



Evaluation of IDRC-supported eHealth Projects

Final Report
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2. Acronyms and Abbreviations

Acacia	Regional IDRC ICT4D research program in Africa
AKDN	Aga Khan Development Network
CAD	Canadian dollars
CEA	Connectivity and equity in the Americas – regional IDRC ICT4D research program in the Latin America and Caribbean region
CME	Continuing Medical Education
eHealth	Electronic Health
eLearning	Electronic channels (i.e. online, mobile) for training
EMR	Electronic Medical Record
FOSS	Free and open source software
GEH	Governance, Equity and Health
GIS	Geographic Information System
HIS	Health Information Systems
ICT	Information and Communication Technology
ICT4D	Information and Communication Technologies for Development
IDRC	International Development Research Centre
LAC	Latin America and Caribbean region
LMIC	Low and middle income country
mHealth	Mobile Health
MHIN	Mozambique Health Information Network
NGO	Non-governmental Organization
OASIS	Open Architectures, Standards and Information Systems
PAN	Pan Asia Networking - regional IDRC ICT4D research program in the Asia region
PDA	Personal Digital Assistant
RHE	Research for Health Equity
SMS	Short Messaging Service
UHIN	Uganda Health Information Network
WHO	World Health Organization

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4. Executive Summary

For more than ten years, the International Development and Research Centre (IDRC) has supported cutting edge research projects in developing countries that examine the relationship between information and communication technology (ICT) and health as part of a growing field known as eHealth. The projects range from exploratory proof-of-concept studies to large multi-country research networks that examine the relationship between eHealth solutions and health outcomes. As it charts a strategic direction for its work in eHealth, IDRC commissioned an evaluation of its work in this area for the past five years as it plans ahead for the next five years. The purpose of this evaluation is to inform future IDRC programming in eHealth research in a way that leverages past experience, current trends, as well as IDRC's niche in the field. As IDRC moves to mainstream its work in eHealth into its Governance, Equity and Health (GEH) portfolio, this evaluation will also be used to chart the course of the organization in better integrating ICT research considerations into existing health initiatives and solidifying health-related expertise in existing eHealth initiatives, while engaging in forward-looking strategic planning, proposal review, proposal development, and grant management that continues to build on IDRC's foundational and catalytic work in this area.

This report provides an in-depth account of the evaluation findings and recommendations for the next five years of IDRC's eHealth programming. The quantitative and qualitative assessment covered 25 projects representing activities in 25 countries in Africa, Asia, and Latin America and the Caribbean (LAC) of which approximately 50% have been completed and 50% remain on-going ranging in scope from \$30,000 - \$2,422,652. The total dollar value of the projects included in this evaluation is approximately \$17 million CAD. To complement the evaluation a targeted literature review of eHealth, a series of Lessons Learned Workshops with grantees and IDRC staff, and key informant interviews with internal and external stakeholders were conducted.

IDRC's internally and externally recognized risk-taking culture has produced some projects that are not only innovative and cutting edge, but instrumental at catalyzing critical pathways within eHealth. According to the quantitative survey, respondents estimated over 8.5 million people impacted by their collective projects. Fifty percent of respondents indicated collectively securing over \$7.3 million CAD in additional funding. Grantees consistently expressed the necessity to understand social and political issues influencing the context to successfully implement an eHealth solution.

Over 50% of the eHealth projects funded by IDRC utilized mixed methodologies to implement their research studies. The majority of the program implementation and intervention evaluation focused on process improvement and its potential impact on health outcomes and overall quality of care. Although, increasingly becoming one of the most critical areas for health research, only 44% percent of quantitative survey respondents indicated measuring health outcomes.

Projects reported influencing policy outcomes in the region to varying degrees. In Africa, strategic eHealth policy decisions have been influenced, such as the decision to scale a program nationally. In comparison, policy outcomes in the Asian and LAC regions have

included increased collaboration and engagement with government authorities, and a commitment to consider project findings in national health information and/or health system strategies. In the 25 projects reviewed, 19 projects reported partners with close ties to 80 organizations throughout all sectors in Africa, Asia, and LAC. All 25 projects included in the evaluation had capacity building as a key objective or activity. Reported support activities and trainings included everything from hands-on use of mobile devices for data collectors at the village level, to the use of the data at the Ministry of Health and decision-making levels, to training cadres of technology experts to design and create health information systems.

Across regions, IDRC grantees have acknowledged the organization's willingness to support research teams to assess, design, develop and test new and innovative eHealth solutions. Software and systems have been developed to support a variety of health system needs, including: patient registration and tracking with electronic medical records, disease surveillance to predict potential threats, decision support to improve patient, mobile health for data collection and health promotion, and eLearning to increase capacity of health professionals and improve accuracy of diagnosis. The estimated number of users of the developed and/or expanded functionality of hardware, software and/or technology-related applications implemented is 1770. The estimated number of individuals impacted by the developed and/or expanded functionality of hardware, software and/or technology-related applications implemented is over 2.7 million.

Projects in all the regions have led to creating increased awareness of eHealth. Awareness amongst higher authorities and government was most frequently reported from grantees working in Africa; in Asia, awareness was raised considerably amongst health providers and institutions; and in LAC awareness was raised mostly amongst researchers and programming partners. Challenges reported by IDRC grantees range from technical to operational as well as political. The lessons learned shared through the evaluation processes include the need to create and sustain a demand for eHealth services, to engage all stakeholders in planning for eHealth activities, to consider the ethical and political dimensions of eHealth, and to address change management and socio-cultural issues throughout the design and implementation phases.

The Vision for eHealth as expressed throughout the evaluation process is exciting as countries set forth their eHealth strategies, aligning on-going and new ICT for health programs with health priorities, health information systems architectures and taxonomies, and eGovernment policies. Demand for eHealth is on the rise as it becomes rapidly mainstreamed within the health systems strengthening and health financing discourses and programs. IDRC's efforts to date position the organization well as it considers its own internal mainstreaming of the eHealth program into the GEH program. This effort will require considering methods to integrate an equity lens into eHealth projects more explicitly, identify opportunities to leverage the strengths of GEH and eHealth program staff in a way that improves project outcomes, define and expand terms and concepts used in eHealth and GEH projects to include a dual lens, and collaborate on shared program goals such as capacity building of project stakeholders and beneficiaries, and supporting the process of getting rigorous and quality research findings used to influence practice and policy.

5. Introduction

Section Summary

- This evaluation is a retrospective assessment of the past 5 years of IDRC eHealth funding to inform future research programming and niche for IDRC in a way that leverages past lessons and experiences
- The evaluation employs a mixed-methodology that used a documentary review, literature review, lessons learned workshops, surveys and key informant interviews as the primary data sources
- The utilization focused evaluation was designed to engage IDRC staff and project grantees. The primary users of the findings are IDRC staff working on supporting eHealth research in the future.
- 25 projects are included in this evaluation, of which 50% are from Africa, 28% are from LAC, and 16% are from Asia. Collectively, the projects represent 28 countries
- The total dollar value of the projects included in this evaluation is \$17 M CAD (can this also be broken down by region? This could give another perspective since PANACeA is only counted as one project above)
- The majority of projects were funded for a 2-year duration

Canada's International Development Research Centre (IDRC) provides research grants to individuals and organizations in the developing world to find solutions to their social, economic and environmental problems. From its creation in 1970, IDRC (the Centre) has been committed to understanding how appropriate access to and use of information can improve development outcomes. This includes supporting research on the use of information and communication technologies (ICTs) in health systems – often referred to as electronic health (eHealth). Implemented across communities in Africa, Asia and Latin America and the Caribbean (LAC), IDRC-supported research projects have examined a broad range of demand-driven research questions that explore the relationship between ICTs and health outcomes.

Historically IDRC funding for eHealth projects has come from the Centre's Information and Communication Technology for Development (ICT4D) Program Area. The projects range from exploratory proof-of-concept studies to the development of new eHealth software and large multi-country research networks. The ICT4D program area is divided into three geographic zones – Africa, Asia and LAC. In addition to the ICT4D group at IDRC, some eHealth research projects were funded in collaboration with other health-focused research programs – notably those found in the Global Health Research Initiative (GHRI)¹ within the Research for Health Equity (RHE) program area. In April 2011, the three regional ICT4D

¹ GHRI is a research funding partnership of five Canadian federal agencies and departments whose mandates span health, research and development assistance. The GHRI partners are the Canadian Institutes of Health Research, the Canadian International Development Agency, Health Canada, IDRC and the Public Health Agency of Canada. (http://www.idrc.ca/en/ev-114548-201-1-DO_TOPIC.html). The design and support of these grants are different from other grants included in this report that are funded primarily through IDRC grants alone.

programs will be combined into a single global program, and several of the thematic areas such as eHealth will be mainstreamed into existing IDRC programs. In the case of eHealth, this mainstreaming exercise will take place within the Governance, Equity and Health (GEH) program, which resides within RHE.

The field of eHealth is rapidly evolving in scope, scale and complexity. It is increasingly involving a multitude of researchers, practitioners and donors working to achieve similar goals of improving health outcomes through appropriate use of ICTs. Given this reality, the purpose of this evaluation is to help situate IDRC's research portfolio in a way that **leverages past relationships and lessons, maps sensibly onto the current and future research issues, and carves out a programming niche that is appropriate for IDRC's mandate and profile in this space.**

Data collected through the review process will also be utilized to inform the transition from three regional eHealth portfolios to a single global program moving forward. Furthermore, the findings will inform the mainstreaming process of eHealth into GEH priorities of improving governance for equity in health systems – and vice versa.

Specific objectives of the evaluation include, to:

- Build on existing evaluation work to provide a cross-regional, cross-program assessment of IDRC eHealth programming.
- Map out current trends in the field of eHealth and situate IDRC's past and current work within this context.
- Provide strategic recommendations on focus areas with respect to eHealth issues, geographic focus, programming modality and approach, and research design as a mainstreamed program within the Research for Health Equity program at IDRC.

5.1 Methodology

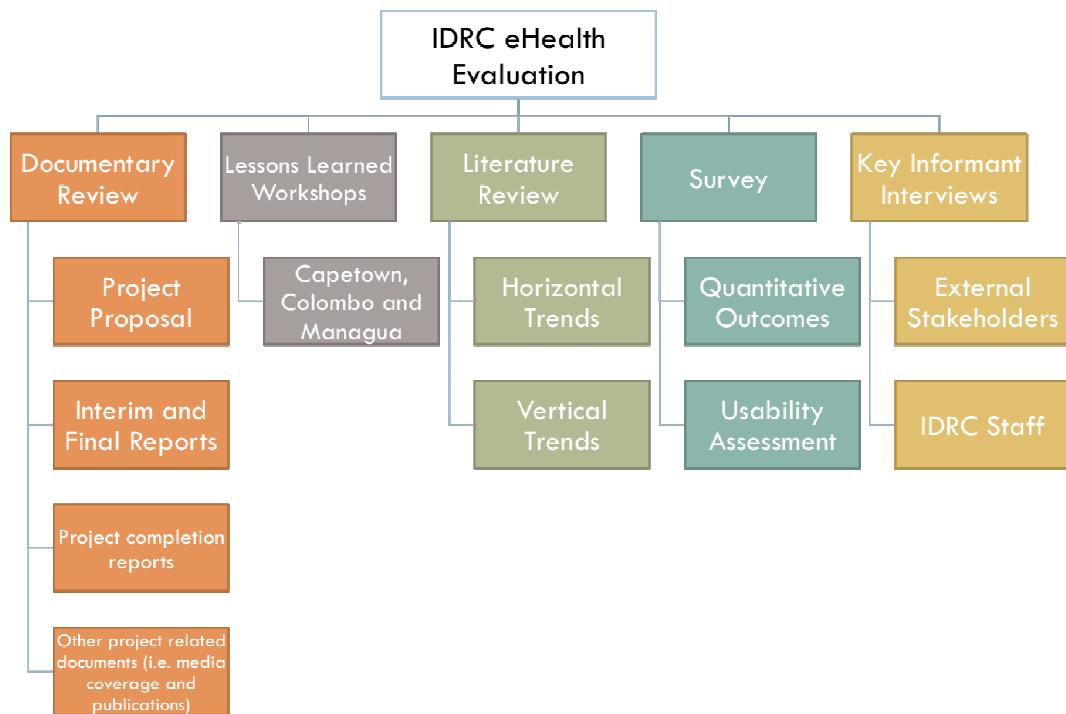


AIM: to inform future IDRC programming in eHealth research in a way that leverages past experience, current trends and IDRC's niche in the field.

The utilization-focused evaluation of IDRC's past five years of grant investments into eHealth research projects in developing

countries aims to quantify and qualify the achievements, challenges and lessons learned from 25 past and current IDRC-funded projects in the Africa, Asia and LAC regions as a basis for informing and guiding the Centre's funding strategy for the coming five years.

A mixed-methods design was used to systematically to situate IDRC's role within the broader environment of eHealth in low and middle income countries (LMICs), to assess specific project outcomes as reported by grantees, to capture and document transferable lessons learned, and to chart the vision and strategy for IDRC's future eHealth work. The methods, described in greater detail in Appendix B include: a systematic review of IDRC grant-related documents and complementary quantitative survey completed by grantees, regional lessons learned workshops, a usability survey for users of applications supported by IDRC, and key informant interviews with internal IDRC staff and external eHealth stakeholders. A review of literature was also conducted to position IDRC's work within the growing body of research examining the impact and effects of eHealth in low and middle income countries, including literature published by IDRC grantees related to their IDRC-funded eHealth research.



The utilization-focused evaluation was designed specifically to engage the primary intended users (i.e. the IDRC staff involved in future eHealth programming support). This involved defining the needs of the evaluation, in addition to informing the data set and recommendations. Chaitali Sinha, IDRC Program Officer, collaborated with the evaluators throughout the entire evaluation process (i.e. design, data collection, analysis, synthesis), to ensure IDRC's intended uses were continually being met. This was complemented by a round-table discussion with IDRC staff in early February 2011, following the circulation of the draft final report. The purpose of this session was to: present and discuss the evaluation findings, discuss GEH's broader strategy and where eHealth fits in, brainstorm and identify potential areas where eHealth fits into GEH's existing portfolio and how GEH priorities could

be more explicitly addressed in eHealth projects, understand the type of resources, exposure and support the GEH team may need for the mainstreaming process and address any existing questions or concerns. Notes from this session can be found in Appendix J.

5.2 Limitations and Assumptions

It is important to highlight the limitations and assumptions made in this evaluation, which may impact the accuracy of findings and recommendations.

5.2.1 Limitations

1. **Time:** The majority of the data collection and analysis for the evaluation was conducted over a short time period (4 months) to align with IDRC's internal timeline for solidifying a new eHealth strategy and program definition. Resultantly, this demanded significant engagement from IDRC staff and grantees to participate in various research activities (i.e. key informant interviews, lessons learned workshops, surveys) with tight deadlines. For instance, our lessons learned workshops were one-day sessions, which limited the level of detail in the discussions. Further, the available time limited the capacity of the evaluators to investigate specific outcomes, challenges and barriers of each project. The evaluation team was structured in a way to maximize efficiency and overcome this challenge. This included delegating tasks by research methodology (i.e. documentary review, literature review, key informant interviews, qualitative analysis, quantitative analysis), while maintaining close interaction, clear direction and a common analytical framework.
2. **IDRC eHealth Strategy:** IDRC did not have a defined eHealth strategy to evaluate the project outcomes against, and determine if IDRC met its intended goals and objectives. This was due to structural aspects of how IDRC supported research on eHealth in the past. Each of the regional programs (Africa, Asia, LAC) had strategies for their ICT4D portfolios – of which eHealth was one component. As such, a cross-program eHealth strategy was not feasible to formulate or follow without the supporting structures and processes in place.
3. **IDRC Projects:** The projects in the evaluation were of different sizes, types (e.g. assessments, literature review, implementation), and at different points in the project cycle. Thus, a standardized criterion could not be designed to evaluate all the projects against.
4. **Project Outcomes:** The evaluators designed and conducted quantitative and qualitative surveys to account for information gaps found in the documentary review. Since, IDRC grantees, in some cases, had not reported on specific quantitative outcomes (e.g. health outcomes, number of people trained), project leaders were asked to provide *estimated* figures. Further, project outcomes could only be evaluated from completed projects, which accounted for only 9 of the 25 projects evaluated. Due to this small sample size, the findings are not statistically significant.

5.2.2 Assumptions

- The 8 projects part of the PANACeA Network in South and Southeast Asia was counted as 1 project
- Project leaders were able to provide accurate figures for outcomes measured

5.3 Overview of IDRC's eHealth Portfolio

Twenty-five projects from the three regions that the IDRC operates in: Africa, Asia and LAC were chosen for inclusion in this evaluation.

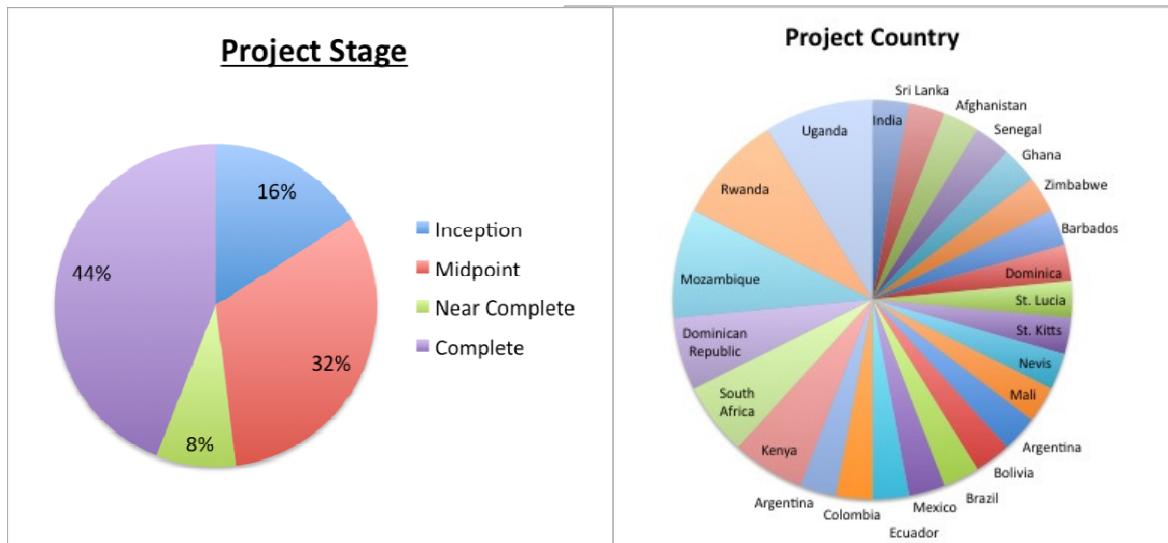


Figure 2: Projects by stage of completion

Figure 3: Projects by geographical distribution

Over 50% of projects are situated in the Africa region, followed by 28% in LAC, and 16% in Asia. A research support project which organized a workshop in Vancouver, Canada, included global participants, support of the PDA Developer Network and a research project assessing privacy and security solutions for eHealth are considered global projects. (See Figure 4). Collectively, the projects are representative of 28 countries (See Figure 3).

Further, projects range in size, focus and stage of development. Approximately 52% of projects have been completed or were nearing completion by the end of 2010. The remaining 48% are either at inception or midpoint of the project cycle (See Figure 2).

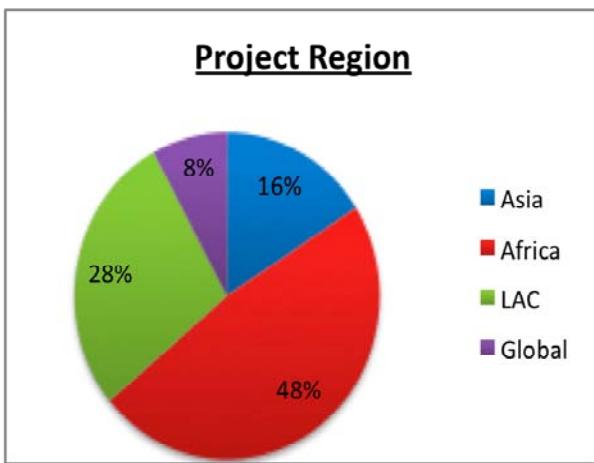


Figure 4: Projects by IDRC region

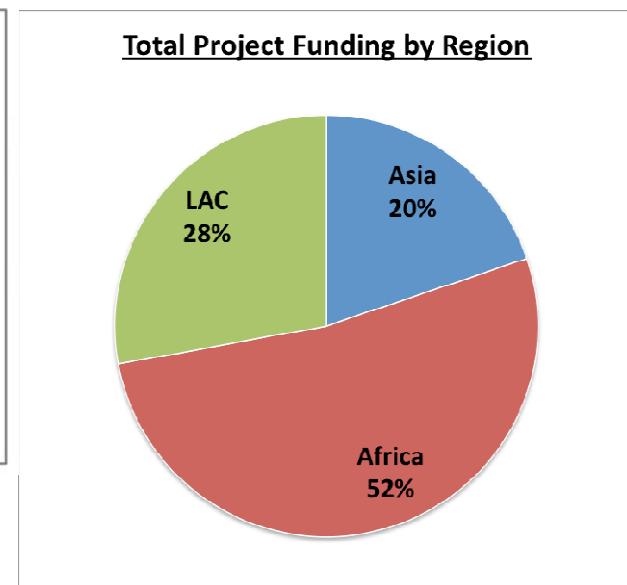


Figure 5a: Total project funding by region

In terms of financial support, over 48% of projects represented in the evaluation have received over \$500,000 CAD in funding. 52% of overall funding was distributed in the Africa region, where the Centre began its work in eHealth (See Figure 5a). The range of funding is \$30,000 - \$2,422,652, and was used to support projects of durations varying from 6 months to 5 years (See Figure 5b). The total dollar value (\$CAD) of the projects included in this evaluation is approximately \$17 million.

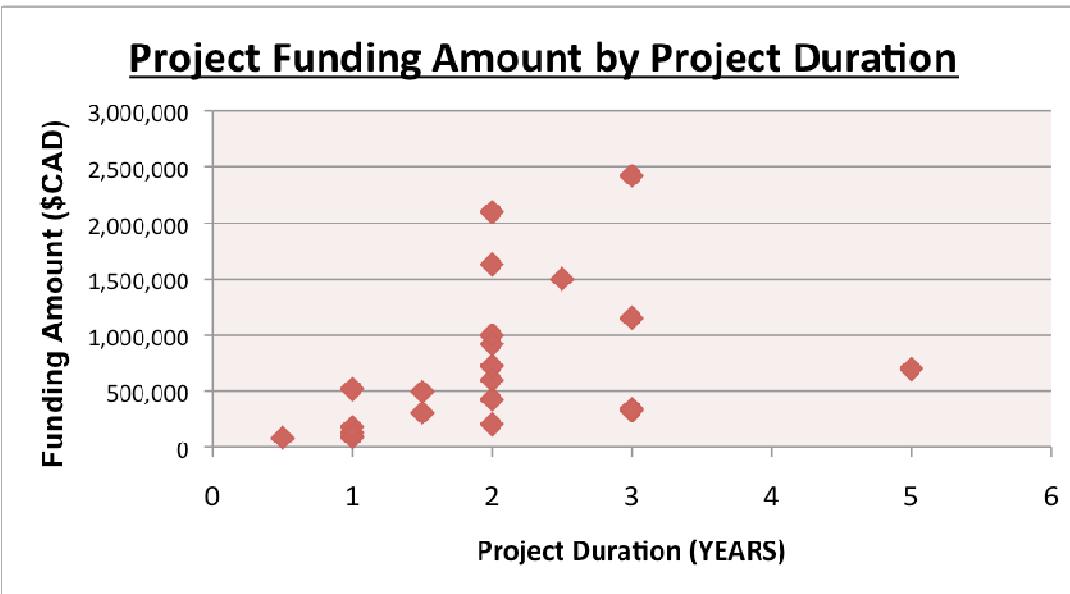


Figure 5b: Project funding amount by project duration

5.4 Summary of Projects and Achievements

IDRC's role in eHealth is seen as "the venture capitalist of ideas", according to Michael Clarke, Director of ICT4D and RHE. IDRC has willingly taken risks to support new innovation and research ideas using new technology applications to improve health outcomes. The risk-taking culture in IDRC's eHealth research portfolio has produced some projects that are not only innovative and cutting edge, but have been instrumental at catalyzing critical pathways within eHealth. Examples of this include IDRC's funding of the OpenMRS Implementers Network and the OpenROSA Developers Network and involvement in early studies of Electronic Medical Records (EMRs) in South Africa. One critical observation that arose from the external key informant interviews is that while some of IDRC's projects have received attention from government officials and media in the regions and countries where they operate, other donors (based in the US) that also support eHealth initiatives in developing countries, were often unaware of the specific details of IDRC's work in the sector.

