby Monitor Project in Kenya (built on InSTEDD’s Verboice), CommCare Africa (built by Dimagi), RapidSMS Rwanda (implementers at Access Project), and Jembi Health Systems.
- The [OpenMRS 2013](https://www.openmrs.org) and [HELINA](https://www.who.int/healthinfo/medical_products/helina/en/) will be held in Eldoret, Kenya between October 7-11. These would be good opportunities for the Ethiopia team to meet other groups involved in eHealth and mHealth work in East Africa.

### International Meetings

Given the strong trends of needs that are consistent across most projects, international workshops might serve to bring together SEARCH teams and expert advisors to build capacity, identify solutions, and take action. Workshops would be based on the needs described above.

**Funding:** $-$$.  **Staff time:** T-TT.

**Specific suggestions for workshop topics & facilitators:**

- Human-centered design
- Strategies for implementing and supporting large scale m/eHealth projects
- Community health workers and mHealth
- Standards-based development
- Integration and interoperability
- Open source practices and tools
- Implementation science and operations research

### Midcourse Re-Assessment Based on Framework

The framework described in this report encourages teams to identify ways to monitor positive and negative impacts throughout implementation and at the close of the project. Mid-course framework assessment would provide IDRC with insights into how equity, governance, and systems integrations objectives are at risk of negative impact or en-route to positive impact. At this point, any red flags might
be addressed and best practices might be shared for the benefit of SEARCH grantees, IDRC, and other global stakeholders.

We suggest that the framework team conduct a mid-course assessment after the first year of project funding, among those initiatives prioritized by the IDRC. Recommendations from this assessment might feed into ongoing capacity-building efforts among SEARCH grantees.

**Funding:** $-$.$$  **Staff time:** T-TT.

**Team Exchanges**

The interventions proposed by the SEARCH grantees have several important similarities with others worldwide implementations. The grantees could find it very informative to interact with groups that have developed and implemented solutions like their own. It would also help for them to join the networking and professional communities around eHealth and mHealth.

**Funding:** $-$.$$  **Staff time:** T-TT.

**Assessment of the Use & Practicality of the Framework**

The eHealth Equity, Governance, and Health Systems Integration evidence-based framework is intended to help eHealth innovators, implementers, researchers, and decision-makers worldwide who are engaged in developing, implementing and evaluating eHealth projects. Fundamentally, the framework aims to improve the impact of e/mHealth technologies on overall health of people with the greatest need.

In order to achieve the intended aim, the framework comprehensively addresses the issues of equity, governance, and health-systems integration. The framework identifies vulnerable populations, decision-making processes surrounding e/mHealth implementation, and details important to successful integration of technology into existing and future health care systems.

Similar to the HEIA, the SEARCH comprehensive framework is intended as an evaluation to be conducted over a period of a few days to a few weeks, using information gathered from existing information, data, resources, and community outreach. Five steps pertaining to each area (equity, governance, and integration) guide the user through the assessment:

- **Step 1: Scoping** - identifies vulnerable or marginalized populations potentially impacted, either directly or indirectly, by the policy, program, or initiative being implemented

- **Step 2: Evaluating Potential Impacts** - information collected is used to prospectively assess the unintended impacts of the policy, program, or initiative on identified vulnerable or marginalized populations in relation to the population as a whole.
Step 3: Mitigation Strategy – strategies to minimize negative impacts and maximize positive impacts

Step 4: Monitoring – of mitigation strategies in terms of process and impact

Step 5: Dissemination - of outcomes, study findings, and lessons learned. Ongoing communication with stakeholders.

The resulting detailed assessments steer research and implementation teams, policymakers, and health-systems officials in directions to maximize positive impacts, minimize negative impacts, garner support, and share e/mHealth experiences. Application of the framework encourages eHealth innovators, implementers, researchers, and decision-makers to consider how projects can be optimized for health equity, good governance and better integration of the health system.

Recommendations for Future Use

The SEARCH evidence-based framework serves as a tool “to encourage creative thinking, collaboration, and practical, actionable solutions on policies, programs, or initiatives impacting health outcomes.”1 The framework enables eHealth innovators, implementers, and researchers to systematically address potential health inequalities, governance, and health-system integration issues affecting eHealth projects. As stated earlier, eHealth is more than just innovation. The fundamental principles of equity, governance, and health systems integration must continue to be at the core of these eHealth initiatives.

The evidence-based framework may be applied in the following ways:
1. By researchers, developers, and implementers to assess their projects during the design, prototyping, and usability testing phases.
2. As part of an ongoing eHealth policy, program, or initiative implementation.
3. Retrospectively to assess current policies, programs, or initiatives in order to identify areas for change or improvement.