The following is a brief introduction to each of the projects included in this review along with an overview of outcomes and outputs (*See Appendix D for more information*). They have been organized by region, and are presented in chronological order to signify the broad spectrum of eHealth activities supported by IDRC, their geographic coverage and organizational growth in terms of supporting more complex projects overtime. The month and year shown in parentheses after each title represents the commencement date of the grant.

5.4.1 Africa Regional Projects

ICTs to support and evaluate the ARV (Anti-retroviral) rollout therapy in the Free State Province, South Africa - South Africa (January 2005)

This action research project aimed to develop a back-end informatics and relational

database to manage the rollout of ART treatment in South Africa, which was one of the largest public health interventions of its kind in the world. The challenges to devise systems for routine monitoring and evaluation of patients on ARVs were numerous, including: scale, duration, outcome determination and donor requirements. The system was designed to optimize data from structured medical records by developing a data collection system using PDA's, a patient and clinician feedback system, and characterization of viral markers



Image 2: Lessons Learned workshop participants in Capetown, South Africa

to improve link between clinical decisions and epidemiological patterns. The project collected electronic patient-level data from the start of the Free State ART program in 2004, and now represents one of the largest HIV patient cohort in sub-Saharan Africa, with 77,000 entries.

The project successfully demonstrated the usefulness of establishing a clinical data warehouse for monitoring and evaluation and research purposes, and was further enhanced by linking data from the South African Death Register, Electronic TB Register and National Health Laboratory Service. The project led to follow-on financing from the European Union to expand the virology project, a proposal to allow nurses to administer ARTs, thereby reducing bottlenecks, achieving national and international recognition, and appealing to the South African government to roll-out the system across the country.

Mozambique Health Information Network – Mozambique (March 2006)

The goal of this study is to identify and to compare the costs of accessing, sharing, and communicating epidemiological data among health care providers, managers, and policymakers using the Mozambique Health Information Network (MHIN) data collection system versus a traditional paper-and-pencil system. The primary objectives of the project are to: develop processes and determine organizational requirements of MHIN, develop a plan to expand MHIN, strengthen HIS pilots by providing access to MHIN services, and inform decisions by increasing timeliness of HMIS data; support frontline health workers by providing relevant health information. The project has developed electronic tools for data gathering and reporting of 11 diseases in Mozambique, deploying MHIN to 11 provinces and all districts (43) in three pilot provinces (Gaza, Inhambane and Zambezia), and designing epidemiological surveillance tools for use at the district, provincial, and national levels.

Capacity Building in Open Medical Record System (OpenMRS) in Rwanda – Rwanda (June 2007)

This project aimed to assess the requirements to develop a workforce for indigenous eHealth system development and deployment. The assessment resulted in the establishment of a Rwanda training program, which has been in operation for one year and graduated 10 Java programmers. Programmers have since been offered contracts with the Rwandan Ministry of Health, and the program has influenced the government to invest in creating a local workforce to support eHealth systems in the country. Training materials developed in the first year of the program will be shared computer programming courses at Rwandan universities.

Uganda Health Information Network (UHIN) - Phase IV – Uganda (September 2007)

The Uganda Health Information Network (UHIN) pilot launched in 2003, and is currently entering Phase IV of its growth and development and accelerating the goal of reducing morbidity and mortality of the population. The platform is designed to track disease surveillance data, especially HIV/AIDS and malaria, HIS reports, drug use and supply

inventory. Also, health workers use the network to receive health information twice a week, continuing medical education (CME) materials and general interest news. The network has grown to include 174 health centers in 5 districts, and a total of 500 Personal Digital Assistants (PDA) and training modules have been provided to health sector workers in five regions. The project has heavily influenced the formulation of Uganda's Health information Systems national strategy.

Open Architecture, Standards and Information Systems (OASIS) for Healthcare in Africa - South Africa; Mozambique; Zimbabwe (October 2007)

The fundamental research question of the OASIS project was to evaluate the potential to build capacity through open approaches (i.e. collaboration, networking and participation), improve access to eHealth solutions, and strengthen HIS in Africa using open technologies². This included three specific actions: in-country capacity development and training programs on open technologies for health, HIS development projects with partners, sustainable working environment where projects supported and maintained by local capacity. The project demonstrated the importance of the community aspect of open source software development and networking meetings. Also, OASIS health informatics laboratory nodes were established at African universities in South Africa, Mozambique and Zimbabwe. Moreover, a non-profit company was registered in South Africa (Jembi) to manage the implementation of the work started by the OASIS project. IDRC has since funded a second phase of the project.

Rwanda Health and Education Information Network (OASIS-RHEIN) – Rwanda (July 2008)

This action-research project will pilot the development of an integrated and interoperable open source health information system and build capacity of nursing staff to provide better care through an integrated electronic learning platform. The project successfully implemented OpenMRS (an open source electronic medical record system) in eight clinics within Rwanda, which contributed to the Ministry of Health deciding to roll-out the software nationally.

□ Harnessing Mobile Phones for Prevention of Mother-to-Child HIV Transmission – Nairobi, Kenya (April 2009)

This project is trialing the use of a mobile phone communications system for programming related to prevention of mother to child transmission of HIV (PMTCT) using a randomized control trial methodology. The proposed system is designed to use mobile phone technology to improve antenatal linkages to care, compliance of PMTCT medications, and postpartum and neonatal support and follow-up, even when mothers deliver at home. Initial results have found that 30% of pregnant women at the targeted health centers in Nairobi, Kenya were not being screened for HIV/AIDS. Resultantly, remedial measures to

² Open technologies are liberally licensed innovations that grant the right of users to use, study, change, and improve the design of said technology through the availability and transparency of its source code, process, etc

improve statistics were taken. Also, the project managed to influence 5 HIV-positive women to deliver at the hospital, versus at home, using messaging via mobile phones.

**Open Architecture Standards and Information Systems (OASIS) across eHealth in Africa
Phase II- Ghana; Kenya; Mozambique; Rwanda; Uganda, Tanzania, South Africa,
Zimbabwe (September 2009)**

The OASIS II project aims to build on aspects of the original Open Architectures, Standards and Information Systems for Healthcare in Africa (OASIS) project, which was previously funded by IDRC. OASIS II is investigating a shared research purpose and combining methods between one existing and four new projects and partners to: 1) elaborate a network-wide OASIS II research methodology, 2) establish an open enterprise architectural framework for eHealth in developing countries and 3) create a collaborative framework for sharing new evidence regarding the impact of eHealth solutions in resource-poor settings. Project plans for the five sub-projects have been established and are underway. OASIS researchers have been actively presenting at various conferences and meetings, and leading the dialogue of open architecture and standards for eHealth. The previous phase of IDRC funding for OASIS helped with the successful establishment of a non-profit organization called Jembi. Organizational development and the growth of Jembi is a key focus in this second phase of the OASIS project.

**Application of a Community eS@nté Platform in Maternal and Child Health in Sénégal –
Senegal (September 2009)**

A collaboration between the University of Cheik Anta Diop in Dakar, Senegal, the OASIS network, and the Ministry of Health and Medical Prevention, this project aims to generate knowledge on how and under what conditions information technology, free and open source software, electronic patient records and telehealth can improve healthcare data and patient care in Senegal. The team in Senegal are reflecting on the design of an enterprise architecture for Senegal, with a particular focus on maternal and child health mortality.

**□ICTs for Equal Access to Human Resources in Health in Francophone Africa –
Mali (September 2009)**

The overall objective of this research project is to better understand how ICTs can facilitate equitable distribution of human resources for health in Francophone Africa. Activities to be implemented include: strengthening existing telemedicine networks to include training and CME tele-consultations, testing and validation of systems designed to delegate tasks in medical imaging (obstetric ultrasound) and cardiology (electrocardiogram), and utilization of virtual simulators for medical education to assist the decision making process of local practitioners. Due to the team's strong connections with policy makers and government officials, they have received government buy-in to expand the program, in addition to external funding to add an additional center.

Strengthening Community Health in Uganda – Uganda (September 2010)

The overarching goal of this project is to strengthen the evidence base of projects using eHealth for maternal care initiatives. Toward this objective, the project team will carry out a scan of existing materials, gather additional input through consultations with individuals and organizations, and examine relevant, locally-driven and standards-compliant eHealth solutions. The resulting overview will serve as a foundation to inform the design of a research project to facilitate Village Health Team to deliver improved preventative and curative health care. This will be executed through a literature review, stakeholders meeting, and investigation of project fit within Uganda's Ministry of Health Vision 2015.

5.4.2 Asia Regional Projects

Project Proposal: Regional Health and ICT Research Network – Asia Region (June 2006)

Through a series of workshops, literature and documentary review and interviews with key informants, the establishment of a strategic regional eHealth research network in the Asian region was investigated. A Project Advisory and Monitoring Team (AMT) was established at an early workshop, which led to the development of a proposal for the “PAN Asian Collaborative for Evidence-based eHealth Adoption and Application” (PANACeA). The aim of the network was to create a forum to assess existing projects, support research of innovative uses of ICT for health in South and Southeast Asia with mentorship, cross project collaboration and a standardized evaluation framework, and advocate for policy development. A workshop was held with 20 participants to discuss, write and submit eHealth research proposals. Eight projects were chosen against established criteria to potentially fund and support through the network.

PAN Asian Collaboration for Evidence-based e-Health Adoption and Application (PANACeA) – Asia Region (June 2007)

Funding for the creation of the proposed PANACeA network was granted, leading to the implementation of a model designed to stimulate collaboration across South and Southeast Asia, to build capacity, generate evidence, and develop relevant policies in the field of eHealth.

PANACeA is financially and managerially supporting eight research projects across 12 countries in South and Southeast Asia. Each of the research projects involves studies in at least two countries, providing a unique opportunity to examine health outcomes as influenced by eHealth across borders. By the end of 2010, projects will have completed their first year of implementation, which was preceded by a needs assessment period. Several peer-reviewed publications and presentations have been made to disseminate the model of collaborative research developed by PANACeA.

The following paragraphs are descriptions of the subprojects within the PANACeA network.

Community-based eHealth Promotion for Safe Motherhood: Linking Community Maternal Health Needs with Health Services System - Philippines; Pakistan; Indonesia

The project aims to evaluate the effectiveness, process and cost-benefit of conducting promotion for safe motherhood using eHealth tools (e.g. SMS) in comparison to traditional methods in three countries: the Philippines, Pakistan and Indonesia. The preparatory phase has been completed, which included designing tools for data collection, conducting focus group discussions, identifying and designing SMS software, testing software and training healthcare providers. Components of the project have started to be implemented in the Philippines and Indonesia; however, activity in Pakistan has been delayed due to instability in the country.

Portable System for Telehealth and Health Informatics in Rural & Remote Areas (THIRRA) - Malaysia; Sri Lanka; Nepal; Afghanistan

This research project is piloting the implementation of a web based open source Electronic Medical Record (EMR) system that is hosted by a single server at a remote clinic, and uses the Wireless Application Protocol (WAP) to deliver the information from the application to the mobile devices of health care providers. The software has been developed and project activities have been initiated in Malaysia and Sri Lanka. In Nepal, sites have been identified, and the implementation of the software is in the final stages.

Economic Evaluation Framework of Computerization in Hospitals – Pakistan; Philippines; Afghanistan

The objective of this project is to quantify the cost of computerization in hospitals, by comparing the cost per laboratory test at hospitals with manual systems hospitals with eHealth systems in Pakistan, the Philippines, and Afghanistan. Results will confirm or reject the hypothesis that the initial cost of computerization of hospitals is recouped over time by efficiency gains. This project has made remarkable achievements in all three countries (Pakistan, Afghanistan, and Philippines). The economic framework developed by the project's health economist is being used in all sites, and data is being collected to inform the cost benefit analysis.

Improving maternal health care services by using ICTs for remote consultation and education - Mongolia and Philippines

This project aims to improve early detection of pregnancy related risks and maternal mortality for rural, pregnant women in Mongolia and the Philippines by connecting rural physicians to 'provincial' hospitals electronically for support. The system will install internet-connected computers and web cameras in rural clinics and provincial hospitals to facilitate collaboration.

Project activities have started as planned in both countries. A decision to use separate software in each country was made to align with local reporting standards, since a tool that worked in both contexts was not found.

Online TB Diagnostic Committees for Clinically Suspect Sputum Negative Patients in the National TB-DOTS Program - Philippines; Pakistan

This experimental study aims to develop a telehealth solution to address delays in the diagnosis of tuberculosis in the Philippines and Pakistan. Specifically, the project will measure the sensitivity and specificity of face-to-face TB diagnosis and online TB diagnosis against a gold standard (TB culture), compare the consensus statements of face-to-face TB diagnosis with that of online TB diagnosis, and compare the presentation-to-decision time lapse of the online TB diagnosis with that of face-to-face TB diagnosis. Data have been analyzed and the findings are being communicated through a variety of different channels.

A Systematic Review of Current ICT Applications in Disasters – The Potentials of Integrating Telemedicine - Indonesia; Philippines; India

A systematic review of ICT applications in disaster situations in Indonesia, the Philippines and India will be conducted to assess opportunities for integrating eHealth solutions to improve healthcare delivery in different stages of disaster. The research framework has been designed and the review and analyses are near-complete.

Framework for Primary health care providers to identify eHealth needs in a Primary Health Care Setting - India; Pakistan; Philippines

This project aims to develop a framework and tool for primary health care providers to identify eHealth needs in India, Pakistan and the Philippines. Project achievements include receiving ethical approval from respective countries, identifying implementation sites, developing relationships with local staff at site, and conducting training. Pending outputs include the literature review and details of the implementation plan and needs.

Basic Intervention Research on eHealth for the Visually Challenged" Project – Bangladesh; Philippines; India

This project aims to investigate the hypothesis that introducing affordable eHealth applications for the visually impaired population into existing health service delivery systems can result into enhanced care. The study is using key informant interviews and secondary literature from Bangladesh, the Philippines and India to evaluate the needs of the target population, and subsequently design an eHealth solution based on the findings.

***Evaluating a Real-Time Bio Surveillance Program: Pilot Project - India; Sri Lanka (July 2008)**

A partnership between LIRNEasia, a South Asian telecom policy think tank, the Rural Technology and Business Incubator and Indian Institute of Technology, Madras evaluated the effectiveness of an eHealth disease surveillance system in the North Western Province of Sri Lanka and Tamil Nadu State in India. The system was designed for community health workers to collect clinical and demographic data about patients that visited targeted

primary healthcare centers, health sub-centers, mobile clinics or house visits using mobile phone application mHealthSurvey. The data collected was subsequently analyzed using statistical algorithms, such as T-Cube, designed to detect variances in health trends for potential emerging disease outbreaks. This data was made available to state authorities real-time, and sent our SMS alerts to stakeholders in emergency cases.

The pilot project completed its two-year term in July 2010. It successfully created a training program for community health workers on mHealthSurvey, collecting 81,000 patient records in Sri Lanka and 38,000 in India. Analysis of this data led to detecting outbreaks of conjunctivitis, malaria, typhoid and diarrhea in the Tamil Nadu State. Lessons from the implementation led to key insights into mobile phone data collection including the need for formal training and certification of community health workers, medical terminology word predication, and a comprehensive disease and syndrome database.

*** Partnership for strengthening Healthcare and Professional Education in Rural Afghanistan – Afghanistan (February 2010)**

This study, supported by IDRC and Roshan Telecommunications, aims to investigate the feasibility and cost-benefits of telehealth to patients in rural Afghanistan and to assess the role for telecommunications operators in future healthcare technology partnerships. Live teleconsultations have been established in Pediatrics and Cardiology, whereas store-and-forward consultations are established in Pathology and Radiology. To-date, 23 live consultations have taken place and 7 continuing education sessions have been arranged between the urban and rural hospitals. In the beginning, the project faced several technical and human resource challenges, which caused delays in starting some services.

** These projects are informally part of the PANACeA network (i.e. invited to workshops and other knowledge translation and networking opportunities)*

These projects are funded through the Global Health Research Initiative (GHRI)



Image 3: Lessons Learned workshop participants in Colombo, Sri Lanka

5.4.3 Latin America and the Caribbean (LAC) Regional Programs

Regional Overview of Mobile Telephony in the Health Services in Latin America and the Caribbean – LAC Region (December 2007)

This study aimed to conduct a regional mapping study that identified existing and ongoing initiatives and key organizations involved in the use of mobile phones for the provision of health services in the Latin America and Caribbean (LAC) regions.

Enhancing Nurses Access for Care Quality and Knowledge through Technology (ENACQKT) – Dominican Republic; Barbados; St. Lucia; St. Kitts (January 2008)

This initiative emerged based on learning's from the "Linkages for Education and Research in Nursing" (LeaRN) project. ENACQKT is utilizing the "training the trainer" mechanism to build capacity of nurses in rural hospitals in Dominican Republic, Barbados, St. Lucia and St. Kitts. The project is focusing on demonstrating and analyzing the value of integrating PDAs into the hospital system to enhance patient care for specific conditions, in addition to introducing end-users to online platform, NurseOne, to use for knowledge exchange. The project has yielded improved efficiency, saving 12 minutes per activity conducted by a nurse. Further, increased awareness of nurse-focused eHealth solutions has occurred in St. Kitts, leading to the Ministry of Health installing full wireless access at the project site in the country.

Punto J: a Portal for Youth-to-Youth Education on Health and HIV/AIDS - Phase II - Dominican Republic; Mexico; Ecuador; Colombia; Argentina (January 2008)

Punto J II is a strategy and applied research project aimed at designing and developing an online regional portal to engage youth in bridging gaps in HIV/AIDS awareness, complimented by an offline volunteer and support network. The project is being implemented in Peru, Bolivia, Mexico, Dominican Republic, Argentina, and Ecuador and will be documented as a case study to share lessons and presented at two regional workshops. The Punto J strategy has been adopted by five countries in the LAC region, which led to collaboration between country government offices.

Pilot Project Using ICTs to Monitor Chagas' Disease in Argentina, Bolivia and Brazil - Argentina; Bolivia; Brazil (February 2008)

The project aims to design, implement and assess an epidemiological monitoring and surveillance system for sero-positive patients of the Chagas disease through the use of ICTs in Argentina, Bolivia and Brazil. The system, referred to as SVS-TIC, was designed to use Geographic Information System (GIS) maps and Palm Pilots, implemented at specific sites and followed up with comparative analysis of findings across geographies, and submitted to a scientific publication. A system was designed following a series of meetings with stakeholders, and in the two-year period of the project, 4,570 individuals were screened on-site at community events. Due to administrative challenges regarding transfer of funds, Brazil decided to withdraw from the program.

Strengthening Health Information Systems to Support Post-Disaster Healthcare in Haiti – Haiti (March 2010)

To support appropriate and effective use eHealth within health systems in Haiti, this project aims to evaluate current practices and identify services and systems that will improve the delivery of health care in Haiti in both short-term emergency relief work and long-term rebuilding efforts. This will include introducing principles of a standards-based national architecture by drawing on lessons from previous, similar implementations, and evaluating those standards and systems to support web and mobile device applications. Focus is placed on supply chain management and electronic medical records. Interoperability between OpenMRS and iSante will be explored as a central activity within the project.

Reseach and Capacity Building toward improving Health Information Systems in Latin America and the Caribbean – LAC region (July 2010)

The goal of this project is to examine the eHealth landscape in the LAC region and contributed to the body of published literature in the region. This will be accomplished by: conducting a landscape analysis in a representative set of LAC countries to identify priorities, policies and practices related to eHealth research and implementation realities in the region. Moreover, awareness campaigns and events will be organized to increase exposure of Free and Open Source Software (FOSS) in health informatics, especially mHealth platforms and tools, amongst HIS developers, implementers and decision makers, and

implementing a workshop to train HIS implementers on how to create evidence based policy briefs related to eHealth solutions.

Public eHealth Innovations in Latin America and the Caribbean – LAC Region (July 2010)

This project aims to contribute to improving the health of marginalized population groups in the LAC region by promoting and supporting the design, implementation and evaluation of innovative, highly effective, and low-cost eHealth solutions. The three components of this project are: an applied research project which will identify innovative, low-cost, and local eHealth solutions through a call for proposals competition, knowledge transfer activities to create awareness and interest in public eHealth solutions among decision-makers in the LAC region, and the development of a regional network of young professionals trained and engaged in eHealth policy, practice and evidence-based influence.

5.4.4 Global Programs

PDA Developer Network: Open Source Personal Digital Assistant Software for Health Data Collection (March 2006)

This project was born out of the OpenMRS Implementers Meeting with the aim to design an open-standards based software architecture for mobile data collection by convening a community of software developers and researchers and implementing the application in at least one setting. The group successfully established the OpenROSA network website and JavaROSA platform, which has since been adopted to create data collection software EpiHandy and EpiSurveyor. The project also illustrated that a good architecture and well organized community is essential to attracting talent. Following the funding of this project, IDRC also began financially supporting The OpenMRS Implementers meeting, which has grown into a community of over 50 active software developers contributing to the extension of the eHealth platform and a mailing list of 300 individuals.

"Because of that funding, they [IDRC] were able to bring together in person Africans who would have not have been able to afford to get together in person. The communities can build virtually, but they are much stronger with the face to face interaction. If once a year when people are able to meet, trade stories, build relationships. It's a much stronger community than just doing Q&A on a list serve for instance. That's where the cross fertilization of innovation and knowledge happens.

- Chris Bailey, WHO

Protecting Medical Information in eHealth Projects (February 2010)

The purpose of this project is to conduct a rigorous examination of the legal, regulatory and management issues that underpin medical privacy discussions in developing countries. While complex issues such as patient consent of health information collection, use, access and security have been identified in developed countries, this research is not easily adaptable to developing countries. The team submitted a draft report in November 2010, based on interviews with key informants and representatives from large technology

companies (e.g. Google, GE), and by attending and organizing workshops. Future plans include drafting a research agenda for health information system designers, users and policy-makers and launching a consultation service to ensure stakeholders more carefully consider mailers of privacy in eHealth.

Sharing Experience and Expertise on National Health Information Systems Strengthening (February 2010)

Enterprise architecture (EA) is defined as coherent set of principles, methods and models that represents the 'nuts and bolts' of the system, and dictates how data is organized, queried and shared. The role of such an EA in the domain of health information systems (HIS) is indispensable, and is the conceptual scaffolding that holds together various data flows and interfaces among different elements of a national health system. As part of a series of workshops dedicated to discussing EA for HIS in developing countries, IDRC organized a one-day workshop on June 3, 2010 in Vancouver, Canada. The workshop convened researchers and practitioners from different countries in Africa, Asia and Latin America, as well as a strong contingent of Canadian eHealth enterprise architecture researchers and practitioners. Outcomes from this workshop include a interoperability lab that was created at University of KwaZulu-Natal, Durban and subsequently demonstrated at MedInfo 2010 in Cape Town. Furthermore, the Health Enterprise Architecture Lab (HEAL) project, which is co-funded by IDRC and Rockefeller Foundation, was born out of the interactions and outcomes from this workshop and the activities that immediately followed.

6. Key Trends in eHealth

Section Summary

- A literature review was conducted to identify key trends in eHealth and contextualize IDRC's work in the broader sector
- Vertical eHealth trends were defined as a specific area of study addressing a specific health system issue. Horizontal trends were defined as cross-cutting health system issues, and provide a more strategic lens for IDRC projects to be evaluated and inform future programming
- The current state of eHealth research exhibits few rigorous evaluations and more qualitative research when compared to quantitative
- **Health Information Systems:** IDRC leading the dialogue on open enterprise architecture frameworks in developing countries; Ex. OASIS; Vancouver Workshop
- **mHealth:** IDRC is supporting a number of mHealth pilot projects that leverage functionalities such as SMS and applications to collect, access or disseminate health information
- **Health Policy:** 92% of projects in evaluation considered impact of outcomes on health policy. Specific projects focused on health policy.
- **Health Governance:** Limited indication that IDRC's eHealth projects support health governance
- **Health Equity:** Equity is an implicit theme in eHealth projects – could be more explicit; Project leaders showed interest in investigating this lens further
- **FOSS:** IDRC is a strong proponent and has a solid reputation of leading FOSS dialogue and supporting software development and fora for developers to meet

A targeted literature review was conducted to identify key themes and emerging topics in the field of eHealth in developing countries. These findings will be used to contextualize IDRC's eHealth portfolio and to understand where the research it has supported fits into the broader global landscape. The following is a summary of key eHealth trends. A more detailed overview of the search criteria, key terms and complete findings of the eHealth literature review conducted to inform this study and related references are provided in Appendix F and G.

The review was conducted between September and December 2010 and focused on literature related to eHealth in low and middle income countries published from 2005-2010 to align with the review study period. Researchers used the following electronic databases: Web of Knowledge, PubMed, Scopus, EMBASE, and The Cochrane Library and specifically searched for documents that were considered as reviews by each of the databases. In cases where articles could not be located within databases, complimentary searches with the same inclusion criteria were conducted using Google Scholar. All searches were limited to articles published in English.

Topic areas covered in the literature review: health information systems, mHealth, health policy, health governance, health equity, free and open source software, disease surveillance, electronic medical records, supply chain management, decision support, disaster response, health financing, and eLearning

The search yielded a total of 8,878 articles. These articles were parsed for discussions on low- and middle-income countries or developing countries, which resulted in 628 articles. The abstracts of the 628 articles were reviewed, and around five to six articles were initially selected for each eHealth trend. Articles that were more organized and thorough were selected, grouped by trend, and reviewed for providing a broad view of the particular trend. In general, these articles were cited more often than others. From these, we selected 34 articles for further analysis (approximately 1-4 articles per eHealth trend), which are summarized here and detailed in Appendix F.

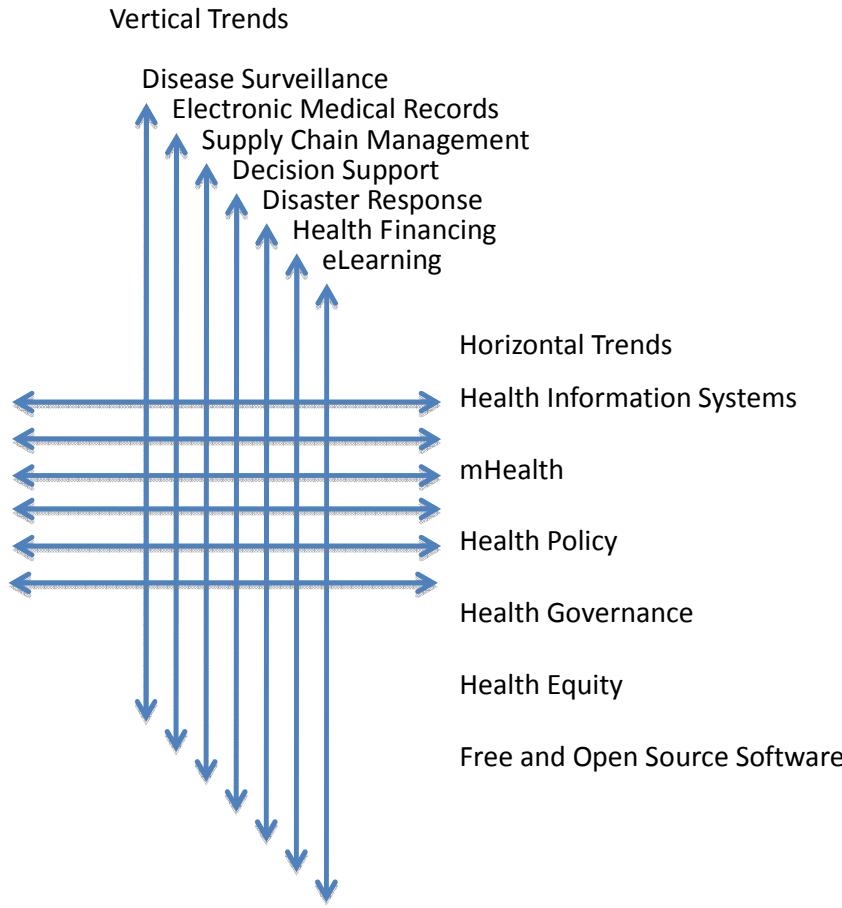


Figure 6: Vertical and Horizontal trends identified in eHealth literature review

The literature review begins with an overview of the current state of eHealth research. This is followed by a description of general eHealth trends and a brief description of the state of eHealth evaluation. In order to demonstrate different dimensions of the eHealth landscape, we deliver our findings from the literature review by identifying vertical and horizontal trends, based on the organization of the literature (See Figure 6). Vertical trends in eHealth were defined as an specific area of study addressing a specific health system issue. While many of these areas often overlap in practice, they can be studied and exist independently. Horizontal trends in eHealth were defined as cross-cutting health system issues. In essence, both trend directions need to be integrated to deliver health services to intended populations.

Very few reviews resulted from keyword searches of the horizontal trends of eHealth; however, these topics were often mentioned in the reviews we have selected to describe the vertical trends. Because of this, we provide discussions on the horizontal trends as found through keyword searches across each of the reviews of the vertical trends.

While the vertical trends identified in the literature review provide an excellent introduction to each type of eHealth program and associated research findings and trends, the horizontal trends provide a more strategic lens through which IDRC-funded projects can be reviewed

and future strategies informed. A summary of horizontal trends has been provided in the main text of this report and expanded versions of both horizontal and vertical trends included in Appendix B. Overall, this literature review is intended to provide an overview of key trends in eHealth and to contextualize IDRC's current investments in the broader sector.

6.1 General eHealth Trends

The WHO defines eHealth as “the use of information and communication technologies (ICT) for health to, for example, treat patients, pursue research, educate students, track diseases and monitor public health” (WHO, 2010a). However, many definitions exist, and in the first of an article series entitled “What is eHealth?”, Eysenbach describes eHealth as a term that many use, but few can provide a clear definition (Eysenbach, 2001). Acknowledging the need for a broad definition, the author then provides his own definition of eHealth:

an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology (Eysenbach, 2001).

Although Eysenbach's definition was published in 2001, the concepts that he captures have withstood the dynamically changing field of eHealth, which was originally referred to as “telemedicine” and has also been previously called “telehealth” (Wootton, 2009). However, at this time, telemedicine, defined as “health(care) at a distance”, is a large arm of eHealth that exists as a cross-cutting theme (also discussed in Pagliari, et al., 2005) in many of the eHealth trends presented in this literature review (Wootton, 2009).

The current state of eHealth research exhibits few rigorous evaluations and more qualitative research when compared to quantitative. Blaya et al. performed a systematic review on evaluations corresponding to the implementation of eHealth activities (Blaya, et al. 2010). They found few rigorous studies on the effectiveness and cost-effectiveness of eHealth systems in developing countries other than those involving data collection with PDAs. In addition, evaluations were linked to academic institutions rather than larger donors and were often more qualitative and descriptive though there is a growing collection of quantitative studies.

In general, eHealth efforts aim to improve conditions in the health systems of LMICs, which are characteristic of human resource shortages in rural areas, a lack of timely and reliable

I think at this point eHealth is going to happen anyway. I think we've already seen the entrepreneurialism in resource poor countries. It doesn't need WHO or the IDRC to make it happen. I think it will happen. The question is - Will it happen in the fragmented, chaotic and wasteful way its happened in the North and the West? Or can it happen in a more dynamic, useful and efficient way that would be better suited to their fragile economies and the more challenging health problems that they face?
-Chris Bailey, WHO

data, unequal accessibility inadequately supplied health facilities, and limited resources (Lucas, 2008). In the literature, applications of eHealth found to demonstrate a positive impact include tracking patients to improve follow-up; treatment adherence monitoring; information transfer between and within institutions; patient registers; clinical and research data collection with PDAs; decision support systems; error reduction through laboratory information management systems and pharmaceutical inventory management systems (Blaya, et al., 2010; Wootton, et al., 2005). However, Lucas reports that there is the concern that eHealth activities have a tendency to focus on “the most high-profile” conditions, which could result in a distortion of proper health resource allocation (Lucas, 2008).

Other reviews described articles on eHealth that relate to using the Internet and other ICTs as patient-centered agents for behavior change. Interventions usually target individuals in particular risk populations (e.g. women of reproductive age) or those who have been diagnosed with diseases (e.g. HIV-positive patients), and there have been effective interventions within this area. For example, reminders sent to patients have demonstrated to elicit increases in treatment compliances, and individuals have reported higher satisfaction with knowledge received through eHealth channels regarding health issues. However, an area that needs to be explored more is the particular behavioral processes that effect improved health outcomes (Pingree, et al., 2010).

Trends in telemedicine, a cross-cutting theme across the eHealth sector, have been found to differ by region. For instance, a systematic review performed by IDRC researchers assessed 109 articles describing the use of telehealth specifically in Asian countries (Durrani & Khoja, 2009). The authors found that nearly 75% of the studies were descriptive, and categorized the articles into five categories: access (20% of the articles), quality (40% of the articles), cost-effectiveness (12% of the articles), change management (7% of the articles), and policy topics (4% of the articles). Some of the Asian countries had incorporated telehealth into larger development activities; however, in total, telehealth was found to be a new field characteristic of slow development.

6.2 Horizontal Trends

The horizontal trends described in this section were found to influence and intersect with all vertical eHealth trends identified. These include: health information systems, mHealth, health policy, health governance, health equity, and free and open source software.

The first horizontal eHealth trend is **health information systems (HIS)**, or an “integrated effort to collect, process, report and use health information and knowledge to influence policy-making, programme action and research”, including the infrastructure, technological and human components, networks, systems, and processes (Lippeveld, 2001; Braa, Hanseth, Heywood, Mohammed, & Shaw, 2007). Many countries in the developing world are placing resources and effort into strengthening their national HIS; however, these efforts are facing many challenges.

In the reviews on HIS, we find that challenges relating to privacy, security, information integration, scale, and sustainability are often discussed. Although it is inevitable for each country to confront its unique set of challenges and successes, one review discusses that the more commonly found challenges include coping with fragmentation, dealing with multiple data sources, and lacking standards (Braa, et al., 2007). These issues are compounded by interoperability challenges when trying to design and implement enterprise architecture structures, which are the foundation of HIS. Hjort-Madsen reports that the challenges are as much technical, as political and economic, arising from the lack of umbrella coordination efforts among existing information systems and a lack of incentives for data and knowledge sharing (Hjort-Madsen, 2006). Also mentioned are challenges less foreseeable at the beginning of deploying strengthening efforts: scalability and standardization, particularly in the context of growing complexity issues, such as favored vertical programs (e.g. HIV/AIDS interventions) funded by international donors and the uneven development between urban and rural areas (Braa, et al., 2007).

IDRC is supporting the advancement, and in many cases, leading the dialogue for designing an open enterprise architecture framework for eHealth in developing countries through projects such as the Open Architecture and Standards Information System (OASIS) being implemented in Kenya, Ghana, Mozambique, Rwanda and Uganda. In addition, in June 2010, IDRC funded a one-day workshop in Vancouver, Canada, which brought together researchers from North America, Africa, Asia, and Latin America to discuss HIS and enterprise architectures in developing countries.

Referred to as **mobile health or “mHealth”**, the application of mobile phones to health delivery is growing with increased consumer penetration and expansion of network coverage. A recent policy white paper was conducted to identify policy barriers and research gaps related to mHealth in LMICs (Mechael, et al., 2010). Study findings were categorized as relating to treatment compliance, data collection and disease surveillance, health information systems and point-of-care support for health workers, disease prevention and health promotion, and emergency medical response. In general, the main barriers and challenges were related to scalability and sustainability – both challenges resulting from limited evidence from which strong conclusions can be drawn about how the use of mobile phones can improve health outcomes and processes. However, the available evidence lacks cost-effectiveness studies, the measurement of clinical outcomes, and studies describing mHealth interventions involving HIV/AIDS, TB, malaria, and chronic conditions. Remarks regarding the lack of high quality studies in the literature have also been made in other reviews on mHealth (Kaplan, 2006). This lack of strong evidence inhibits the construction of global or national policies, strategies, and guidelines that could alleviate the challenges mHealth projects face regarding scale and sustainability.

IDRC has funded pilot projects specifically studying the impact of mobile phone solutions on improving health outcomes. For instance, a project being executed in the Philippines, Pakistan and Indonesia is testing the effectiveness of sending safe motherhood messaging via SMS. Although small-scale in nature, cross-country studies are rare in the mHealth literature, and results may offer insights into scaling interventions. In other cases, projects were found to integrate mobile phones as an additional channel to collect data and view patient and health information as part of broader eHealth implementations.

Another horizontal trend prevalent in the eHealth literature is **health policy**. Mars et al. concluded that eHealth is absent from policy even when governments or international organizations support its use, and necessary on both global and local levels, eHealth policy demonstrates itself to be evolving (Mars, 2010). In contrast to developed countries, which have more policies for eHealth issues, the authors draw from a couple of rare cases of eHealth policy in LMICs and mention that developing countries are “in danger of being led...into adopting so-called international best practices, which may well be inappropriate for the developing world” (Mars, 2010). Emphasis on policy making at both global and local levels is also echoed in an article by Gerber et al. (Gerber, 2010). Dzenowagis describes that collaboration with national policy makers, specifically those involved with ICT policy, will be essential in linking the health sector into national ICT policy; however, lack of bandwidth, as well as reliable ICT infrastructure, within LMICs are “severe constraints” (Dzenowagis, 2009). Edirippulige et al. cites that the exclusion of the health sector in national ICT policy is a cause for the slow adoption of eHealth, and reasons the authors provide for this include: the lack of awareness of the benefits among policy makers, lack of evidence for the benefits, limited finance, prejudice, lack of expertise, and health system inertia (Edirippulige, 2009).

Many projects funded by IDRC have directly impacted national eHealth policy development, as described later in this report. One specific project being supported by IDRC is currently investigating the key privacy and security issues in eHealth in developing countries with goals to develop a framework that will influence policy and decision makers. Grantees almost unanimously reported the need for additional support regarding influencing eHealth policy outcomes; however trainings and workshops focused specifically on drafting eHealth policy briefs were not found in the evaluation.

Another horizontal theme of eHealth is **health governance**, or “the actions and means adopted by a society to organize itself in the promotion and protection of the health of its population” (Dodgson, 2002). WHO in its report “Building Foundations for eHealth” describes how health governance encompasses four principles: accountability, participation, consistency, and transparency, all of which the report states are applicable to eHealth (WHO, 2006). In general, for the countries integrating ICT into national policies, governance is mentioned as an objective at both national and subnational levels. At the national level, Hennessy et al. (2010) describes the integration of e-strategies into governmental policies. The authors describe a handful of countries that have or intend to use ICT for improving governance: Burundi’s development policy includes the use of ICT for promoting good governance; Rwanda has a subplan entitled ‘e-government and e-governance’ within its development activities; and Tanzania aims to use ICT for good governance and transparency in a nationwide eLearning initiative (Hennessy, 2010).

Health governance is also frequently discussed in the literature at sub-national levels, particularly in countries where the health system has undergone or is undergoing the process of decentralization. Discussed by Séror, one example of governance at the sub-national level is Uganda, where ICT infrastructure is enabling the government’s efforts in restructuring and decentralizing its health system (Séror, 2007). In Uganda, at the district level, the responsibilities include the implementation of national health policies, planning and management of local health services, delivery of basic primary care and education through local health facilities to promote community participation in healthcare.

Information systems at the district level have been effectively delivering governance, as well as supporting collaboration and research activities. Data collected at the district level can also be viewed on the MoH website.

There were limited indications from the review of IDRC's work to support governance as it relates to eHealth.

Health equity can be considered as the “absence of systematic disparities in health (or in the major social determinants of health) between groups with different levels of underlying social advantage/disadvantage – that is, wealth, power, or prestige” (Braveman, 2003). Health equity was mainly addressed in the reviews relating to HIS. Braa et al. (2007) provides a description of how success in creating an HIS is achieved where ICT access is available not only between rural and urban regions, but also in both the private and public sectors. Citing that most of these differences come from the designs developed separately for public and private sectors, Heeks describes that public hospitals have “more limited” and “older” infrastructure for HIS, and in terms of staff, there are fewer workers with technological training in the public sector (Heeks, 2006).

However, the difficulty of promoting equity in an HIS representative of a country’s population is much more complex. As an example, the authors exemplify how the apartheid era in South Africa set a fragmented and incompatible infrastructure upon which a more standardized HIS that collected data from all population groups was to be built. Additionally, Wootton et al. (2005) mentions that equity to health care access is “not the ultimate goal of a health-care system” but further investment will be necessary to assure telemedicine applications are available in underserved regions (Wootton, 2005).

Investigating in health equity issues was a common future interest reported by grantees; however, only one project was found to focus specifically on this eHealth trend. Researchers in Mali are studying the impact of ICTs on achieving equitable access to human resources in health. Further, some projects were found to address gender equality issues in the evaluation of their eHealth studies.

Lastly, **Free and Open Source Software (FOSS)** is an approach to eHealth that focuses on the way ICT tools are designed, developed, and shared. Although free software and open source software are grouped together in this category, there are strong implications on their differences in terms of licensing agreements, current and future use, and access to source codes. In open source software, source codes are available to anyone; whereas, in free software, the source code is not freely available, yet the software itself is available for anyone to use (Kalogriopoulos, 2009). In their literature search, Walsham et al. (2005) stresses that more research is needed on the distinctions and subcategories between free software and open software, and existing articles do not provide details.

In terms of open source software, Williams et al. mentions the use of an EMR system built on an open source platform to be a “useful and significant tool for developing countries” since it reduces costs, can be easily modified and tailored to local contexts, and opens up the opportunity to gain from collaboration (Williams, 2008). After detailing the open source systems for EMRs in Peru and Haiti, Fraser et al. (2005) describes that open source systems

are cheaper for institutions with larger human resource capacity, and alternative options include commercial relational databases. In a systematic review of telehealth in Asia by Durrani and Khoja (2009), 14% of the 109 studies reviewed reported using open source software. Similarly, Stol et al. (2009) identified 27 studies describing 34 projects using open source software, and after in their review, they provide four points for future research, including aspects of open source software, taxonomy of open source software research, project diversity, and research methods.

IDRC has been a strong proponent of the FOSS approach, and has developed a reputation for advancing this eHealth trend. It has achieved this by not only funding the development of specific FOSS eHealth applications, but also fora for software developers to collaborate and meet face to face. The OpenMRS Developers Network is an example of a model that has advanced the development and adoption of a FOSS application, in addition to being replicated by other FOSS applications.

6.3 Summary of eHealth Literature Review within the Context of Evaluation

The eHealth trends described above have considerable overlap, and the reviews cited reflect large gaps in knowledge and few standards in practice in a rapidly expanding field. However, within this rapidly expanding field, there is a growing presence of efforts aimed at standardized evaluation, which is emphasized within the IDRC eHealth projects. In this section we look at articles that provide background and perspective on eHealth evaluation, including four articles published in 2009 and 2010 in *PLoS Medicine* to provide background and perspective on eHealth evaluation.

Dávalos et al. conducted a comprehensive review of the literature and found very few articles reporting the use of economic evaluations in informing telemedicine projects (Dávalos, French, Burdick, & Simmons, 2009). Of the articles reported by Dávalos et al., results generally were ungeneralizable; methods were not uniform; costing analyses were often the focus, instead of economic analyses accounting for broader economic benefits from multiple perspectives; studies capturing telemedicine projects in the long-term are scant; and data are often not appropriate for a reliable economic evaluation or studies include small sample sizes (Dávalos, et al., 2009). Research guidelines for conducting a cost-benefit analysis of a telemedicine program in a setting where many competing health priorities compete for limited resources are included in the article.

The first article by Catwell and Sheikh argues the need for “continuous systematic multifaceted evaluations” of eHealth, and after acknowledging the necessity and complexity of evaluating eHealth, the authors provide a framework for this process while stressing the importance of evaluating eHealth interventions during all stages of design, development, and deployment (Catwell & Sheikh, 2009). The second article by Bates and Wright focuses on the opportunities and challenges in creating “robust international cross-cultural eHealth research”, while examples of “successful collaborations” between developing and developed countries are provided (Bates & Wright, 2009). The authors also take an approach that contrasts local levels to international levels of eHealth, and they discuss how local implementation of ICT lacks standardization, which hinders broader collaborations

from working as readily (Bates & Wright, 2009). The authors suggest facilitating eHealth evaluation through (Bates & Wright, p. 3, 2009):

- “Promoting education about the importance of conducting eHealth research”
- “Developing coherence in description of eHealth interventions”
- “Agreeing on common outcomes measures”
- “Improving reporting, indexing, and systematic reviewing of the literature on eHealth”

The third and last article in the series tackles the “tricky” questions in eHealth evaluation: quantitative or qualitative; patient-level or system-/organization-level; formative or summative evaluators (Lilford, 2009).

As a response to this series, the authors of the fourth article, argue that “assumptions, methods, and study designs of experimental science” are not as appropriate in evaluating eHealth interventions than one that can account for the “personal, social, political, and ideological components” (Greenhalgh & Russell, 2010). The authors provide ten “guiding principles” as alternatives to those mentioned in the first three articles (Greenhalgh & Russell, p.4, 2010):

- “Think about your own role in the evaluation”
- “Put in place a governance process (including a broad-based advisory group with an independent chair) that formally recognises that there are multiple stakeholders and that power is unevenly distributed between them”
- “Provide the interpersonal and analytic space for effective dialogue (e.g., by offering to feed back anonymised data from one group of stakeholders to another)”
- “Take an emergent approach. An evaluation cannot be designed at the outset and pursued relentlessly to its conclusions; it must grow and adapt in response to findings and practical issues which arise in fieldwork.”
- “Consider the dynamic macro-level context (economic, political, demographic, technological) in which the eHealth innovation is being introduced”
- “Consider the different meso-level contexts (e.g., organisations, professional groups, networks), how action plays out in these settings (e.g. in terms of culture, strategic decisions, expectations of staff, incentives, rewards) and how this changes over time”
- “Consider the individuals (e.g., clinicians, managers, service users) through whom the eHealth innovation(s) will be adopted, deployed, and used”

- “Consider the eHealth technologies, the expectations and constraints inscribed in them (e.g., access controls, decision models) and how they ‘work’ or not in particular conditions of use”
- “Use narrative as an analytic tool and to synthesise findings”
- “Consider critical events in relation to the evaluation itself”

The different approaches represented by each of these four articles reflect the difficulties in creating an effective evaluation of an eHealth intervention. However challenging, as greater investment is made in eHealth even greater attention to evaluating its impact on health outcomes and the relevant cost implications must be made. Organisations such as IDRC, which focus on the cross section of practice and research, will need to take a stronger leadership role in defining the types of research needed to support the assessment of impact and inform scale and sustainability.

Among the IDRC projects, evaluations are being integrated to ensure a richer understanding of what happens during projects – an indication that emphasis is being placed on standardized evaluation within IDRC projects. For example, most of the projects follow a Utilization-Focused Evaluation (UFE) approach where by the intended users and intended uses of the findings guide the entire evaluation process. One example of a UFE approach in action is the OASIS II network. The evaluation process underway has identified the different project leaders within the network as the primary intended user group, as such, it is this group of individuals that play critical roles in defining the study, engaging with the evaluator throughout the data collection, analyses, formulationg findings and facilitating use of these findings. The PANACeA project is in the latter stages of a UFE study to determine how the project supported networking and capacity building across the multi-country research network. There are project-specific evaluations planned within each of the multi-country research projects. These evaluations will draw on the KDS framework³.

Within the eSAC project, a developmental evaluation approach, which adheres to all of Greenhalgh and Russell’s Top 10, will be conducted. The developmental evaluation (DE) approach, applicable to all the elements of eSAC will involve evaluation expertise and engagement with a broader DE Community of Practice.

³ The Khoja-Durrani-Scott (KDS) framework for eHealth evaluation was established based on the analysis of different evaluation theories to identify the factors and stages of evaluation most applicable to eHealth. The framework is a matrix which plots 7 themes of eHealth evaluation (i.e. health outcomes, technology outcomes, economic outcomes, behavioral and socio-technical outcomes, ethical outcomes, readiness and change outcomes, policy outcomes) by four stages of eHealth planning (i.e. development, implementation, integration, sustained operation). The framework was evaluated by researchers from 12 countries across South and Southeast Asia and is currently being used to evaluate the eHealth projects supported by the PANAcEA Network.

7. Evaluation Findings

Section Summary

- **Health Research Outcomes:** 48% of projects evaluated used an eHealth solution to tackle a specific health challenge (e.g. HIV/AIDS). The remaining focused on broader health systems strengthening. Majority of projects used a mixed methodology, and reported on process improvement versus health outcomes.
- **Policy-related Outcomes:** 92% of projects mentioned “policy” in project documents, however the substance of frequency varied between four domains: suggesting potential policy activities, suggesting policy changes, concrete policy activities and outcomes and after-thought and assumption
- **Strategic Partnerships and Networks:** 76% of projects reported an average of 5 partners, most of which were NGOs or academic institutions. Overall, IDRC grantees partnered with 80 organizations from Africa, LAC and Asia.
- **Capacity Building Outcomes:** 100% of projects reported capacity building as a primary objective or activity. Workshops were the most common capacity building activity, used to train workers on technology tools, research methods or software development and design
- **Technology Outcomes:** 60% of projects reported developing and/or implementing an eHealth technology. Users found the solutions to facilitate collaboration and clinical diagnosis and to be useful, reliable, time-saving, cost-saving and usable.
- **Publications and Conference Presentations:** Based on the quantitative survey, 44% percent of grantees published 1-2 manuscripts in open-access (OA) peer-reviewed academic journals, 44% published 1-4 manuscripts in non-OA peer-reviewed, and 11% published one manuscript in non-OA non-peer-reviewed journals. Ninety-nine percent of respondents indicated presenting at least one time at a regional conference.