Use of the evidence-based framework may also be used to facilitate capacity-building efforts surrounding eHealth interventions. Such efforts enable achievement of the SEARCH objective – to support researchers in low- and middle-income countries to conduct rigorous and useful research on how and when eHealth can influence the functioning of health systems to improve health outcomes, and ultimately, to contribute toward reducing health inequities.
REFERENCES

## Appendix A: Input cost metrics for system implementation per site

### Direct Costs – one time

- Hardware and peripherals – e.g. mobile devices, computers, laptops, keyboards, mice, UPS, power extension cables, etc.
- Network and Telecommunication supplies – e.g. router, modem, switch, Local Area Network (LAN) cables.
- Application development and deployment e.g. programmer effort.
- Configuration management (interface, system) – e.g. setting up new users, forms etc.
- Packaged and customized software (software, software upgrades, software license).
- Project planning, contract negotiation, and procurement.
- Initial IT support costs.
- Cost of converting retrospective data.
- Initial user training – accounting for number of sessions, per diems, training material, accommodation, venue, training personnel costs.
- End-user project management.
- Facility upgrades - site renovation costs (e.g. grilles to secure the rooms, cost of furniture).
- Office accommodations, furniture and related items.
- Costs for conducting site assessments (transport, per diem allowances).
- Transition costs (costs of running 2 parallel systems in cases where there is paper and mobile).
- Quality assurance and post implementation review.
- Power back-up – e.g. purchase of generator.
- Other initial costs.
- Overall initial implementation cost.
## Direct Costs - Recurrent

- Software maintenance, subscriptions and upgrades (data refresh, software upgrade, software fees, interfaces, and other upgrades).
- Data subscription fees.
- Maintenance (system maintenance, travel, administration).
- Hardware and equipment (hardware replacement, equipment replacement and supplies (paper and toner)).
- Salaries for IT and assigned end-user staff (technical, administrative and clinical).
- Power back-up recurrent costs – maintenance and petrol.
- Ongoing training.
- Security personnel.
- Facilities rental and utilities.
- EHR consultant costs, and other personnel consults.
- Reviews and audits.
- Other ongoing (operating, other-not specified, reporting).
- Overall ongoing (annual, total, per record/per encounter).

Appendix B: Author Biographies

Caricia Catalani, DrPH, MPH

Short Biography
Caricia Catalani is a researcher, teacher, and advocate whose work focuses on digital innovations for global health. She specializes in the engagement of community health workers and underserved communities in m/eHealth design, development, implementation, and research/evaluation. With over 18 years of experience working on community health projects and research with under-served populations, Dr. Catalani has collaborated with and led studies related to community, maternal, child, reproductive, sexual health, and HIV/AIDS. She has worked around the world, in communities throughout the United States, Asia, Africa, and Latin America. She has served as principal investigator and co-investigator for numerous studies, including technology usability evaluation and user experience assessment, community-based participatory research, implementation science and operations research, program evaluation, systematic review, and randomized clinical trials. She is currently leading global health technology studies in Kenya, Rwanda, and Cambodia. For the past 4 years, she has designed curricula and taught courses in digital innovations for health at the University of California, Berkeley, School of Public Health, Stanford University, and New York University.

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Female

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Short Biography

Dr. Were is a Research Scientist at Regenstrief Institute, Inc. and an Assistant Professor of Medicine at Indiana University School of Medicine in Indianapolis, Indiana. He is also the Chief Medical Information officer for the AMPATH program in Western Kenya. Dr. Were’s work focuses on developing, implementing, and evaluating mobile Health and computerized clinical decision support systems for resource-limited settings. In particular, he has overseen development and implementation of mobile solutions for home-based counseling and testing, HIV, HIV care, oncology and chronic disease management. In the U.S., he leads projects that use health information exchange infrastructure to improve transition of care from inpatient to outpatient settings. He was named one of the Top 11 mHealth Innovators in 2011 by the UN Foundation and Rockefeller Foundation and mHealth Alliance. Dr. Were is a practicing physician with board-certification in Internal Medicine, and completed the National Library of Medicine (NLM)-sponsored medical informatics fellowship. He served as co-chair of the mHealth Alliance Evidence Working Group (USA), and is currently on the board of Scientific Counselors at Lister Hill Center of NLM at the National Institutes of Health (USA). He is also an editorial board member for the Journal of the American Medical Informatics Association.

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Short Biography

Angela Hoth is a clinical pharmacist with 20 years of patient care experience in primary care and geriatrics. She has also practiced in anticoagulation, heart failure, HIV, and medicine-psychiatry clinics. While at the Iowa City Veterans Affairs Healthcare System, Dr. Hoth led the design, funding, and implementation of the Primary Care-Mental Health Integration Initiative. In addition, she has been involved in health services research in geriatrics and geriatric behavioral health care. In May 2013, she completed a Masters of Public Health degree at the University of California, Berkeley, focusing on the areas of impact evaluation and design and implementation of innovative public health interventions. Her primary interests lie in applying principles of human centered design to public health systems and interventions and the impact of mobile Health interventions on health measures, health literacy, quality of care, and patient & provider satisfaction.

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PLEASE SEE OTHER APPENDICES IN PDF VERSION