This section of the report is the most critical as IDRC reflects and learns from the past five years of eHealth programming. It is largely based on an intensive review of IDRC grantee proposals reports and other project-related documents, a complementary quantitative

survey⁴ completed by IDRC grantees, a usability survey⁵ completed by users of IDRC-sponsored software, along with outputs from the lessons learned workshops and key informant interviews. The section has been organized by key outcome- and output-oriented thematic areas identified at the outset of the evaluation. These were identified as critical areas to examine to comprehensively landscape the scope, scale, achievements, challenges, and learning exhibited by IDRC itself and its grantees. Thematic areas include Health Outcomes, Policy-related Outcomes, Strategic Partnerships and Networks, Capacity Building, Technology, and Publications and Presentations. These areas were defined based on the evaluators experience working with eHealth projects and discussions between the evaluators and IDRC regarding the most important areas of study and interest for the organization.

During the three Lessons Learned Workshops and through the documentary review and surveys, grantees reported on what they perceived to be the most significant outcomes of the projects and related research that they undertook. The following is a snapshot of these some of these outcomes.

According to the quantitative survey, respondents estimated 8,846,601 people impacted by their collective projects. Fifty percent of respondents indicated securing additional funding. Additional funding was secured from the Rockefeller Foundation, the European Union, IDRC, CDC, PEPFAR, among others. Over \$7.3 Million CAD was reportedly secured in additional funding.

The quantitative survey was implemented using Survey Monkey during October through November 2010 in which 19 respondents representing 18 projects were invited to answer 45 questions defining five main domains. These domains were Partners and Networks, Capacity Building, Technology, Health Outcomes, Policy, and overall project Outcomes. Respondents were selected based on their role as Project Leader on past and/or current IDRC-funded eHealth grants. Sixteen were able to complete the survey yielding a **response rate of 84.2%**. The survey aimed to complement a broader evaluation of different eHealth projects supported by IDRC in the last five years. Some results are estimates and not necessarily definitive. Demographic categories are reported as proportions. The statistics and graphs below show the overall results of the survey and where appropriate comparisons have been made between completed projects and those still in progress.

Projects in the Asia region specifically reported IDRC funding leading to attracting additional financial resources, in comparison to projects in the LAC region, which reported IDRC

⁴ Results from the quantitative survey are based on responses from 19 of the 25 projects in the evaluation. In some cases, analysis of only completed projects is presented, which represents 9 of the 25 projects in the evaluation. In these cases, the authors have explicitly stated the difference in the text.

⁵ The usability survey is based on responses from 17 of the 24 individuals identified as candidates by project leaders

funding attracting additional resources (e.g. mentorship, staff). While a few projects in the Africa region have successfully attracted additional funding to expand projects. Nevertheless, this was not reported as a significant outcome, but rather as a challenge.

All regions reported a deeper understanding of the local context and realities as a significant outcome of their research. Grantees consistently expressed the necessity to understand the social and political issues of the context to successfully implement an eHealth solution. Many were thankful and excited for having the opportunity to conduct research that would specifically be relevant to and impact the region they worked in.

7.1 Health Research and Related Outcomes

All eHealth research is ultimately focused on contributing evidence and knowledge on using technology as a tool and to help solve a health challenge. Twelve projects under this review used eHealth tools for one or more specific health areas such as HIV/AIDS, Maternal Health, Community Health or Chagas Mazza. Of these, HIV/AIDS was by far the most common health issue address by projects (5). The remaining 13 projects focused on more general health systems strengthening through activities such as regional mapping, landscape analysis or creation of an eHealth network or on developing technologies or applications that are applicable to broad health systems.

Measurement of Health Outcomes

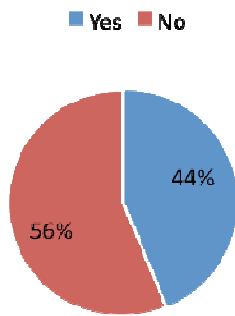


Figure 7: Number of projects measuring health outcomes (quantitative survey)

Projects reporting improved health outcomes as a significant outcome were sparse across all the regions, and overall, small in impact. For instance, one project reported influencing five HIV-positive pregnant women to deliver at a hospital, in comparison to home, for improved and safer care. While relevant and representative of preliminary results, IDRC has to consider cost-benefit of its investments. However, the projects have brought forth a number of useful lessons and insights into designing and implementing eHealth solutions, which will inform and equip future projects with the capacity to more attentively focus on this objective.

Over 50% of the eHealth projects funded by IDRC utilized mixed methodologies to implement their research studies. One project had a randomized clinical trial, while a handful of others had a case control study design (including many of the sub-projects within the overarching PANACeA project). Four had a systematic and literature review component with complementary key informant interviews. Only four had a stated sample size in their project documentation. Almost half (12) of the projects funded by IDRC disclosed a health outcome focus with the majority specifying HIV/AIDS or EMR (?). Most of the literature and systematic reviews focused on infrastructure assessments to contribute to feasibility assessments and evaluation. Furthermore, the majority of the program implementation

and intervention evaluation focused on process improvement and its potential impact on health outcomes and overall quality of care. Ten projects reported having met their objectives (with the caveat that not all are completed yet) and have disseminated their findings in conferences, publications and meetings.

Although, increasingly becoming one of the most critical areas for health research, only 44% percent of quantitative survey respondents indicated measuring health outcomes. HIV/AIDS was the most common health outcome measured as reported by the respondents. Other health outcomes-focused project examined TB, Safe Motherhood, and visual impairment. Methods of evaluation and metrics for health outcomes included mortality rates, quality improvement, cost-benefit analysis and clinic visits.

7.2 Policy-related Outcomes

Projects reported influencing policy outcomes in the region to varying degrees. In Africa, strategic eHealth policy decisions have been influenced, such as the decision to expand a program nationally. In comparison, policy outcomes in the Asian and LAC regions have included increased collaboration and engagement with government authorities, and a commitment to consider project findings in national health information and/or health system strategies.

When we talk about creating peer-to-peer networks, it assumes that those networks do eventually exist and are sustainable. The IDRC has been funding some of those networks, including the OpenMRS community and other things. The funding the IDRC has been providing has been quite synergistic of what we've been trying to do in terms of our guidance. They've been providing some of the gasoline to make that happen. So that's been essential.

-Chris Bailey, WHO

There was a wide range of policy-related activities, tools, and research reported by the 25 projects. Only two projects made no mention of policy in their project documents. Nine of the 25 projects include policy as an ancillary component of the project or as an afterthought, without any specific policy-related activities or objectives. These projects make statements such as "findings will help inform policy", but do not mention any specific policy-related activities, outputs, outcomes or results, making it difficult, or at times, impossible to understand the true policy implications of the project. The PANACeA network was found to include "policy" as a key cross-cutting consideration (with dedicated resources) for the organization. This helped to ensure policy considerations were taken into account across the lifecycle of the projects the network supports. Although the outcomes of the network's policy objective are mixed, this commitment demonstrates that the network recognizes policy as a cross-cutting and persistent thematic area, versus a consideration at the beginning or end of a project.

Eight of the 25 projects have specific policy activities, outputs, or outcomes. See Table 5 in Appendix K for a list of policy tools and documents. This list of tools and documents range from specific policy-related documents and policy briefs, to activities or policy-related research questions. One common theme was related to policies within the healthcare system that impacted the implementation of the eHealth technology project. Two projects found that the implementation of eHealth technologies required a

review of the policies that designate health care provider responsibilities, their ability to provide certain aspects of care and to collect data on that care. Policies that would allow greater responsibilities to lower-levels of health care providers to treat and collect data would free-up bottlenecks and allow for much wider reach of the eHealth technology and resultant access to care.

Types and Quantities of Policy-Related Activities

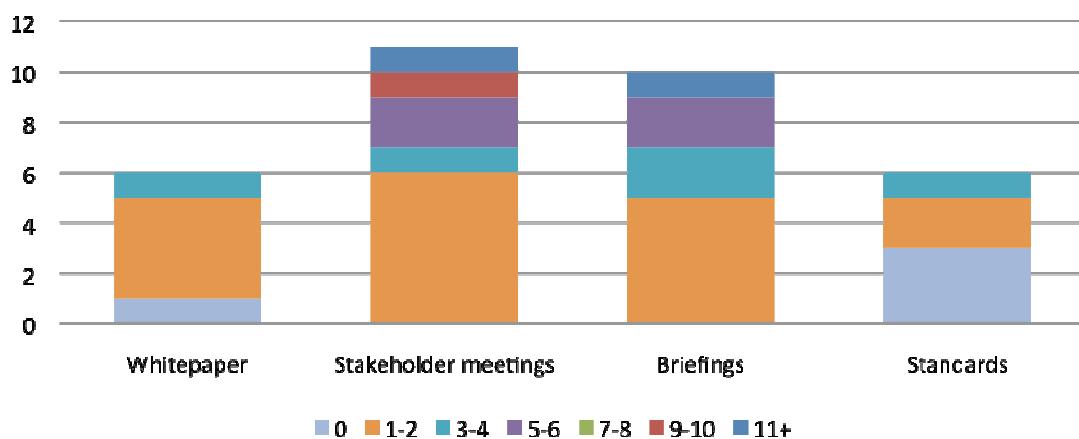


Figure 9a: Types and quantities of policy-related activities (quantitative survey)

Another pair of projects found a need to review and suggest changes to policies related to electronic medical record reporting data elements or sharing of EMRs between health facilities. The introduction of new eHealth tools must fit the needs and strategy of the health system, but at the same time require a review of the policies constraints that may hinder or block the implementation of the technology. The resulting reports and information from new eHealth data collection tools must be useful at the decision-maker and policy level. Three projects suggested documenting the experience of working with the government agencies and decision-makers as a lessons learned tool for broader applications. The documentation of policy-level relationships and experiences seems to be an area that many projects could include and learn from but an output that is not usually planned or budgeted.

Two thirds of respondents from the quantitative survey reported producing policy-related outputs. All reported producing up to four whitepapers. All reported holding stakeholders meetings, 60% indicated holding 3 to 6 meetings and 40% indicated holding nine or more. All reported holding briefings, 80% indicated holding 1 to 6 briefings and 20% indicated holding eleven or more. Two thirds reported establishing up to four standards. All completed projects reported producing up to four whitepapers compared to only 50% of projects currently being implemented. All reported holding stakeholders' meetings, completed projects have had at least three, whereas, all projects currently being implemented reported having 1 to 2 stakeholder meetings. There is no difference in the number of briefings between both groups of projects. Two thirds of completed projects

compared to one third of projects currently being implemented report establishing standards.

Africa

Uganda Health Information Network has become a part of the countries National Health Information System Strengthening Team to inform policy on eHealth. Influenced the MOH to hire staff focused on developing eLearning materials

Asia

Founding of the eHealth Association of Pakistan, the first organization of its kind in the country focused on leading the eHealth policy dialogue

Latin America and Caribbean

Recognition from the Peruvian, Bolivian and Mexican government for the implementation of the Punto J online platform, leading to collaboration amongst the offices

Figure 9b: Examples of policy outcomes catalyzed by IDRC funding from each region

7.3 Strategic Partnerships & Networks

The documentary review illustrated that engaging in varied partnerships with NGOs, governments, universities and the private sector are critical for execution of IDRC-funded and general eHealth activities. In the 25 projects reviewed, 19 projects reported partners with close to 80 organizations throughout all sectors in Africa, Asia, and LAC. On average, projects engaged with five partners, with a preference for non-governmental and academic institutions. OASIS II reported 15 partners, the highest of all the projects evaluated.

Based on the quantitative survey, 40% of the respondents indicated engaging with industry partners, 93.6% indicated having academic partners, 80% indicated having NGOs as partners, 77.8% indicated having government partners, 80% indicated having Ministry of Health partners, 44.4% indicated having Ministry of Science and Technology, 30% indicated having Ministry of Information and Communication, and 45.5% indicated having Community Based Organizations as partners in their projects. No respondents indicated having Faith Based Organizations as partners in their projects (See Figure 10).

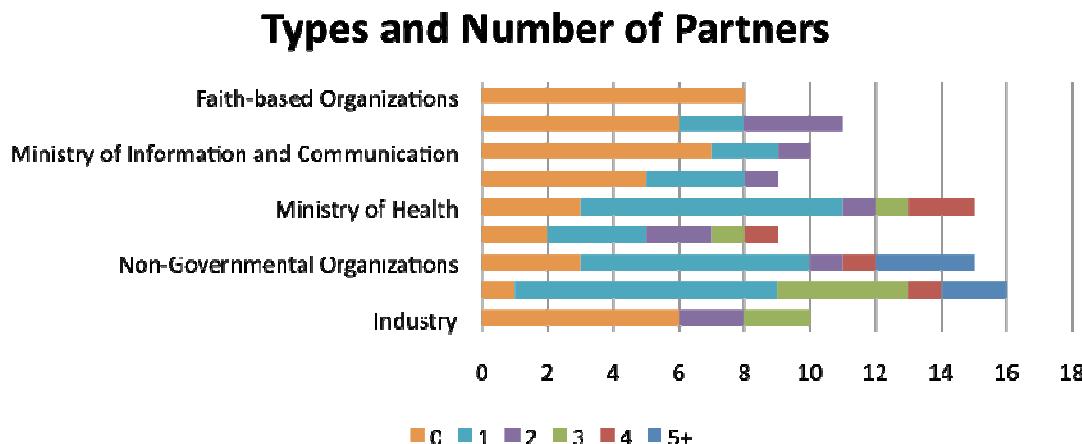


Figure 10: Types and number of project partners (quantitative survey)

Both complete projects and those in the implementation phase showed no difference in the types and number of partners. There was a general trend in both groups to have more academic partners than any other type, 70% reported by completed projects and 55.6% reported by projects currently being implemented.

All respondents provided information on the types of activities engaged by one or more of their networks. Of those that answered, all engaged in convening network meetings, defining a common agenda, collaborating on technologies, providing access to decision makers, access to resources, and convening capacity building workshops. Fifty-six people were reported to have received funds through these networks. Thirty-two people were reported to have received funds through these networks in completed projects compared to 24 people in projects in the implementation phase. Eighty percent of the networks reported that they provided mailing lists. There were no major differences in the types of network activities between completed projects and those in the implementation phase.

7.4 Capacity Building

Capacity building was reported as a significant outcome by projects regardless of region. IDRC funding has led to building organizational capacity, human resources capacity, and partner and stakeholder capacity. In the Africa region, many of the capacity-building outcomes reported were focused on training community health workers on various eHealth solutions. Although projects in the Asia and LAC region reported similar outcomes, internal organizational strengthening, in terms of working with international organizations refining financial management systems and improving research skills, was more strongly reported by projects in these regions.

All 25 projects included in the evaluation had capacity building as a key objective or activity. Reported support activities and trainings included everything from hands-on use of mobile devices for data collectors at the village level, to the use of the data at the Ministry of Health and decision-making levels, to training cadres of technology experts to design and create health information systems.

The majority of activities related to these three capacity building themes were conducted in the Africa region. Likewise, cooperation with local universities and incorporation of training programs into university courses or departments also occurred in Africa.

Based on the quantitative survey, nearly 89% of respondents reported engaging in capacity building activities. Over 88% implemented workshops; over 82% implemented tools, 47% developed manuals and provided mentoring, and over 17% provided certifications.

Half of the respondents indicated providing training materials in print form. Twenty-one percent reported one training manual and 14.2% reported developing five or six manuals. Fifty percent reported developing teaching aids in print; 12.5% reported developing 4 teaching aids and 12.5% reported developing seven or more. Forty percent reported developing six or more course materials. Fifty percent developed 5 or more testing materials. Forty-three percent of respondents reported developing demo use cases; 35.7% reported one to three demos developed and 14% reported developing six or more.

Capacity building themes

1. The use of mobile devices or eHealth technology to improve the knowledge and skills of front-line health providers or educators.
2. Building capacity for in-country specialists to conduct quality eHealth, HIS, and mobile technology research.
3. Building capacity for in-country specialists to design, develop, program, and maintain HIS and mobile technology devices and software.

Capacity Building Statistics

- Respondents reported **1462 individuals trained** through their collective projects. Ninety-three percent of respondents reported having one or more training workshops with nearly 43% reporting seven or more.
- Over 45% of respondents reported having one or more training courses. Over 44% reported one or two and 11% reported having seven or more.
- Seventy-seven percent of respondents reported having one or more mentoring with over 53% reporting seven or more.
- Fifty-four percent of respondents reported training through eLearning with 22% reporting six or more eLearning trainings.
- One third of respondents reported training through continued medical education with 22% reporting seven or more.
- One third provided training through distance education with all of them reporting seven or more.
- Over 63% of respondents reported training through conferences with 36% hosting one or two and 9% hosted seven or more.

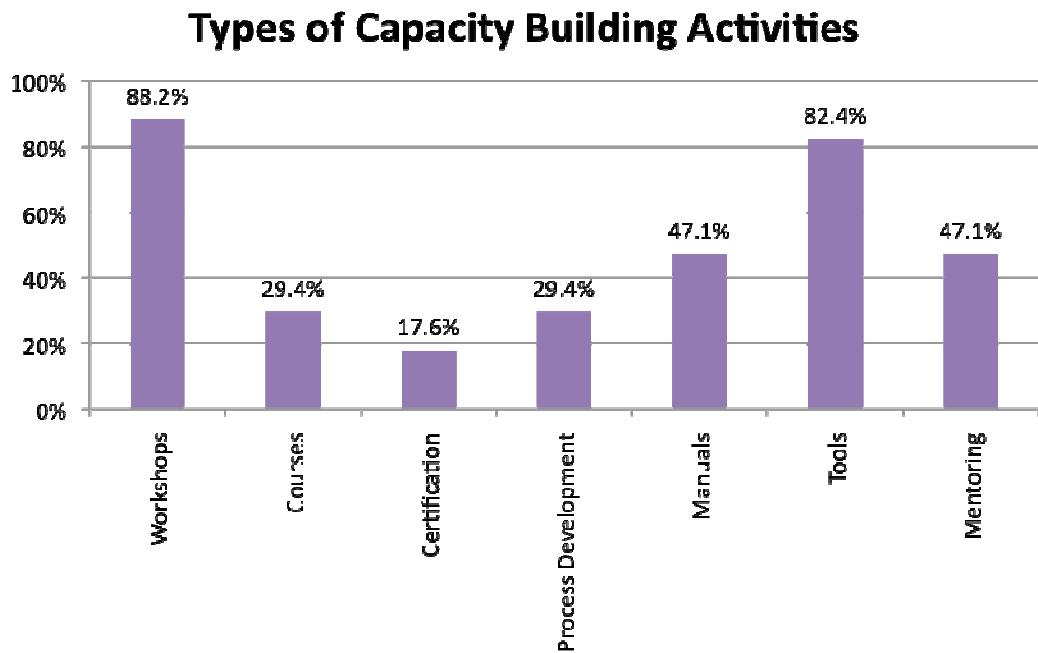


Figure 11: Types of capacity building activities (quantitative survey)

Fifty percent developed digital manuals 8.3% developed six. Forty-two percent of respondents developed digital course materials 25% developed seven or more. Fifty percent developed Wikis with 40% developing only one. One third developed eLearning software and 11% developed seven or more. None developed mLearning software.

Nearly 78% of respondents reported engaging in capacity building activities in completed projects compared to 100% of projects currently being implemented. More completed projects developed workshops (100% vs. 77.8%, respectively), whereas, more projects currently being implemented developed tools (88.9% vs. 75%, respectively.) Completed projects trained more people than projects currently being implemented. More completed projects implemented training workshops than projects being implemented (n=8 vs. n=5, respectively); interestingly, a greater percentage of projects being implemented carried out workshops than completed projects (100% vs. 89%, respectively). There was no difference in the percent of training courses conducted between both groups of projects. More projects in the implementation phase conducted mentoring and eLearning and conferences than completed projects. More completed projects conducted continuing medical education and distance education than projects currently being implemented.

One half of the respondents indicated providing training materials in print form. There was no difference in the number of course and testing materials produced between completed projects and projects currently being implemented. More manuals, teaching aids, and demos use cases were developed by projects currently being implemented compared to completed projects. More projects currently being implemented than completed projects developed digital manuals. On the other hand, more completed projects developed digital course materials than projects currently being implemented. There was no difference

between both groups of projects with regard to the development of Wikis and eLearning courses. Neither group developed mLearning software.

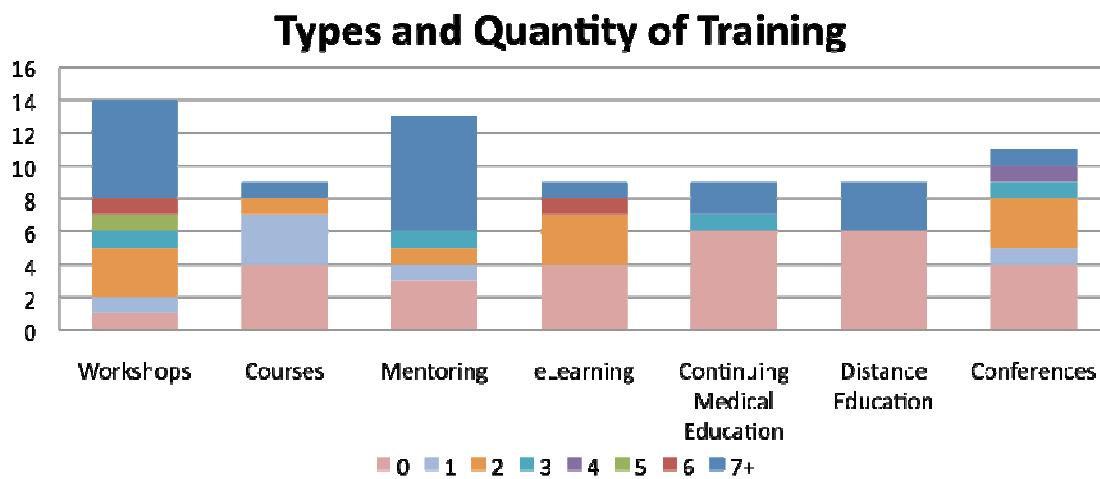


Figure 12: Types and quantities of training activities (quantitative survey)

7.5 Technology

Across regions, IDRC grantees have acknowledged the organizations willingness to support research teams to assess, design, develop and test new and innovative eHealth solutions. Software and systems have been developed to support a variety of health system needs, including: patient registration and tracking with electronic medical records, disease surveillance to predict potential threats, decision support to improve patient, mobile health for data collection and health promotion, and eLearning to increase capacity of health professionals and improve accuracy of diagnosis.

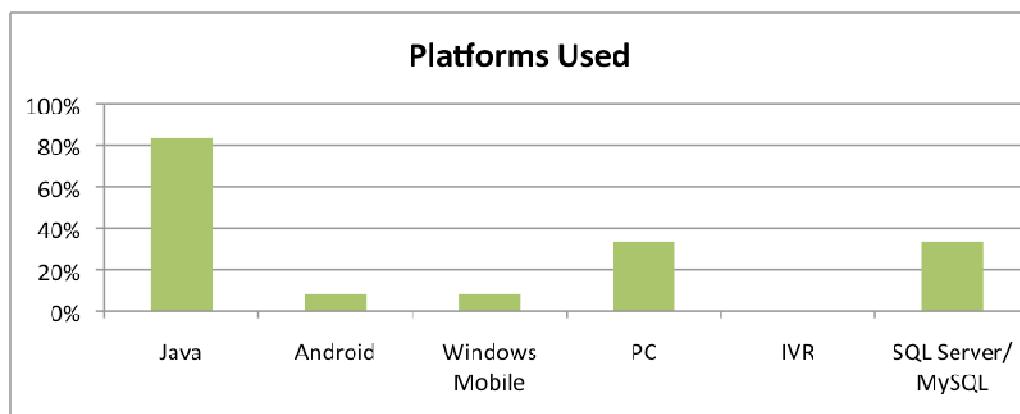


Figure 13: Types of software platforms used in projects (quantitative survey)

The estimated number of users of the developed and/or expanded functionality of hardware, software and/or technology-related applications implemented is **1770**.

The estimated number of individuals impacted by the developed and/or expanded functionality of hardware, software and/or technology-related applications implemented is **2,784,150**.

Software developed in the Africa region has been found to be more technically advanced and integrated into national health information systems, in comparison to Asia and LAC, which have been more focused on low-tech solutions (e.g. SMS health promotion) and internal and external capacity building. IDRC has supported projects such as Uganda Health Information Network (UHIN) and Open Architecture Standards and Information Systems through multiple phases of growth and development, which may account for this discrepancy between regions.

In speaking with external key informants in the eHealth sector, it was found that for those who were familiar with IDRC's work they referenced projects and researchers in the Africa region. This might be explained by the fact that funding for projects in Africa started earlier and are overall larger in size compared to the Asia and LAC regions. Concrete information describing the types and specifications of technology were not easily extractable from the documentary review. However, both the quantitative survey and the usability survey provide a detailed picture of the perceived impact, outcomes, and outputs related to IDRC's technology-related investments in eHealth.

According to the quantitative survey 82% of respondents reported developing and/or implementing hardware, software and/or technology-related applications. Over 84% implemented open-source applications. Over 85% percent reported the ability to download the application for free. Over 83% of respondents report developing the application for Java, one third developed applications for PC, 16.6% reported developing Windows Mobile or Android applications.

The majority of projects reported using HL7 data standards⁶. Respondents also reported using xForms⁷ and emergency data exchange language. Respondents report accounting for health information security and privacy by de-identifying and encrypting data.

⁶ Health Level Seven International (HL7) is the global authority on standards for interoperability of health information technology with members in over 55 countries. HL7 is one of several [American National Standards Institute \(ANSI\)](#) - accredited Standards Developing Organizations (SDOs) operating in the healthcare arena. Most SDOs produce standards (sometimes called specifications or protocols) for a particular healthcare domain such as pharmacy, medical devices, imaging or insurance (claims processing) transactions. HL7's domain is clinical and administrative data.

⁷ XForms is an XML format for the specification of a data processing model for XML data and user interface(s) for the XML data, such as web forms. XForms was designed to be the next generation of HTML / XHTML forms, but is generic enough that it can also be used in a standalone manner or with presentation languages other than XHTML to describe a user interface and a set of common data manipulation tasks.

More completed projects reported developing and/or implementing hardware, software and/or technology-related applications than projects currently being implemented (88.9% vs. 75%, respectively). There was no major difference in the implementation of open-source applications or the ability to download the application for free between both groups. There were no differences in the development of Java or PC applications between both groups of projects. One completed project reported developing Windows Mobile and one project currently being implemented reported developing Android applications.

"The results were very interesting based on the use of tools adapted to low bandwidth and less energy consumption.

We have understood that the most advanced technologies are *not* a requirement or prerequisite for e-health and with little means a lot of the goals are achievable.

- Dr. Cheick Oumar Bagayoko

Completed projects reported benefiting a greater number of people compared to projects currently being implemented (2,743,150 vs. 41,000). The estimated number of users of the developed and/or expanded functionality of hardware, software and/or technology-related applications implemented was greater in completed projects than projects currently being implemented (1250 vs. 520). There was no difference between both groups of projects regarding data standards and health information security and privacy.

7.6 Results of the Usability Survey

A usability survey was implemented using Survey Monkey in December 2010. Twenty-four individuals were invited to participate of which 17 were able to complete the survey giving a 71% response rate. Evaluation of software platforms and applications consisted of ranking of perceptions on a five point (Likert scale) and multiple response questions. Mean scores are reported when available and demographic categories are reported as proportions. The graphs below show the overall results of the survey.

The indicated software platforms or applications included eHealth Safe Motherhood, EpiSurveyor, HMIS, and ODK Collect. Reported uses of the software platforms or applications include:

1. Support to community health workers
2. Adult and pediatric HIV care and treatment
3. Maternal care delivery
4. Pediatric and perinatal referrals and care
5. Health care delivery (ePrescriptions)
6. Health surveillance
7. Monitoring and evaluation
8. Data collection
9. Market research
10. Access to information
11. Medical information entry at point of care
12. Data registry
13. Activity reporting
14. Spatial distribution of data

The majority of the respondents indicated using OpenMRS, JavaRosa, or mHealth survey accounting for 65.1% of the sample.

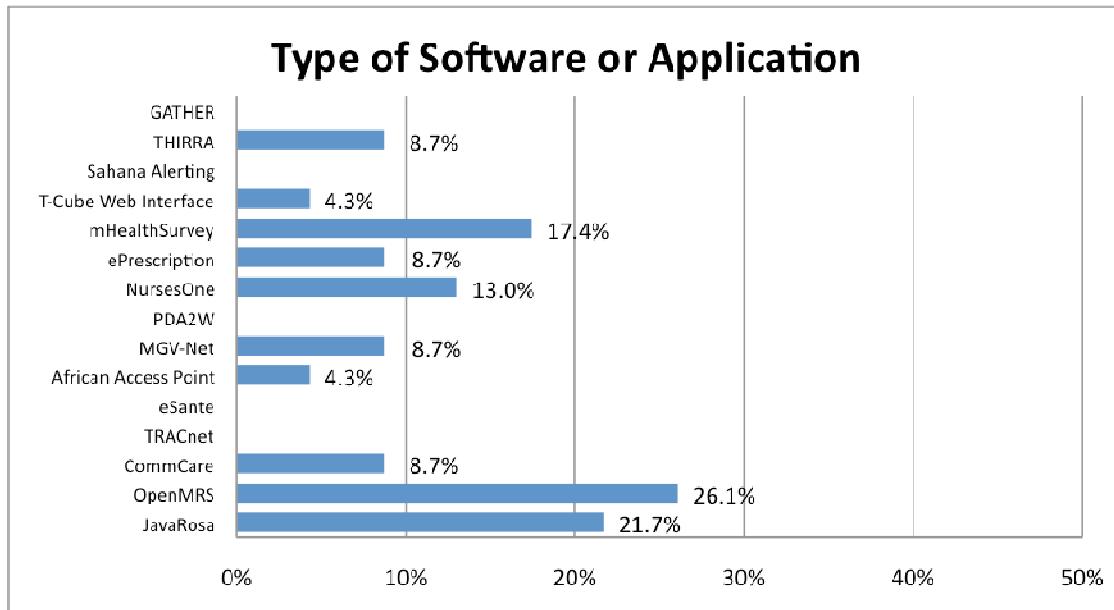


Figure 14: Types of software or applications used in projects (usability survey)

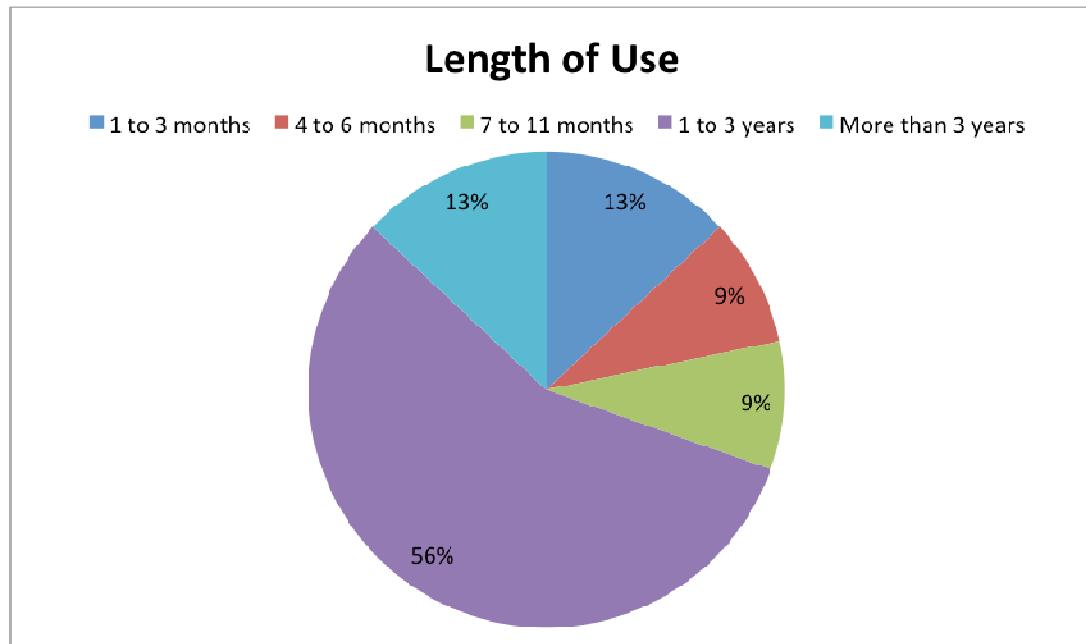


Figure 15: Average length of time software of application used in projects (usability survey)

The majority of respondents indicated using the software platform or application for 1-3 years with only 13% having longer experience. Thirteen percent indicate novice experience, defined as 1-3 months experience. Approximately 18% have 4-11 months experience with their software platform or application.

Respondents were asked to rank aspects of particular software platform or application attributes from very low=1 to very high=5. All attributes ranked relatively positive. However, functionality, portability, affordability and reliability were ranked highest (4, 3.9, 3.7, and 3.7, respectively). Maintainability ranked the lowest at 3.2 followed by ease of learning at 3.4 and finally, efficiency and user interface at 3.6.

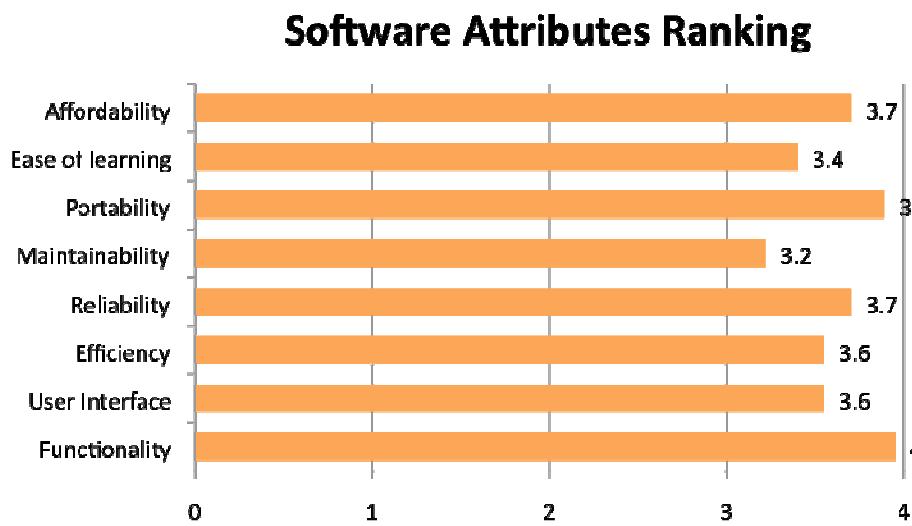


Figure 16: Ranking of software or application attributes (usability survey)

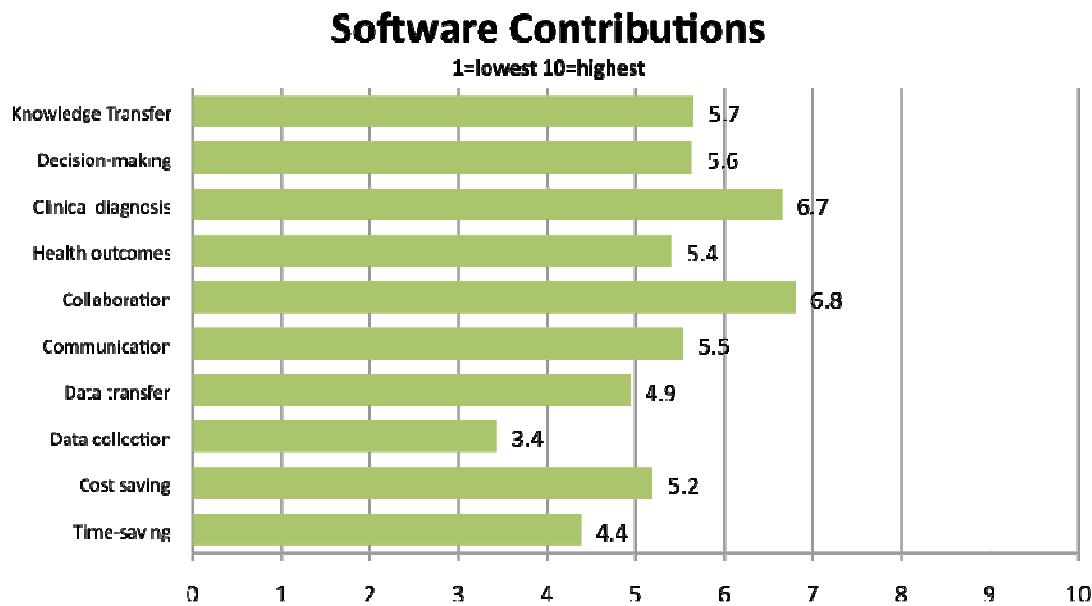
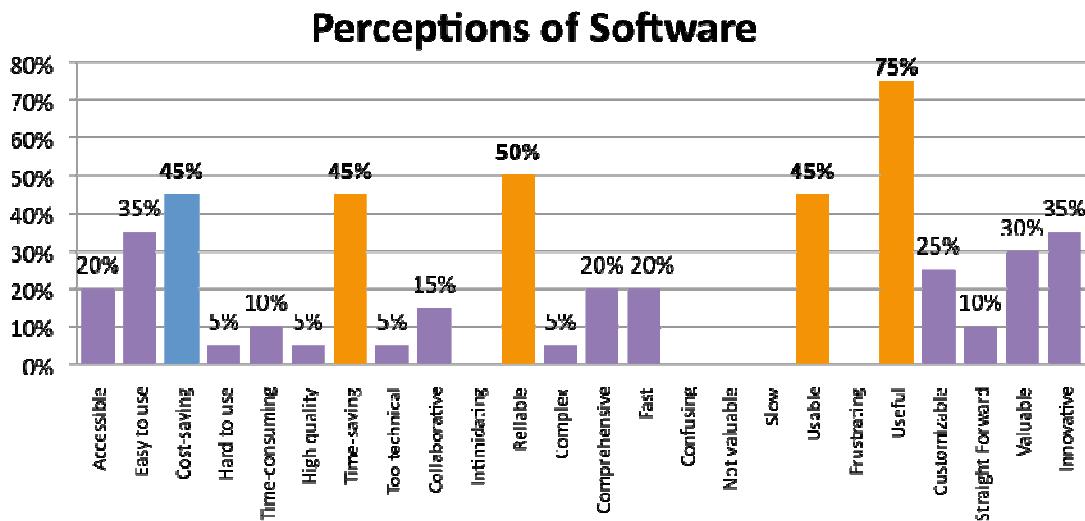


Figure 17: Contributions of software of applications to project (usability survey)



Respondents indicated the five most applicable descriptions of perceived qualities of the

Figure 18: Perceived qualities of software or application used in project (usability survey)

software platform or application used for their project. The five top attributes were **usefulness** (75%), **reliability** (50%), **time-saving**, **cost-saving**, and **usable** (all 45%). Moreover, 35% indicated that their software platform or application was easy to use and innovative. Approximately one quarter of the respondents found their software platform or application to be accessible, comprehensive, fast, customizable and valuable. No one attributed intimidating, confusing, not valuable, or slow to their software platform or application. In addition only 5% of respondents indicated that their software platform or application may be hard to use, too technical or complex. Only 10% indicated that the software platform or application may be time-consuming and 15% indicated that it was collaborative.

Respondents evaluated the contributions of their software platforms or applications to key project components. The highest ranking was the ability for collaboration followed by clinical diagnosis (6.8 and 6.7, respectively). Moderate contributions of software platforms or applications were seen in knowledge transfer, decision-making, communication, health outcomes, and cost-saving. The weakest contribution of the software platform and applications was data collection followed by time-saving and data transfer, respectively.

The implementation process was shown to be relatively positive. Respondents rated overall value and positive change at 3.9 out of 5 (See Figure 19). Furthermore, training was not perceived as difficult and moderately challenging.

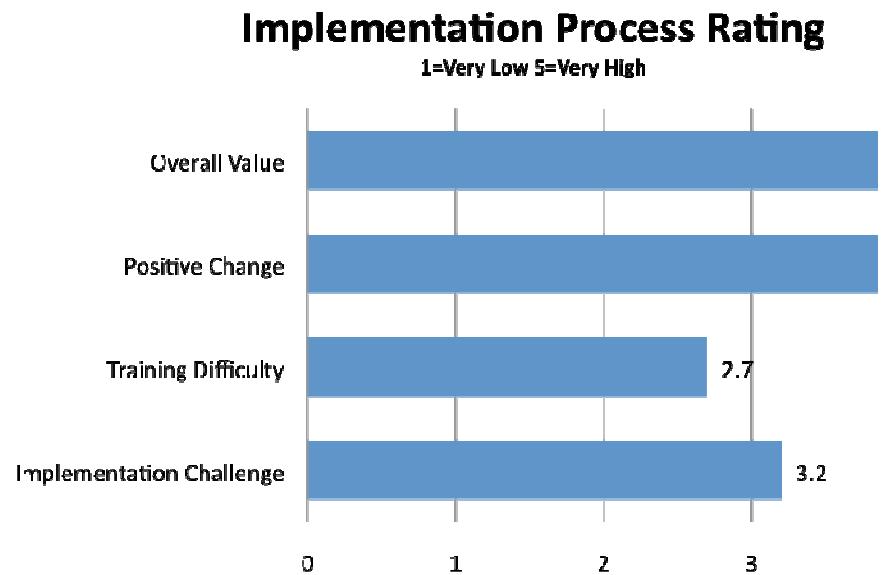


Figure 19: Rating of software or application implementation process (usability survey)

Workshops, electronic user guides, and online user support tools are the most common available training materials as indicated by the respondents. Certification and mLearning training software were the least common training materials available to the respondents.

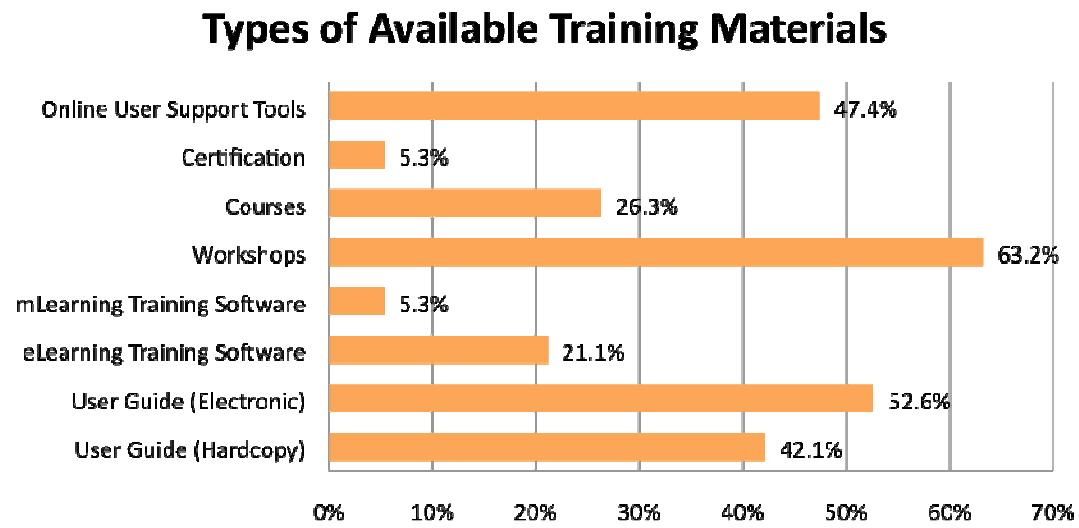


Figure 20: Types of available training materials for software or application (usability survey)

The highest ranking support response was having questions answered followed by organizing in-person networking and addressing usability bugs. Supporting maintenance and implementing suggestions ranked lowest at 3.5.

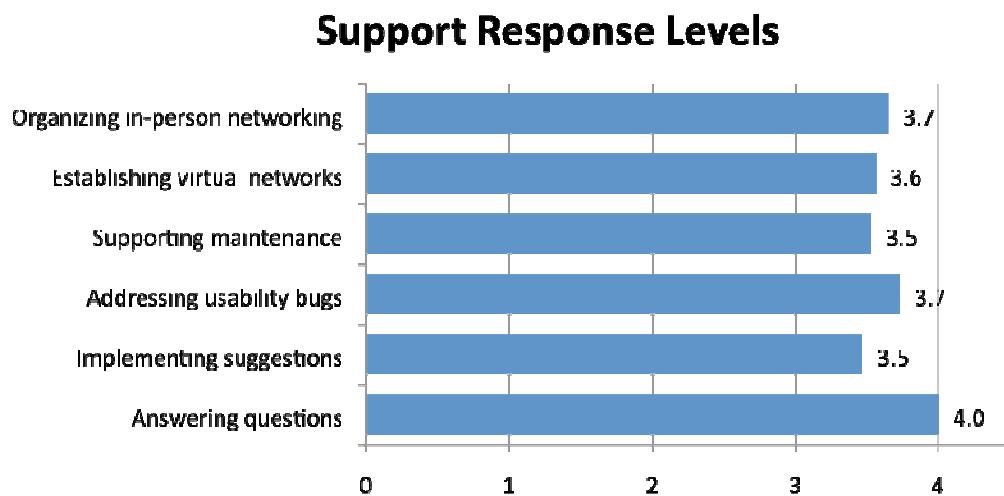


Figure 21: Rating of support response levels for software or application (usability survey)

Respondents overwhelmingly indicated email support as another type of support for their software platform or application. Online chats and workshops were indicated as other common types of support. Less than 16% indicated using a feedback form as a means of support. Approximately one fifth of the respondents indicated utilizing telephone support, local and international IT staff, and FAQs.

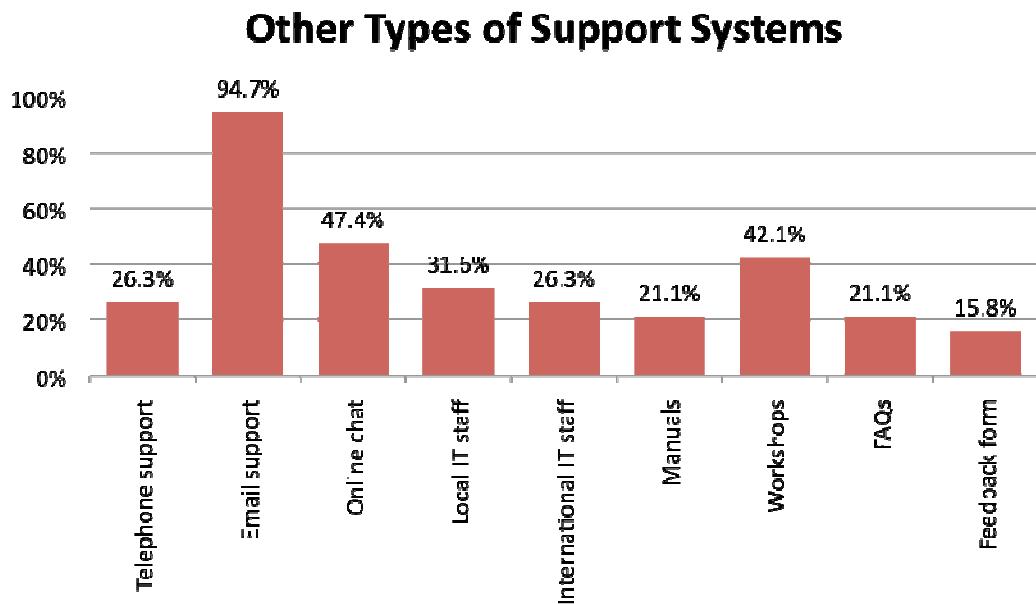


Figure 22: Other types of support systems for software or application (usability survey)

Strengths of software platform or applications include impact in the following ways:

1. Notification system
2. Data collection
3. Real-time submission of data
4. Ease of Use
5. Flexible
6. Positive results
7. Accessibility to information
8. Identifying patients lost to follow up
9. Tracking perinatal patients and pediatric immunizations
10. Generating reports
11. Stakeholder buy-in

7.6.1 Usability Survey Recommendations

1. Users indicated a greater need for learning and training
2. Better user interface
3. Affordability
4. Better systems integration
5. Better internet access in rural areas
6. Better network reliability
7. Better synchronization of data
8. Increase community health worker computer literacy

7.6.2 Recommendations for Improving Technology Support

1. More training
2. Better user guides
3. Forums for non-technical users
4. Better online support
5. Build regional teams
6. Online groups and forums
7. Quality control of packaged core modules

7.6.3 Recommendations to Future Users of software platforms or applications

1. Get appropriate training
2. Carefully choose phones
3. It is beneficial
4. Software is easy to learn
5. No need to reinvent mistakes, learn from previous users
6. Managing patient records and follow up
7. Adverse drug event alert system
8. Organize infrastructure support before adopting software
9. Maintain equipment regularly
10. Explore more opportunities for use of software

7.6.4 Novel Uses for software platform or application

1. Healthcare surveys
2. Integration with biosensors
3. Online real-time chat
4. Facilitation of clinical referrals
5. Primary care
6. Continuing medical education
7. Information sharing
8. Adverse drug event alert
9. Census data collection
10. Spatial analysis of collected health data

7.7 Publications and Conference Presentations

Projects in all the regions have led to creating increased awareness of eHealth. General trends indicate that in Africa, this meant awareness amongst higher authorities and government; in Asia this meant awareness amongst health providers and institutions, and in LAC this meant awareness amongst researchers and programming partners. Projects in each region have been not only featured in academic literature and conferences, but also mainstream publications.

Based on the quantitative survey, 44% percent of grantees who reported published 1-2 manuscripts in open-access (OA) peer-reviewed academic journals, 44% published 1-4 manuscripts in non-OA peer-reviewed, and 11% published one manuscript in non-OA non-peer-reviewed journals. Ninety-nine percent of respondents indicated presenting at least one time at a regional conference, 22% indicated eleven or more. All respondents indicated presenting at least one time at an international conference, 22% indicated nine to ten. Ninety-nine percent of respondents indicated presenting at least one time at an eHealth specific conference, 33% indicated nine to ten. Two thirds of respondents indicated presenting at least one time at a health specific conference, 22% indicated nine or more. Two thirds of respondents indicated presenting up to six times at a technology specific conference.

Media coverage & Public relations

78% of respondents indicated that they had at least one **newspaper article in local or national media** –one third indicated nine or more newspaper articles in local or national media

56% of respondents indicated having one or more **newspaper articles in global media** -11% indicated eleven or more newspaper articles in global media

One third indicated having **radio interviews in local media** -22% had 1-4 interviews and 11% had eleven or more local radio interviews, 45% respondents indicated having **national radio interviews** 33% indicated having 1-4 national radio interviews and 11% eleven or more national radio interviews

45% respondents indicated having one or more **blog posts** -22% indicated having nine or more blog posts

78% indicated producing one or more **project pamphlets** –two thirds produced up to 6 project pamphlet

The following table outlines the transferable documents created by the projects. A compilation of these documents can be used as a “tool-kit” for future projects to avoid reinventing the wheel and maximizing existing resources.

Document	Region/Country	Project	Status
Guidelines for HIV/AIDS clinical research and evaluation data collection system	South Africa	ACACIA_102411	Completed
Book chapters in Biosurveillance: Methods and Case Studies" (eds. Taha Kass-Hout), publisher - Taylor & Francis Group, LLC	India and Sri Lanka	PAN-105130	Completed
Documentation of lessons on capacity building	South Africa	ACACIA_106275	
Documentation of collaborative EMR work in a post-disaster situation	Haiti, post-disaster situations	CEA_106147	End of project Sept 2011
Documentation of lessons learned from innovative public eHealth initiative in LAC (toolkit, comparative analysis, best practices)	LAC	CEA_105798	End of project Jan 2013
Train the trainer manuals on utilization of the PDA network technology in the health care environment	Caribbean (Dominican Republic, Barbados, St. Lucia, St. Kitts-Nevis)	CEA_104544 Assess the role and impact of innovative ICTs in the Caribbean	End of project Jan 2011
Flowchart and toolkit and lessons learned for regional replication	Argentina, Bolivia, Brazil	CEA_103818 Chagas monitoring ICT project	End of Project Jan 2010, but seems they requested an additional year for completion...
Document on the Role of ICT applications in the prevention of HIV / AIDS	LAC	CEA_103814 - Use of ICT to engage youth in HIV/AIDS prevention	End of Project Jan 2010
"The potential of mobile telephony for the improvement of health services in Latin America and the Caribbean" ICA/IDRC/PAHO April 2008	LAC	CEA_103369 - regional mapping of mobile phone technology use for health	Completed
Documentation of global review of health information and medical privacy issues in developing country contexts	LAC, Africa, Asia	ACACIA_106115 Health information and medical privacy	End of Project Feb 2011
Documentation and evaluation of technical training program and software tools for scale-up and replication	Rwanda, Africa	ACACIA_105708 open access systems in Africa for eHealth	End of project Sept 2011
Documentation of the experiences, lessons learned, and suggestions for national capacity development and scaling-up of the initiative	Rwanda, Africa	ACACIA_104862 OpenMRS in Rwanda to track HIV patient care and follow-up	End of project not clear (According to May 2009 report, this output is in progress, no final report...)

Document	Region/Country	Project	Status
Training Software Developers for Electronic Medical Records in Rwanda	Rwanda, Africa	ACACIA_104862 OpenMRS in Rwanda to track HIV patient care and follow-up	Completed
Handheld computers for survey and trial data collection in resource-poor settings: Development and evaluation of PDACT, a PalmTM Pilot interviewing system, Int.J.Med.Inform.(2009)	Africa	ACACIA_101974	Completed
A systematic review of the use of telehealth in Asian countries, J Telemed Telecare 2009; 15: 175-18	Asia	PAN_104161	Completed
Scott RE, Khoja S, Ramos AJ, Cheah M, Dapaah KF, Elder L. A Pan-Asian research network for evidence-based adoption and application of e-health. J Telemed Telecare, 2007; 13 (Suppl. 3): S3108	Asia	PAN_104161	Completed
Case Study in: Wireless Technology for Social Change: Trends in Mobile Use by NGOs	Uganda	ACACIA_104819	Completed
Conceptual Framework for a Comprehensive eHealth Evaluation Tool	Asia	PAN_104161	Completed

Table 1: Transferable documents produced by projects

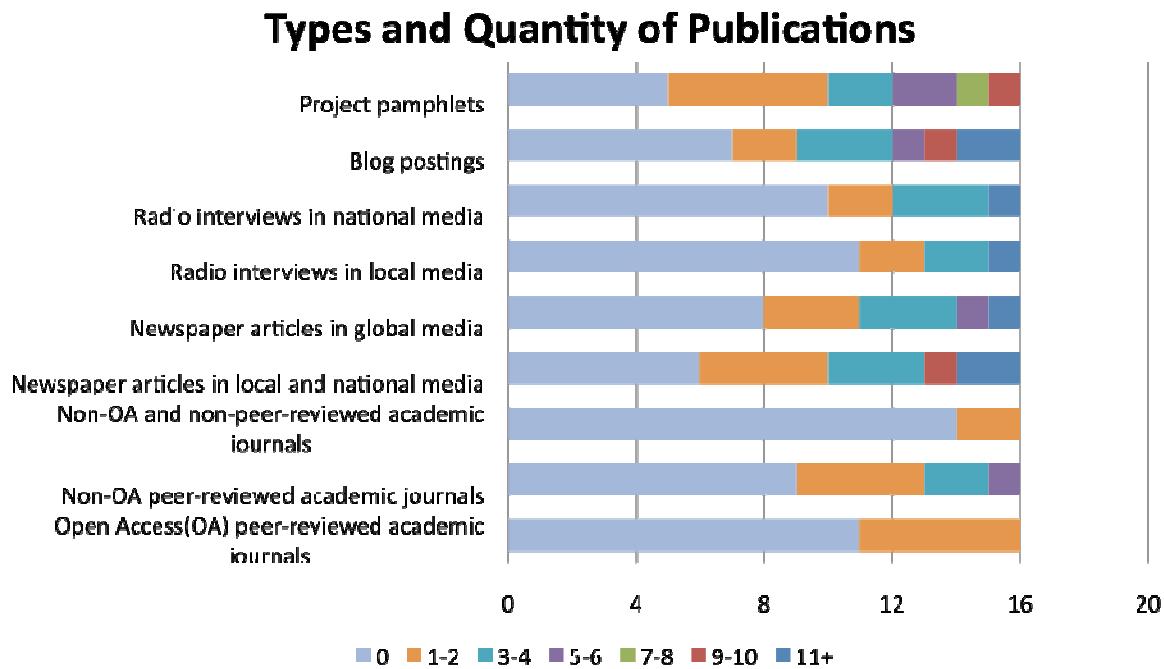


Figure 23: Types of quantity of project publications (quantitative survey)

More completed projects published 1-2 manuscripts in open-access (OA) peer-reviewed academic journals than projects currently being implemented (44.4% vs. 14.3%). There was no difference between both groups with regard to publishing in non-OA peer-reviewed journals, non-OA non-peer-reviewed journals, having one or more new paper articles in global media, or having radio interviews in local media. More completed projects reported having newspaper articles in local or national media (77.8% vs. 42.9%), having national radio interviews (44.4% vs. 71.4%), and project pamphlets (77.8% vs. 57.1%) than projects currently being implemented. A higher proportion of projects currently being implemented indicated having one or more blog posts than completed projects. No major differences were reported between both groups of projects with regard to presenting at regional, international, eHealth specific, or technology conferences. More completed projects reported presenting at health conferences than projects currently being implemented (66.7% vs. 42.9%)



Image 4: Project roadmap session at Lessons Learned workshop in Capetown, South Africa

8. Challenges

Section Summary

- Key challenges to eHealth implementation identified ranged from technical to operational to political and social

The following six major challenges were identified:

- **Technological:** Infrastructure and reliable networks; and the large time commitment required and difficulties developing software from scratch
- **Policy:** Lack of an enabling policy environment and frameworks and standards to facilitate scaling projects(were standards also discussed vis-à-vis interoperability??)
- **Project Management:** Coordination amongst project stakeholders and partners, that often live in different geographies and have multiple commitments
- **Funding / Finance and Administration:** Transferring funds from IDRC to projects, and from primary recipients to third-party recipients in alignment with project timelines
- **Local Context:** Lack of understanding of the social, culture and political dynamics that govern eHealth implementation



IDRC grantees throughout their reports as well as in the Lessons Learned Workshops provided insight into the key challenges that they face as they implement eHealth programs and related research. These challenges range from technical to operational as well as political and social. The following is a summary of major challenges as reported by IDRC grantees that ought to be taken into consideration for future programming as well as to inform strategic funding opportunities.

Image 5: Dr. Joaquin Blaya at Lessons Learned Workshop in Managua, Nicaragua

8.1 Technological Challenges

Infrastructure, alongside reliable and affordable network connectivity, is still cited as a challenge in all regions to implementing eHealth solutions. This is especially the case in rural and remote areas. In the African and LAC regions, the difficulty and time commitment to developing software from scratch was acknowledged as a challenge, noting the lack of existing applications that can be applied in multiple contexts. However, given that the costs of technology are continually decreasing, and there is increased competition and more support for open-source solutions, participants were confident that software and applications will become easier to develop and deploy, and increase the level of eHealth innovation.

8.2 Policy

The lack of an enabling policy environment for eHealth solutions was remarked by projects from all regions. Specifically, the lack of standards and frameworks threatened the ability for projects to achieve scale and sustainability in the long run. Many projects noted the challenge of securing government participation and commitment for continued presence and appropriation. Some stated that a network model (e.g. PANACeA) was the ideal way to lead eHealth policy efforts and represent interests across the region, however, there are a multitude of models that can be explored.

8.3 Project Management

The complexity of research teams funded by IDRC was a key finding in this evaluation. Project teams often consist of multiple stakeholders across multiple countries with leaders that have multiple professional roles. Consequently, coordinating amongst partners in different time zones, organizing face-to-face meetings, and maintaining dedication was a challenge cited consistently by projects in all regions. Participants in the LAC regional lessons learned workshop suggested a need for increased training and awareness of project management skills and collaboration tools. In the African and Asian regions, the lack of available local skilled capacity, ranging from management to software developers to community health workers was reported as a challenge to implementing health informatics projects.

8.4 Funding/Finance and Administration

The challenge of available funding on the ground in accordance with scheduled activities was reported by projects in the African and Asian region. Transferring funds from IDRC to research teams, and from the primary recipient to other network members, has especially been an issue for the PANACeA network and its partners. Projects in the African region, which are receiving funding from multiple sources, noted the challenge and additional time required to adhere to the different reporting requirements requested by donors. Increased coordination amongst

donors was suggested. Participants from the African and PAN-Asia region were found to also face barriers raising financing for implementation of solutions beyond the research component supported by IDRC.

8.5 Local Context

Developing a sound understanding of the local context was reported as a challenge by projects in the African and Asian regions. Oftentimes, it was found that the focus of the funding from IDRC was on technology development, versus establishing a solid understanding of the socio-cultural dynamics in which the proposed solutions were being deployed. Cultural issues such as disease stigma and language barriers were identified as specific challenges.

8.6 Research

Projects in the LAC region noted the challenge of designing a sound research project, specifically, how to find a balance between research depth and breadth in a way that still informs the evidence base in a meaningful way. Participants suggested engaging more institutions and disciplines to overcome this challenge, and continue to work towards developing a research culture in the region focused in measuring the health impact of eHealth solutions.

9. Lessons Learned

Section Summary

- Understanding the **socio-political context** of an project site is critical to implementing eHealth solutions and designing appropriate change management strategies
- While **partnerships** were found to be integral to the success of an eHealth implementation, partnership selection, early engagement and standardized reporting are important considerations to ensure effective and useful collaboration
- Promotion and support of developing **free and open source software** has been very important to advancement of the eHealth sector
- Institutional and organizational **capacity building** is the single most frequent and important area of project activities, outcomes, milestones, and challenges
- **Research** projects must balance the focus on technology development and implementation with a commitment to measuring the intended health outcomes of the intervention.
- **Partnerships** with government officials and policy makers should be established at the onset of the project, beginning with the development of the project proposal, to develop a trusting relationship and gain long-term support
- IDRC's "**Grant Plus**" **model** allows partners and managers to learn from challenges and respond to the true health, technology, cultural and political challenges on the ground with *workable tailored solutions*



Image 6: Lessons Learned session at workshop in Capetown, South Africa

The Lessons Learned Workshops gathered IDRC grantees from the African, Asian and LAC regions to reflect on what they learned from their experience implementing IDRC-funded initiatives. Overall, 38 participants attended the workshops, which took place in Cape Town, South Africa, Colombo, Sri Lanka and Managua, Nicaragua. This section highlights the major lessons learned as identified during these workshops

and complemented by data collected from the documentary

review and in the key informant interviews. Through the work of IDRC, many opportunities have been created for peer learning across regions and from the Southern Hemisphere to the Northern Hemisphere.

9.1 Understanding the Socio-political Context and Managing Change

Project implementers and managers found that a lack of understanding of the social and cultural factors affecting health and access to health systems poses challenges to implementing eHealth systems. Often the implementation of a new eHealth initiative will uncover new health challenges, such as the difficulty of managing stigma with HIV/AIDS test result data collection for pregnant women. Understanding these social, cultural and political dynamics can help understand the success or failure of eHealth initiatives.

Projects and implementers used a range of approaches and strategies to mobilize the target population to use the new technology in eHealth research projects. Change management was often a critical part of the implementation process for many projects. Some projects found that older health workers had difficulty adopting the new technology. Hostile and unmotivated health care workers and uncooperative hospital managers often create roadblocks to implementation. Busy health worker schedules, unwillingness to change daily habits, and reliance on traditional face-to-face supervision or traditional data collection methods provide challenges to many projects on the ground.

You can't talk about the technology without understanding the social and political relationships. It happens constantly that we're talking about in Ghana, how do we get the insurance system to be interoperable with the clinical systems. So we start the conversation like that and we end up talking about Isaac Adams' relationship to Elias and Elias' relationship to so and so and which donor might be convinced to do the following and whether we can twist the arm of the World Bank people. Even if you start from a technology lens and even if you start by trying to solve a technological problem, it's literally impossible to not end up mired in social and political discussions.

- Karl Brown, Rockefeller Foundation

In some cases health workers perceived the extra task of entering data as irrelevant to their work or their patients, but useful for research purposes only. Projects typically began by collecting data that report patient outcomes or drug compliance, information that was useful at an institutional, government, or donor level. As implementation progressed and users became more comfortable with the data collection process, they were able to transition to collecting patient monitoring and medical record data, information that is much more useful for clinicians.

Lessons Learned: African region

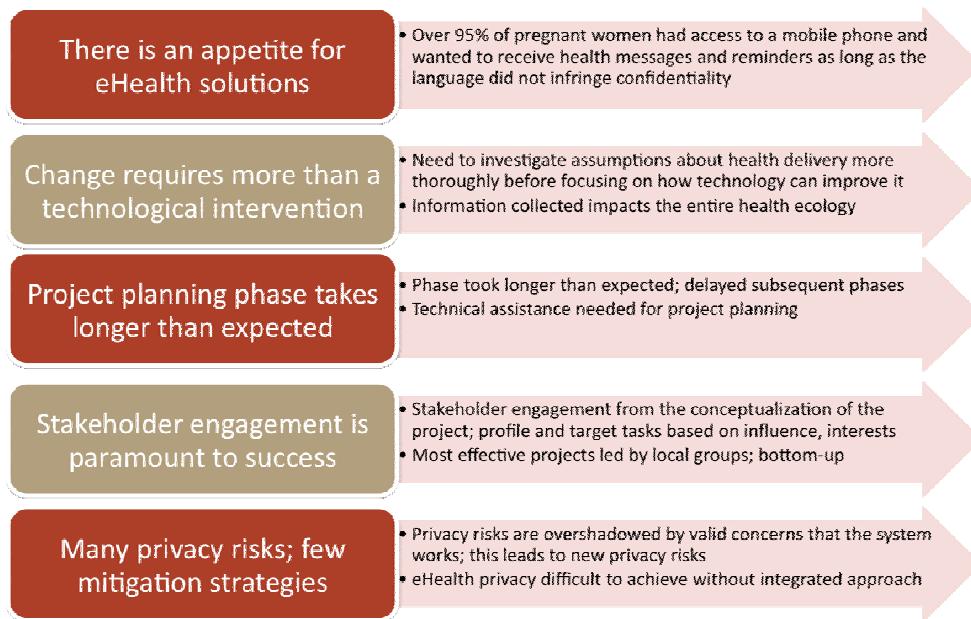


Figure 24: Lessons Learned from workshop in Capetown, South Africa

It is important that the end user of the technology, the nurse, doctor or health worker, see the benefit of the technology as an application that will directly improve the quality or process of their work. As the project implementer, understanding the health worker's needs is essential to foster change management and achieve buy-in from the users of the new technology.

Many eHealth interventions face the challenge of linking Health Information Systems together, from facility to national level. The information and data may be collected and stored, but the capacity to use that information in a useful way may be lacking. Health workers will not benefit from new information if they are not able to use that new data in their own daily practice. This issue speaks to initial research design, incorporating technology and new tools that are useful to the end user, and also to targeted capacity building interventions for the end user to be empowered by the new technology.

With all of these change management challenges, not every project shows successful adoption and use of new eHealth technologies. However, even in cases where the research shows that the intervention is not successful, with well-designed research projects implementers and managers can learn why the intervention is not working. This kind of operations research can provide some very interesting results and concrete lessons for moving forward and is of interest to the research community.

9.2 Managing Partnerships

Collaborations between projects and organizations were reported as both a challenge and the most successful aspect of IDRC eHealth research. The networks and collaborations that are fostered through IDRC's efforts bring together technical experts, implementers, evaluation and measurement experts, academic researchers and policy-makers to improve the overall research and project implementation. A network of partners is very effective in promoting collaboration, and a project with diverse stakeholders is key to success. Networks help partners form new groups and connections that can open the doors to other donors and funding opportunities, build professional confidence, and promote peer-mentoring.

Despite their critical role in success, collaborations can be very challenging. Fostering good partnership requires a great investment of time, tactics to overcoming administrative hurdles among different organizations, and solutions to procedural difficulties in distributing funds among multiple partners. Projects with multiple donor sources struggle with inconsistent reporting requirements and patchy funding schedules. IDRC-funded projects with partners in multiple countries faced administrative challenges with the flow of funds and communication from IDRC.

An effective collaboration will involve all stakeholders from the proposal design stage to tap into every player's area of expertise and avoid reinventing the wheel. This early engagement of all stakeholders will also build relationships and trust among the partners. The selection of

implementing partners for collaboration is critical and should be based on organizational ability, time commitment, and integrity and commitment of the partner organization.

9.3 Technology Design and Development

Lessons concerning technology show that IDRC's role in promoting open source alternatives to closed, private, and proprietary external systems has been very important in the field of eHealth. Research projects that have developed, used and promoted open source options demonstrate to governments and ministries that there are viable options which promote in-country capacity and future collaboration. Paul Biondich, Founder of OpenMRS, shares his lessons regarding the use and promotion of open-source software solutions:

It is amazing how profitable it can be to give something way. What I mean by that is that there is an inherent instinct in people to not show work in progress until it is "right" – and what we have learned is that by making things available even in their rough and unpolished state, that it is a much stronger way of encouraging collaboration and getting people to want to buy-in

So, although your gut tells you is that if you show something that is incomplete, that people will cast a stone at it, and say it is not good enough, but often times, in resource poor environments, where people are struggling with the same issues and then seeing them work in progress often leads to figuring out a way in which they can contribute

Its counter-intuitive to people just starting in this space, but its become very clear to me that releasing early, sharing early and sharing often is very very powerful

Projects found that enterprise level software applications were the most beneficial but were not widely available.

Project implementers and managers learned that access to mobile phones and technology is increasing quickly, but telecommunications infrastructure is not ubiquitous or reliable in all areas. Many projects faced data transfer challenges depending on the reliability of power and infrastructure. As investment in infrastructure continues to increase, the potential reach of eHealth solutions will expand.

Another critical lesson learned in relation to technology that was well articulated by Chris Bailey from WHO is:

*"I've learned that we should not be developing hammers looking for nails.
The first rule for knowledge management is: listen before you talk. If we take*

the principle of pure learning and shared knowledge seriously, then that starts leading us to technical considerations that become very important.

One of the things that ministries of health have constantly asked over the years is - What software do I use? That's the wrong question. The question they should be asking is - what is the health problem we are trying to solve or facilitate through IT? And what is that information flow? And what is the functionality that we need to actually accomplish that goal? And what are the technical specifications that can create that functionality? Can I put it into a document to give to a vendor so I know what software to use?"

Bailey's suggested approach was expressed in many ways throughout the review process by the grantees as they struggle with the lack of knowledge of how to approach eHealth at the national level.

9.4 Capacity Building



Image 7: Chaitali Sinha and other participants at workshop in Capetown, South Africa

Capacity building is the single most frequent and important area of project activities, outcomes, milestones, and challenges. Two levels of capacity building were achieved in the projects under review; institutional and organizational capacity of the partners was built as a result of their IDRC grant, and capacity building of the health or technology workforce was almost always included as a part of project activities. Likewise, capacity building needs and limitations presented challenges at both levels of IDRC projects: capacity of the partners to implement and

manage rigorous research projects, and the lack of some health professional's capacity to implement the project.

At the organizational level, implementing partners reported high levels of increased capacity as a result of their IDRC grant. The eHealth research funding was a catalyst to strengthen organizations and to build their reputation in the field to implement new eHealth initiatives. The funding and mentoring from IDRC increased organizational confidence, increased exposure in the field of eHealth research, expanded research skills and methods, and strengthened the organizations. Many projects that were seed-funded by IDRC now have a life of their own, an indication of successful capacity building.

At the same time, the capacity of the partner organizations on the ground is sometimes a roadblock to progress. From a project management point of view, it is difficult to find partners and individuals in the beginning phases of project design who are capable of the wide range of skills necessary for the project to be successful. Partners are expected to have research skills, but also be able to complete the evaluation, documentation, policy influence, and transfer of knowledge. While part of the IDRC relationship aims to build these skill sets in their partners, it can be challenging to find organizations that can take on this wide range of tasks in addition to the rigorous research project. This kind of organizational mentoring and capacity building is what has made so many of the IDRC partners successful long after their research funding. By providing the necessary capacity building to the leadership, IDRC has helped academic researchers transition into a sustainable NGO role.

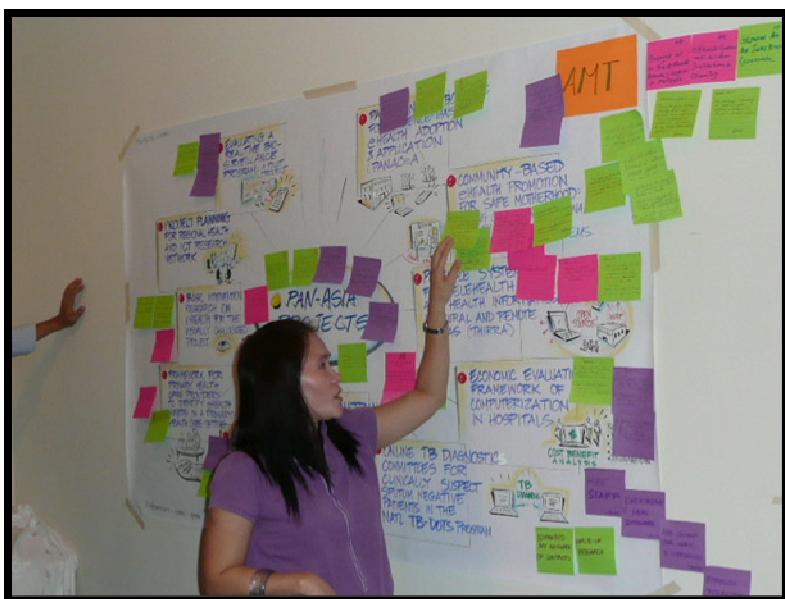


Image 8: Lessons Learned workshop participants in Colombo, Sri Lanka

building as its primary mandate. For instance, in Rwanda, IDRC has supported the development of a training program that teaches software developers how to create modules on electronic medical record platform, OpenMRS, to support government initiatives. In its first phase, the program graduated 10 individuals and matched them with job opportunities. The program is now entering its second phase and considering options on how to scale up operations, while also making training manuals and documentation available to universities in the country.

While building capacity is the most frequent activity-level outcome, it is also a common barrier to implementation, both from the technology field and among health professionals. A sustainable approach to capacity building will be critical over the next five years. Even in situations where training programs are building the capacity of new technology experts, it may be difficult for them to find jobs after training. One solution may be working alongside universities to integrate educational opportunities with career opportunities to ensure that the investment of capacity will be sustained in-country. The human capacity element of a project

The most frequent project activities and milestones reported by partners involve capacity building, and it is widely recognized by partners that capacity building is essential to the implementation of eHealth projects. It was mentioned by project implementers repeatedly that the success of projects relies on the people who plan, implement, use and benefit from the eHealth intervention.

In some cases, IDRC has funded projects that focus on capacity

should be thought of as a process – from recruitment to training to employment to ongoing mentoring.

9.5 Transferable Research Results

Experiences from eHealth project implementers and managers have shown that eHealth research must continue to strive to produce applicable and transferable health outcome results. High quality research that achieves some understanding of health outcomes must be conducted in a long-term stable funding environment. The inherent need to focus on technological aspects of projects must continually be balanced with the intended health outcome of the intervention. There is often a danger of shifting the focus of attention to the technology, while losing sight of the ultimate goal of improved quality of life for the target population. Research questions must begin with the health problem and then use technology as a potential solution.

Despite IDRC's focus on advancing health outcome level research, only 4 of the 25 projects under review were designed to measure health outcome results. Of 32 future research interests listed by participants in the Lessons Learned pre-workshop assignment, only 2 are health outcomes-level research. IDRC must continue to strive for health outcome results in eHealth research, and continue to focus on the health component of the initiative using technology as a solution.

Lessons Learned: PAN-Asia Region

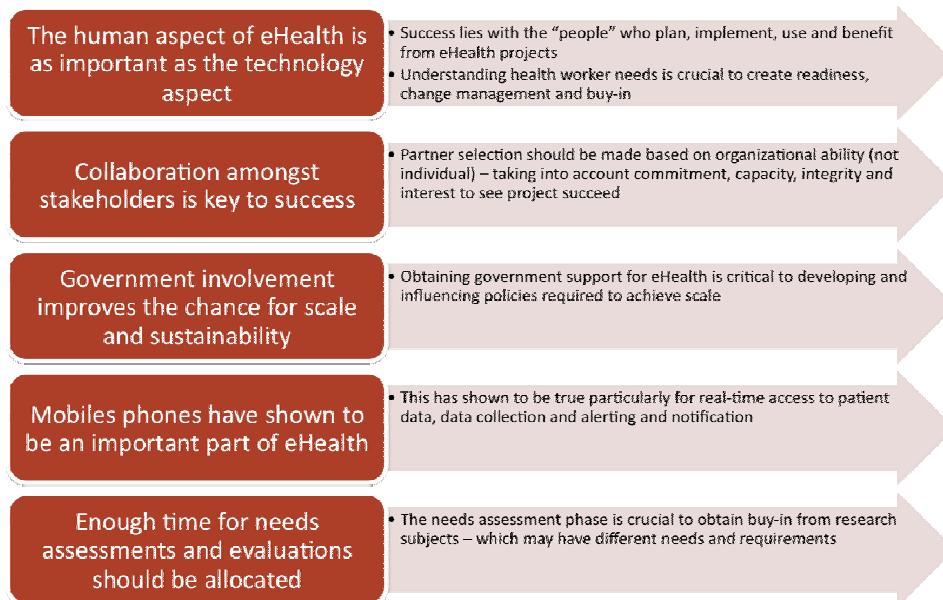


Figure 25: Lessons learned from workshop in Colombo, Sri Lanka

9.6 Impact and Sustainability

eHealth research projects must work within existing Health Information Systems and strengthen the technology and use of those systems to benefit the health of the population. Unfortunately,

"The most important lesson that I have learnt over time is that the success of eHealth lies with the 'humans' who plan, implement, use, benefit and evaluate the projects. eHealth is not about technology. It is about the people who are working for or benefit from health services. It is important to understand the needs of these people, create readiness and obtain buy-in from different groups of people to make the projects successful."

- Dr. Shariq Khoja

projects often implement within a flawed health system. A thorough analysis and understanding of the HIS should include an assessment of the needs and challenges of that system. In the words of Holly Lad, a Lessons Learned workshop participant and Project Leader, "*One cannot expect to make a dysfunctional health management information 'system' less so by merely transferring the problems to an electronic format.*" A single health technology intervention cannot be expected to solve all of the problems in an entire health information system, but

needs to become a part of the evolving solution.

Many of the IDRC-funded research projects are small-scale pilot projects, but "...any eHealth project has the potential to benefit a large portion of society," said Dr. Alvin Marcelo at the Colombo lessons learned workshop. In order to achieve scale and impact a wider population, projects and implementing partners must work closely with government and Ministries at all levels of the national health system. Partners and project managers repeated the lesson in interviews, workshops, and documents, that government support is critical to developing and influencing policies to achieve scale.

The experiences of project implementation in eHealth have shown that government partners and institutions should be involved in the project from the onset, beginning with the development of the project proposal. This early relationship helps researchers focus on the practical application and health outcomes and to remember that the project is not funded only for the sake of research. Early relationships also help the government and ministry policy-makers become more familiar with the research community and understand that policies based on evidence will be more effective and secure. A deeper understanding of the value and potential of technology to increase access to healthcare will lead to governments that are more supporting of eHealth implementation.

The UHIN is a project that conveys the advantages of building a strong relationship with government officials. The project has influenced the Ministry of Health to hire a full-time consultant to further develop distance learning materials, in addition to becoming the reference point for informing the countries national HIS strategy. Likewise, Dr. Alvin Marcelo is an example of an individual who IDRC first supported through a competitive grant program in the

Asian region, and continued to support his professional development through leadership roles in the International Open Source Network (IOSN) and PANACeA Network. Recently, Dr. Alvin Marcelo was appointed an advisory position to the Ministry of Health in the Philippines on eHealth issues, and is in a position to influence policy outcomes.

With successful relationships between research partner and policy-makers, IDRC-funded eHealth research has influenced national-level policies that have been adopted and implemented. However, it is important to remember that decisions to implement a policy on a large scale should not rely on preliminary results or one pilot research study alone.

The ability of an organization to become sustainable depends on resource mobilization after their IDRC-funded research project is complete. Projects that were able to demonstrate a clear “proof of concept”, either through the development of a product or by advancing to the second phase of implementation, were more successful in mobilizing additional resources. However, funding restrictions from many agencies that do not fund infrastructure, facility rentals, and other items essential for organizational sustainability make it difficult for some partners to find additional donors.

For many organizations, strategic planning and resource mobilization can be a challenge that requires targeted mentoring and capacity building to help leaders learn how to communicate their organization’s achievements and future direction. Sustainability of projects is enhanced by a cooperative but hands-off approach from the Ministry of Health partnership and the replication of the project in other countries.

9.7 Operations and Management

The experience of managing eHealth research projects at IDRC has led to many lessons learned about the best approaches and techniques to support and mentor implementing partner organizations. Program Officers at IDRC use the “Grants Plus Model” which calls for Program Officers (POs) to become heavily involved in the project throughout inception, research design, implementation and evaluation phases. The partners are given independence and freedom to implement their own project, but the IDRC Program Officer’s role is to build individual and organizational capacity through mentoring, and to provide links and suggestions for networking, conferences, workshops, and other pertinent resources.

Lessons Learned: LAC Region



Figure 26: Lessons learned from workshop in Managua, Nicaragua

By staying engaged and active in the project from start to finish, IDRC Program Officers can help address challenges before they become a disaster that could lead to failure of the project. The “Grants Plus” support of projects takes a systems approach, understanding that research is not only collecting data and writing up results, but a process of building capacity and growth for the organization. Smooth flow of financial, administrative and project coordination relies on trust that is built through this close relationship with the partners. IDRC is seen as an “honest broker”, an organization that is open to dialogue and building long-term relationships based on trust.

As a result of this strong relationship and organizational mentoring, partners report increased flexibility and confidence in the field of eHealth research. Internal organizational capacity is strengthened through the mentoring provided by IDRC. New research and evaluation skills, increased confidence as an eHealth research and new skills for project management were all reported results of IDRC project mentoring.

Because of the intensive involvement in projects, the approach of IDRC management has been one that embraces, learns, and grows from challenges. This problem-solving approach and hands-on “Grants Plus” management style allows partners and managers to learn from challenges and respond to the true health, technology, cultural and political challenges on the ground with workable, tailored solutions. This organic learning process allows projects and managers to find innovative cutting-edge solutions to the challenges in the field of eHealth.

Despite all of the time and effort put into project management, there are process and management problems, especially for projects involving multiple partners, stakeholders, and countries. From IDRC's point of view it can be a logistical challenge to navigate the different administrative and financial structures of multiple partners. From the partners' point of view, delays in receiving funds from IDRC or sub-granting partners deteriorates their sense of ownership, independence and trust.

10. Vision for the Future of eHealth

Section Summary

- **Africa:** Establishing an open and collaborative enterprise architecture and eHealth policy framework to facilitate the development of comprehensive health information systems, and continuing to invest in infrastructure and human capital were reported by participants as critical to realizing the potential of eHealth in the next 5 years.
- **Asia:** Participants felt confident that the next 5 years would be some of the most dynamic for eHealth in the region. The following aspects were highlighted as components for advancing scale and sustainability: alignment between technology and health through an eHealth strategy, investments in universal access to both health and technology infrastructure, and a focus on affordable, accessible, attainable, empowering, and equitable technologies and mechanisms for implementation
- **LAC:** The participants' vision for eHealth in the LAC region focused on the notion that in the future, technology as a key tool for health care will be ubiquitous and "just the way we do things". eHealth would support providing reliable data for high-quality patient care and the prevention of epidemics through disease surveillance activities would be a significant priority. Governments would make open standards a legal requirement and promote open source software.

The overall Vision for eHealth as expressed during the lessons learned workshops illustrates a hopeful level of advancement in eHealth for grantees from all regions. The following are highlights from participants in the Lessons Learned Workshops by region.

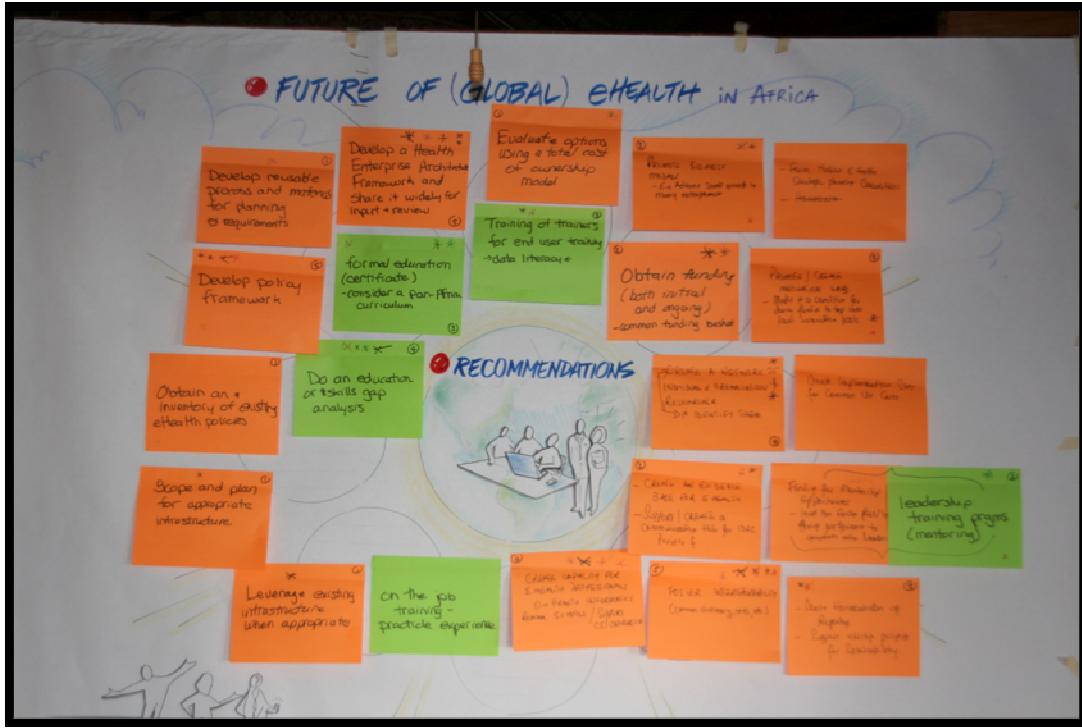


Image 9: Vision for eHealth in Africa session at Lessons Learned workshop in Capetown, South Africa

10.1 Africa Region

Participants at the Lessons Learned workshop in CapeTown, South Africa, almost unanimously favored the “Vision for eHealth in Africa” session, citing that it instilled hope for the future and provided a broader view of what to aspire towards. The group began by discussing the need for an open and collaborative eHealth enterprise architecture that could be shared, modified and adopted across the region, in addition to continue investing in appropriate infrastructure where needed, and leveraging existing infrastructure where appropriate.

Participants believed that the research community should continue developing a strong evidence base for eHealth, and consider evaluating eHealth options using a total cost of ownership model. These activities should be supported by establishing national eHealth strategic planning committees and local innovation labs and developing a toolkit of reusable processes and materials for planning and requirements.

Investing in human capital was cited as a significant priority. Specific suggestions included establishing schools and training programs with regional curriculums and certificate programs to create capacity for more eHealth professions, and continue to expand training of trainer programs.

To foster an enabling environment for eHealth, participants recommended developing an eHealth policy framework by aggregating existing eHealth policies and common dictionaries and standards to facilitate interoperability. This type of collaboration could best be facilitated if donors coordinated funds, so that funding was obtained from a common basket.

10.2 Asian Region

In the Asian Region, there was an overarching sense that the next five years would be some of the most dynamic for eHealth given the heightened interest and momentum gained in the past year. To begin, participants advocated that the first thing that they would like to see in terms of eHealth is guidance at the Global level on how countries should be approaching eHealth at the national level. This included: guidelines and incentives that encourage partnerships between industries, development of an eHealth certification & accreditation, e-human resource service, and enterprise architecture

As a follow on, participants envisioned that each country would have its own eHealth Strategy to align technology with health priorities that would also look specifically at supporting the enabling environment through a focus on improving health outcomes, developing of an enterprise architecture, and solidifying an eHealth budget.

To move from pilots to scale, the vision was to promote universal access to basic infrastructure, but to make sure that the enabling environment was in place to capitalize on advancements in eHealth innovation and proven interventions. The following aspects were highlighted as components for advancing scale and sustainability: alignment between technology and health through an eHealth strategy, investments in universal access to both health & technology infrastructure, and a focus on affordable, accessible, attainable, empowering, and equitable technologies and mechanisms for implementation

Participants highlighted a vision for greater engagement by the general population and direct to consumer support within eHealth activities. This includes: community participation in design, development, and use of eHealth, gender engagement in the design, development, and use of eHealth and policies that address privacy & security concerns

The gap in demand and ability to provide and support eHealth is widening. One vision element that was highlighted to address this is the development of an eHealth curriculum to advance training and create an eHealth ready workforce- both in terms of users but also in terms of designers, programmers, and implementers.

In order to achieve the vision of universal access, participants reported the need for better engagement among industries as well as user and service provider groups (public, private, user, and commercial) to facilitate interoperable eHealth solutions. Further, participants felt that while there are bodies that were created to lead in the coordination and sharing of information- that there wasn't a cohesive and active platform at the global level that PANACeA could connect

with between eHealth meetings and conferences. Their vision to address this was the development of the “Global Forum for eHealth Knowledge Sharing & Networking”, which would serve as a repository of materials and dynamic platform for policy-makers, practitioners and researchers to engage both physically and virtually in networking and information exchange.

10.3 LAC Region

The participants’ vision for eHealth in the LAC region focused on the notion that in the future, technology as a key tool for health care will be ubiquitous and “just the way we do things”. They envisioned an integrated community of practice, where trained professionals (both doctors and technicians) will be working in multidisciplinary teams, and the eHealth community of practice will have reached critical mass. This would subsequently enable the dynamic exchange of ideas and information across the region.

eHealth would support high quality clinical care, providing reliable data for patient care, disease surveillance, program management and evaluation. The prevention of epidemics of contagious and non-contagious diseases would be a significant priority. Further, health departments would use ICT not only to enter information, but also to promote public two-way communication and participation. Governments would make open standards a legal requirement and promote open source software. Participants believed that the research tools and capacity needed to measure the health outcomes and impacts achieved through these technology applications would be readily available.

11. Recommendations

The following recommendations are based on the analysis of the evaluation findings, and recommendations provided by key informants and workshop participants. Many of them relate to eHealth in general, while some specifically articulate what IDRC's role should be as the organization mainstreams eHealth into its global health portfolio and continues to contribute to the advancement of innovation, scale and sustainability in eHealth and greater emphasis on health outcomes, health equity and health systems strengthening considerations.

In order to realize the vision above, grantees recommended IDRC to "stay the course", meaning to continue to fund eHealth. In addition, they urged IDRC to maintain its commitment to rigorous, developmental evaluation and active knowledge translation among the NGOs, organizations and governments working to build intercontinental capacity for eHealth. Other recommendations included continued investment in local capacity building in eHealth technologies and research, as well as in efforts to strengthen collaboration, disseminate eHealth

results and promote their replication. Along these lines, the identification of elements that contribute to sustainability and of ways to convince governments of the importance of eHealth were also mentioned as necessary to supporting the vision.

They are very keen listeners to people in the community, and often times ideas that were not getting traction from larger philanthropies, IDRC has come and provided start-up capitalization of those ideas so that they do get more mainstream attention

– Paul Biondich

Two more specific recommendations made were that IDRC should (1) support the analysis and detection of priorities (epidemics) in health in the coming years and the research that promotes their control by applying ICTs and (2) encourage IDRC-funded projects to use open standards and open source.

Finally, IDRC was encouraged to continue past practices of being participative with grantees and seeing the projects they fund as catalysts to larger change. To achieve these recommendations, grantees requested further support from IDRC and eHealth stakeholders, specifically:

- Donor alignment across global and regional eHealth strategies that support collaborative policy development
- Facilitate the creation and reuse of culturally appropriate content
- Support further development of the PANACeA network

- Create innovation and incubation laboratories to test new ideas
- Increase funding support for studies that investigate the socio-cultural aspects of e-Health (e.g. gender equity)
- Establish capacity building programs & standardized curriculums
- Support the development of regional and national eHealth strategies
- Establish a global eHealth resource center that includes fora for knowledge sharing & advocacy

11.1 eHealth Programming

For those familiar with IDRC's work in eHealth, the organization is known to be a learning-oriented risk-taker, funding projects with catalytic impact that other donors are not willing to fund in a way that capitalizes on the organizations strengths. These strengths include promoting and sponsoring action research and implementation science, communities of practice, and big-picture investments (enterprise architecture, standards, privacy and security, interoperability). In this regard, IDRC should continue to take a similar approach to its future programming in this area.

"Assisting policy makers and decision makers at the Ministry of Health in Kenya/ Africa see the value of e-Health in collecting, collating and mining their own data for decision making is another important gap that can be addressed by IDRC and partners."

- Dr. Joshua Kimani

One aspect that may shift is its focus on innovation. There was an overarching anti-pilot sentiment expressed throughout the evaluation process by grantees and external eHealth stakeholders alike. In this regard, IDRC will need to assess how it will balance continuing to create an environment that enables innovation while advancing some of its earlier investments into broader scale and greater sustainability. This can happen either from financially supporting grantees to implement

programs and research at much larger scale and/or greater levels of academic and policy-related rigor or sponsoring grantees to engage in activities and research that will contribute to advancing the enabling environment needed for eHealth to thrive.

11.1.1 Policy-related Support

Specifically it was recommended that IDRC help create the technical substrate in an open and documented way that allows people within indigenous environments and people to do the necessary scale up that is being requested by the Ministries of Health in countries. As a complement to this, grantees expressed the desire to leverage IDRC contacts and network to interact with policy makers, and make IDRC eHealth projects known. Further, grantees wanted IDRC to support multi-year grants to strengthen the evidence base of one idea, which will increase the likelihood of influencing policy change. They also recommended that IDRC support the collaborative development of an eHealth Policy Framework for projects and countries to adopt. Similarly, IDRC could have a role in investigating how specific ISO standards can apply in a resource poor setting, like what are the successes and challenges of such an approach versus more of an emergent approach that use standards base on need.

11.1.2 Capacity Building

Capacity building is at the core of virtually every activity IDRC supports is. Throughout the evaluation this focus of all IDRC funded projects and programs was clear. It was interestingly qualified by Paul Biondich who reflected on capacity building as follows:

Many people think that there is not capacity in resource-poor environments to carry out the work in Health IT implementation. What I have found is that there is a lot of capacity, but the capacity often doesn't know what it doesn't know, so very simple collaboration with them that is very light touch and is empowering, and I think that open source communities are an important way to empower people that we have actually see a number of examples of indigenous people building up and supporting health information technology activities, that is inherently much more sustainable than typical parachuting in and implementing systems.

In the LAC region, Lessons Learned Workshop participants wanted more training in advanced research methods. In the African region, it was suggested that IDRC promote the use of local software developers, support local incubation labs, and provide resources for projects to bring and train Masters Students. Karl Brown from the Rockefeller Foundation noted the potential synergies and partnership opportunities between IDRC, the Fogarty Center and Rockefeller Foundation, particularly around the idea of institutionalization of training and research opportunities in eHealth.

11.1.3 Networks and Community Building

In addition to capacity building, IDRC's support for networks and community building was highlighted. *"To help further stimulate the ecosystem we need to create more public good communities like OpenMRS, so I do think that there is value in the IDRC supporting things like the pharmacy information and laboratory information system community,"* says Paul Biondich, of OpenMRS. IDRC's support for the PANACeA research network has led to the development of an emerging community of supportive and motivated eHealth researchers. At the Lessons Learned workshop in Colombo, Sri Lanka, there was a strong feeling that the community part of the PANACeA network would lead the dialogue on eHealth policy in the region. Further, IDRC was viewed as the ideal organization to convene the broader eHealth community to participate in discussions regarding strategic eHealth issues by both internal and external stakeholders. IDRC should continue to leverage this strength and drive the agenda and lead donor coordination efforts, which it has started to do.

The evidence base is the number one missing piece, but we have to decide what evidence will suffice. Efficiency, increase in services, better data for maternal mortality and civil registrations etc.

EJ Ashbourne, World Bank

11.2 eHealth Research

One of IDRC's core strengths- inherent in its name- is its focus on and leadership in the cross section between development programs and research. Its ability to identify and support risky, cutting edge research is a uniqueness that it should continue to hone. As IDRC plans forward, a strategic opportunity presents itself – notably for IDRC to define what rigorous eHealth evaluation ought to encompass. Based on the review of literature, there is a significant range in the quality and rigor of existing eHealth studies. While internal stakeholders highlighted the organization's mandate of improving health outcomes, it was not matched with project outcomes from most of the 25 grantee projects included in this evaluation.

While IDRC has supported critical research regarding what works and how it works, it has not contributed in any meaningful way to the evidence needed to determine health impact and/or measure relevant health outcomes of eHealth activities. The overall evaluation findings suggest that the organization has been more inclined to fund projects that provide lessons on eHealth implementation science versus determining if eHealth solutions lead to improved health outcomes. This need not be a zero-sum game as there is room and requirement for both types of research (and the significant overlap that exists between them) when contemplating research designs and approaches to address pressing local research questions. Moving forward, IDRC will need to consider its priorities when developing its new research funding strategy. Some indications of internal perceptions about eHealth research projects revealed reservations about research rigor. The process of mainstreaming into a health program at IDRC – focusing on issues of health governance, health equity, and health systems strengthening – will lend itself

well to applying health research methods, including action research alongside health outcomes research, and metrics to its investments in eHealth.

Throughout the evaluation process, grantees and other stakeholders were asked to identify research questions and priorities. Key areas of research and related questions included:

11.2.1 Health Outcomes

- Does eHealth / mHealth lead to improved patient outcomes? Improved system efficiencies? Enhanced human resources utilization?
- How does IT contribute to the promotion of healthy behaviors, especially sexual and reproductive health and HIV/AIDS prevention?
- To what extent does the use of ICTs for disease surveillance lead to early detection, treatment and cure of the disease?
- To what extent does eHealth warning systems improve treatment compliance for children?
- What are examples of patient relevant eHealth / mHealth solutions in the developing world?
- Crowd-sourcing Health: Can a larger group of experts give more accurate and timely diagnosis than face-to-face methods?
- Can a simple SMS-based reporting system combined with mobile money reimbursement prevent maternal mortality?
- Will allowing patients to access their personal medical records via SMS or Web lead to making more informed decisions?
- Impact of ICT on reduction of maternal mortality

11.2.2 Policy and Standards

- How can we develop inter-jurisdictional health policies to allow eHealth to work at its full global potential?
- What is the process of integrating eHealth issues and concerns into current e-governance frameworks – in terms of funding, institutionalization and implementation?

- How can potential privacy and security innovations in developing countries be leveraged in developed countries, as a form of ‘technology transfer’?

11.2.3 Technology

- What are alternatives to unreliable wireless connectivity and/or current network infrastructure? How much will it cost? How will it be sustained? Will it cause class divide?
- How can disparate clinical applications interface with one another to share patient information?
- What are the benefits and limitations of providing health information over the web?
- How does eHealth make the functions of the central/district health centers easier?
- How can ICT be deployed in a “Data to Action” cycle (data collection and analysis; data interpretation; information use and applied knowledge)?
- What is the role of mobile phones for the transfer and communication of medical information from the periphery to the centre?
- What are the features of an integrated health information architecture that supports health information and data management?
- What is the role of open source tools for development of hospital information systems in order to produce reliable information?

11.2.4 Scale and Sustainability

- How can we develop a framework to extend our project into other hospital departments, and hospitals in other countries?
- When seed funding for ten community health centers is provided, how can we develop a model to scale to 50 additional “self-funded” community health centers in 3 years?
- How can we test and incubate sustainable eHealth business models in the developing world context?
- What are the indicators of readiness for eHealth in a healthcare organization in a developing country to ensure adoption and sustainability?

- What is the appropriate time horizon needed to support incremental innovation in eHealth programs?
- How can we create a low-cost, scalable model of an eHealth system to improve health in rural areas of developing countries and influence policy?

11.2.5 Social, Cultural, Political

- What are the gender dimensions of eHealth? What are the gender issues, if any, involved in ICT adoption amongst female nurses and data capture staff?
- How can we address social inequities in access to health through the use of eHealth?
- What social systems need to be in place to support the technical systems used for collaboration?
- What measures can be taken to mitigate the power dynamics being caused by rapid data sharing?
- How do you introduce eHealth into a dysfunctional HIS?

11.2.6 Partnerships

- How to encourage local organizations to develop and/or maintain eHealth systems in developing countries, and have them work together and with international organizations?
- How do eHealth acceptability studies influence telecom operators to invest in appropriate technology platforms?

One area of desired support from grantees was in the area of distribution and dissemination of research findings. They recommended that IDRC disseminate project findings using IDRC distribution channels to increase resource mobilization and attract financing to continue project, implement research findings, scale etc.

11.3 Sustainability

Throughout the evaluation, it was unclear what the end game was for IDRC's eHealth investments. In the documentary review, it was difficult to assess the sustainability of IDRC's investments in eHealth to date. As mentioned earlier in the study, this is in part a symptom of the regional programming of eHealth that was embedded within ICT for Development (ICT4D or ICTD) research agendas. Nevertheless, when moving forward this should be considered during the due diligence process - *what do you hope will happen to the project after the fact and what types of resources will be required?* Using the example of Jembi, the non-profit offshoot from the OASIS project - *how can projects realize the same success in terms of coming full circle (idea, design, development, implementation, spin-off, self-sustaining)?* As the organization considers what it would like its legacy to be and the sustainability of its efforts- more thoughtful deliberation is needed along with a strategy that can help guide future programming that yields a body of work and more concretely quantifiable and qualifiable contribution to eHealth.

In addition, grantees requested that IDRC consider refunding new phases of projects, and/or providing support to implement research findings. Projects requested resources such as technical assistance to create business plans, policy briefs

The whole system suffers from pilotitis. The problem with pilotitis is that you let a thousand flowers bloom, but it's not a garden. They can't speak to each other.

-Chris Bailey, WHO

and organizational structures, experts to support designing research protocols and opportunities to collaborate with like-minded organizations, grantees in the same and/or different geographies. In cases where refunding projects is not possible, a process that supports project follow-up 1, 3, 5 years after completion was suggested as part of the role that IDRC should, but is currently not playing.

Beyond access to additional funding, grantees and internal stakeholders expressed the desire to have more organizational strengthening and/or more thorough evaluation of organization and leadership as many projects struggled with the lack of staff retention, high turnover, and setbacks timelines. It was felt that better due diligence upfront may mitigate this issue. To overcome the challenge of coordination and project management, grantees also requested access to tools for document sharing and online meetings. The suggestion of IDRC "study trips" to visit similar projects in different geographies was made.

Investments in this regard have already begun; a collaboration with IDRC's Donor Partnership Division has led to supporting a resource mobilization and business plan workshop for the PANACeA network in 2010, and working with Jembi to improve the organization's business processes and practices, and solidify a growth strategy. Lessons from these engagements will be critical to understanding how to scale up these efforts across IDRC's eHealth projects.

Helping academic researchers transition to an NGO role requires capacity building to help the leadership make the transition. Resource mobilization and strategic planning are important for organizations but are often lacking. For many leaders who lack experience, the strategic planning and resource mobilization processes can be a wake-up call. These processes are about how you interact and communicate what you are doing in your organization.

11.4 Mainstreaming

One of the purposes of this evaluation was to inform the mainstreaming process that IDRC has decided to undertake to bring technology into its sector-specific initiatives. According to Michael Clarke:

With the current transition from ICT4D as a separate entity to a mainstreamed approach, there is a unique opportunity to integrate ICT4D research into programming across the IDRC. The challenge is to communicate to the thematic programs the ICT4D message as a value-added proposition that enhances research for development generally. The reality is that research today, whether applied or basic, will benefit from the application of the ICT4D lens which asks questions of the production, distribution, use and ownership of knowledge. The transformative impact of new technologies cannot be understated. ICT4D studies social change driven by these technologies, not the technologies themselves. This message also must be communicated to partners who may see the support of ICT4D research disappearing as the Program Area is mainstreamed. We need to help them understand the new program structure and how they will continue to have the opportunity interact with the thematic program areas in agriculture and the environment, social and economic policy, health and science and technology, and for them to see that ICT4D will be an integral perspective in those programs.

This transition is being experienced throughout the world. Increasingly, Ministries of Health are establishing ICT departments that explore more than computers at the MoH. The evaluation findings and GEH workshop held in Ottawa, Ontario in February 2011, led to identifying five main ideas to launch the mainstreaming process.

1. Address equity issues in eHealth projects more explicitly

Equity was found to be an underlying aim of all eHealth projects supported by IDRC. Technology at its core can be an equalizer by improving access to information that will lead to better decision making by patients and health professionals alike. However, shifting to defining this objective more explicitly, perhaps as a requirement in project proposals, was identified as an opportunity to explore during the mainstreaming process.

2. Use strengths of the GEH team to strengthen eHealth projects and vice versa

Gaps identified in IDRC's eHealth projects through this evaluation was viewed as an opportunity for GEH lend its expertise to improve project outcomes. Specifically, leveraging GEH's experience in health systems research and equity analysis to structure eHealth projects and identify indicators to measures health outcomes equity was found to be a significant opportunity. Similarly, GEH projects can benefit from understanding how eHealth solutions, such as mobile data collection and mobile money, can be used to improve their project outcomes. Moreover, the frameworks and theories from the ICTD discipline can be drawn upon for this purpose.

3. Define terms used in eHealth and GEH projects

The ambiguity of terms and concepts used in eHealth and GEH projects, such as "low-cost," "access" and "health equity" was recognized as a chance to develop definitions and deepen the team's overall understanding of how the concepts are used and measured in practice.

4. Collaborate on capacity building initiatives

Supporting capacity building of IDRC project stakeholders and beneficiaries was found to be a common goal and strength of the GEH and eHealth portfolios, and is an opportunity for collaboration across the portfolios.

This evaluation should continue to be used to inform the development of mainstreaming priorities and guidelines for IDRC staff throughout the world.

11.5 IDRC as a Donor

IDRC is viewed broadly as light and non-bureaucratic (David Aylward, mHealth Alliance). According to Nicole Genereaux:

That's why a lot of donors are coming to IDRC, we are doing good work and we don't have a competing mindset, and partnering has became an embedded practice at IDRC. What drives us is the willingness that the donors's collaboration will make a bigger impact on the availability of information, on the standardization in this area of work and the adoption of some standards that will facilitate the actor and the people who are the end users.

Other donors expressed an appreciation for IDRC's push for greater donor coordination and alignment and shared their approaches to supporting eHealth programming as a means of hopefully helping to inform and/or contrast how IDRC approaches its funding activities. For Adam Slote at USAID:

Our strategy is carrot and stick. The carrots that we use is that each country must come up with a country strategy, and we encourage them to think about eHealth and provide them with best practices. The sticks are we have an organizational policy where if any country anticipates spending more than 100K on Health IT is required to go through a review by our CIO office. Our CIO office has a set of guiding principles that Chaitali has seen and is being used for donor collaboration, but outlines communication and collaboration, sustainability etc. – is part of the review process. This process would be useful for IDRC – a set of guiding principles that teams within IDRC considering eHealth should adhere to.

However, many donors were unaware of the specifics of IDRC work, indicating a need for a communications strategy that will convey IDRC's mandate and project outcomes in a way that allows for the organization to increase its profile in the broader sector.

During the Lessons Learned Workshops, the role of institutions like WHO came into discussion particularly when examining the promotion of an enabling policy environment for eHealth. According to Christopher Bailey from WHO:

So the question is - How can WHO use its convening role and special relationship with Ministries of Health to help countries become standards compliant but in a practical way that actually suits their needs? If the existing standards don't fit their needs, how can we feed the information back into the process to make sure they are truly global standards not northern standards and how can these standards be adapted so that they are of practical use for the actual health care setting in country? I think that as an umbrella is a key role for WHO in the space.

In this effort by WHO to lead in a practical way, IDRC can leverage both its convening power as well as its networks throughout the world to help inform this process.

12. Conclusion

One of IDRC's core strengths- inherent in its name- is its focus on and leadership in the cross-section between development programs and research. Throughout the evaluation process there was wide recognition of IDRC's risk-taking nature and the innovative and cutting edge results that "have been instrumental at catalyzing critical pathways within eHealth". IDRC has supported the a body of critical research on what works in the field of eHealth and how it works. To its credit, IDRC's research capacity building mandate and the gradual changes that have been achieved (individual and organizational capacities strengthened) have laid the foundation for supporting research that examines the interface between eHealth and health outcomes (public health and individual health). However, it has yet to contribute in a meaningful way to the evidence examining health impact and/or measuring relevant health outcomes of eHealth activities. More emphasis is needed from IDRC, as it continues to support eHealth research, to follow through on examining health outcomes.

The ‘end game’ for IDRC’s eHealth investments is unclear in terms of outcomes and sustainability. As the eHealth programming within the Centre moves out the three regionally focused ICTD programs and into a coherent global portfolio, more thoughtful deliberation is needed along with a strategy that can help guide future programming that yields a body of work and more concretely quantifiable and qualifiable contribution to eHealth. Based on the debrief with the GEH team and former members of the ICTD team working on health, much of this will be determined in the coming months – leveraging the findings of this evaluation report. This confirms the intended uses of this evaluation study.

IDRC’s role ‘in promoting open source alternatives to closed, private, and proprietary external systems has been very important in the field of eHealth’. Research projects that have developed, used and promoted open source options demonstrate to governments, private sector, and civil society that there are viable options which promote in-country capacity and future collaboration that can lead to sustainability and scale. IDRC is supporting, and in many cases, leading the dialogue for designing an open enterprise architecture framework for eHealth in developing countries through projects such as the Open Architecture and Standards Information System (OASIS). IDRC is “viewed as the ideal organization to convene the right stakeholders to participate in discussions regarding eHealth based on discussions with both internal and external stakeholders”.

For IDRC grantees, there is a demand for more organizational strengthening support (strategic planning and resource mobilization) and for more opportunities to collaborate with like-minded organizations, grantees in the same and/or different geographies. Grantees also recommended continued commitment to rigorous, developmental evaluation and active knowledge translation among the NGOs, organizations and governments working to build intercontinental capacity for eHealth. To help promote the enabling environment for grantees, IDRC should examine the provision of support multi-year grants to strengthen the evidence base of one idea, which will increase the likelihood of influencing policy change and the collaborative development of an eHealth Policy Framework for projects and countries to adopt. Through such approaches, IDRC can contribute to the creation of the technical substrate in an open and documented way that allows local institutions to support the necessary scale up that is being requested by the Ministries of Health in countries.

Government officials and media in the regions where the projects are implemented know and acknowledge the work of IDRC, however there is relatively limited understanding and recognition of IDRC and its work among other donors that work in the sector. To address this IDRC should be more pro-active in communicating about its work at the global level. Government partners and institutions should be involved in the project at an early stage, beginning with the development of the project proposal. This will help align eHealth research with larger health and health-related research priorities in a way that better informs policy, scale, and sustainability.

As IDRC charts the way forward, it ought to continue reinforcing its strengths that include promoting and sponsoring action research and implementation science, communities of practice, and big-picture investments (enterprise architecture, standards, privacy and security, interoperability). Finding a balance between investments that enable innovation, while strengthening levels of rigorous academic and policy-related research and provide extended support to earlier investments to achieve broader scale and greater sustainability will be IDRC's challenge and strength. IDRC should continue to leverage its reputation as an organization that 'convenes the right stakeholders to participate in discussions regarding eHealth' and drive the agenda and lead donor coordination efforts.

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14. Appendix

14.1 Appendix A: Glossary of terms

eHealth is a term used to describe the combined use of electronic communication and information technology in the health sector or is the use, in the health sector, of digital data-transmitted, stored and retrieved electronically-for clinical, educational and administrative purposes, both at the local site and at a distance

eLearning comprises of all forms of electronically supported learning and teaching. The Information and communication systems, whether networked or not, serve as specific media to implement the learning process. The term will still most likely be utilized to reference out-of-classroom and in-classroom educational experiences via technology, even as advances continue in regard to devices and curriculum.

An **electronic medical record (EMR)** is a computerized medical record created in an organization that delivers care, such as a hospital. Electronic medical records tend to be a part of a local stand-alone health information system that allows storage, retrieval and modification of records.

Enterprise Architecture (EA) is a rigorous description of the structure of a health information system, which comprises of enterprise components (i.e. pharmacy management, laboratory management), the externally visible properties of those components, and the relationships (e.g. the behavior) between them. EA describes the terminology, the composition of enterprise components, and their relationships with the external environment, and the guiding principles for the requirement, design and evolution of a health information system. This description is comprehensive, including enterprise goals, processes, roles, organizational structures, organizational behaviors, business information, software applications, and computer systems.

Health Information System is the underlying technology and processes that manages the collection, storage, retrieval and secure exchange of health care information, data, knowledge and communication between patients, providers, government entities, and insurers, if applicable.

Interoperability is the ability for diverse systems and technologies in a health information system to work and communicate with each other

JavaROSA is an open source platform for data collection on mobile phones

mHealth is the application and use of mobile and wireless technologies for health services and information management. mHealth applications include the use of mobile devices in collecting community and clinical health data, delivery of healthcare information to practitioners,

researchers, and patients, real-time monitoring of patient vital signs, and direct provision of care (via mobile telemedicine).

mHealthSurvey is a mobile application being used by IDRC grantees to collect clinical data

OpenMRS is a collaborative open-source project to develop software to support the delivery of healthcare in developing countries. OpenMRS is founded on the principles of openness and sharing of ideas, software and strategies for deployment and use. The system is designed to be usable in very resource poor environments and can be modified with the addition of new data items, forms and reports without programming. It is intended as a platform that many organizations can adopt and modify avoiding the need to develop a system from scratch.

Platform is some sort of hardware architecture and software framework (including application frameworks) that allows software to run. Typical platforms include a computer or mobile phone's architecture, operating system, programming languages and related interface.

Scalability is a characteristic of a system, model or function that describes its capability to cope and perform under an increased or expanding workload. A system that scales well will be able to maintain or even increase its level of performance or efficiency when tested by larger operational demands

Standards are the output of standardization, which is the process of developing and agreeing upon technical standards. A standard is a document that establishes uniform engineering or technical specifications, criteria, methods, processes, or practices. Some standards are mandatory while others are voluntary. Voluntary standards are available if one chooses to use them. Some are de facto standards, meaning a norm or requirement which has an informal but dominant status. Some standards are de jure, meaning formal legal requirements. Formal standard organizations such as International Organization for (ISO) or the American National Standards Institute, are independent of the manufacturers of the goods for which they publish standards.

Sustainability is the capacity of a project to build a model or system that can endure and achieve long-term maintenance

Telemedicine is a rapidly developing application of technology where medical information is transferred through interactive audiovisual media for the purpose of consulting, teaching and/or remote medical procedures or examinations.

14.2 Appendix B: Methodology

The methodologies used to conduct the evaluation were as follows.

1. Documentary Review: Project Reports & Evaluations

The documentary review and analysis aimed to examine and synthesize information extracted from the proposal documents and interim reports submitted to the IDRC as part of the monitoring and evaluation of the grant. This was executed in three separate phases.

Phase 1: Systematic extraction of information from IDRC grantee proposals, reports, and publications for each project under the following topic headings: organization details, project details, partners, research design, health outcomes, capacity building, policy development, technology assessment, project outputs, sustainability, lessons and recommendations.

Phase 2: Extraction of information of one topic heading from all 24 projects into one document.

Phase 3: Synthesis and analysis of information within each topic heading to identify common themes and lessons learned.

2. Literature Review

A targeted literature review was conducted to identify key themes and emerging topics in the eHealth field in developing countries. This was used to contextualize IDRC's eHealth portfolio, in addition to understanding where the agency fits into the broader landscape.

The literature review was conducted using the following criteria:

- Review of 20- 40 existing literature reviews on eHealth in developing countries published between 2005 – 2010 to inform vertical eHealth trends
- Review of 5-10 published reports and/or whitepapers on eHealth in developing countries published between 2005-2010 to inform horizontal eHealth trends
- Limited to literature published in the English language
- Coverage of the following vertical eHealth trends: eHealth networks, eHealth, telemedicine, health information systems, electronic medical records, mHealth, data collection or decision support, disease surveillance, supply chain management, eLearning, disaster response
- Coverage of the following horizontal eHealth trends: eHealth policy, health governance, health financing, health equity, and free and open source software
- Coverage of the following software platforms: OpenMRS, JavaROSA, and eS@nte
- Focus on literature where eHealth studies were implemented in a developing country(s)

This was complimented by a review of the articles published and/or in press from the 24 IDRC grant projects being reviewed.

3. Lessons Learned Workshops

Three Lessons Learned Workshops were conducted in Cape Town, South Africa (9/18/2010), Colombo, Sri Lanka (10/26/2010) and Granada, Nicaragua (12/4/2010) to convene IDRC grantees in each region. The workshops were designed to engage grantees in an interactive discussion regarding the lessons learned, challenges and successes experienced within each project, in addition to the participants' vision for the next 5 years of eHealth in the region. This included an exercise which required participants to visually map out key steps, processes and decisions taken for the execution of their project. The outputs of these workshops were packaged into shorter reflection reports and used to guide the results, challenges, lessons learned and recommendation sections of this evaluation.

4. Semi-Structured Interviews with Key Informants

Interviews were also conducted with approximately 15 key informants from IDRC and 10 key informants from external organizations that are actively engaged in eHealth activities (*See Appendix for list of interviewees*).

IDRC Project Managers and Programs Officers (15)

IDRC Project Managers and Program Officers, with at least one from each region, were interviewed to gain insight into the rationale for funding and historical account of each grantee. This discussion was complimented by questions regarding the perception of major achievements realized from IDRC funding, in addition to the challenges and lessons learned through each project. For Project Managers and Program Officers that were new to IDRC's work in eHealth, interviews focused on defining the vision for the future.

External Stakeholders (10)

External Stakeholders from organizations such as World Health Organization (WHO), the World Bank, and the Rockefeller Foundation were interviewed to understand the external perceptions of IDRC's contribution to eHealth in developing countries. This was complemented by questions regarding the Centre's strengths and weaknesses, in addition to recommendations for the future of IDRC funding in eHealth (*See Appendix for Interview Guide*).

5. Surveys

Two web-based surveys were developed and administered using the software program, Survey Monkey. The first survey was designed to capture quantitative outcomes from eHealth implementations. The analysis of the survey results was limited to projects in the evaluation that have been completed. The survey was completed 18 times. The results of nine completed

projects were aggregated in the analysis and the others used to provide a broader sense of IDRC's quantitative impact in eHealth.

The second survey was designed to assess the usability and value of eHealth software and/or applications developed as a result of IDRC funding. This survey was sent to end-users recommended by project leaders.

Both surveys were designed in collaboration with IDRC (*Surveys attached as separate documents*).

14.3 Appendix C: Timeline

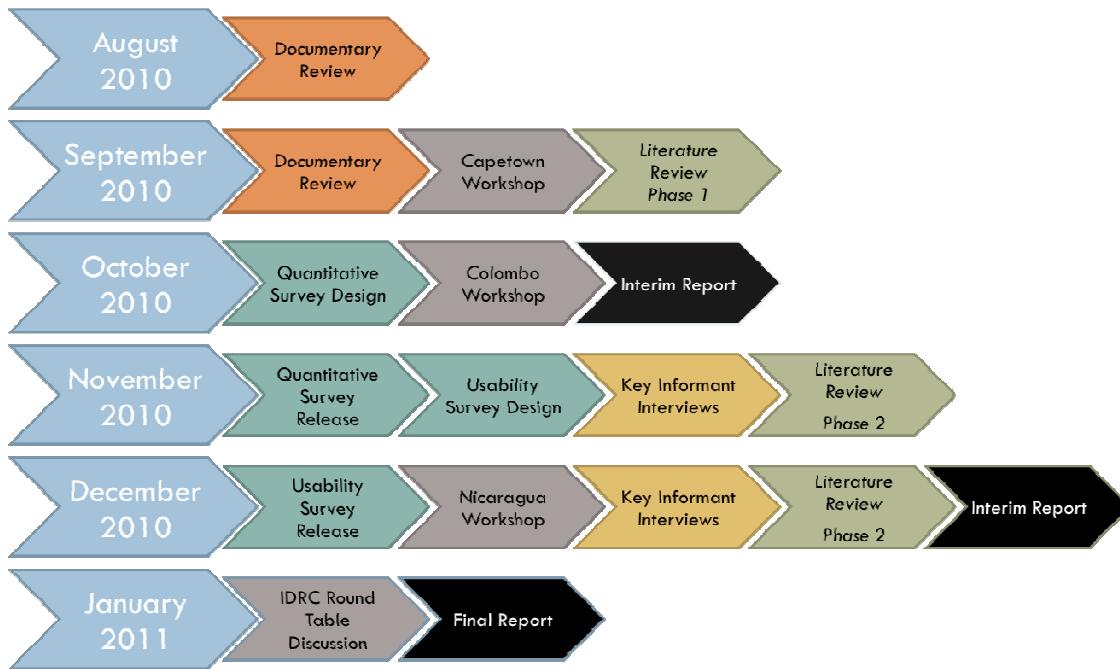


Figure 27: IDRC eHealth evaluation timeline

14.4 Appendix D: IDRC projects included in the evaluation

Project Name	Project #	Funding (\$CAD)	Region	Country	Stage	Theme
Evaluating a Real-Time Bio Surveillance Program: Pilot Project	105130	349,900	PAN Asian	India; Sri Lanka	Complete	Implementation
PAN Asian Collaboration for Evidence-based e-Health Adoption and Application (PANACeA)	104161	2,422,652	PAN Asian	N/A	Complete	Network
Project Proposal: Regional Health and ICT Research Network (Asia)	103360	180,468	PAN Asian	N/A	Complete	Assessment
Partnership for strengthening Healthcare and Professional Education in Rural Afghanistan*	106117	35,000	PAN Asian	Afghanistan	Mid-point	Implementation
Protecting Medical Information in eHealth Projects	106115	90,000	ACACIA	N/A	Mid-point	Standards/Policy
Application of a Community eS@nté Platform in Maternal and Child Health in Sénégal	105720	426,400	ACACIA	Senegal	Mid-point	Platform
Open Architecture Standards and Information Systems (OASIS) across eHealth in Africa - Phase II	105708	2,100,000	ACACIA	Ghana; Kenya; Mozambique; Rwanda; Uganda	Mid-point	Implementation Standards/Policy
Rwanda Health and Education Information Network (OASIS-RHEIN)	105293	920,500	ACACIA	Rwanda	Mid-point	Implementation Network
Capacity Building in Open Medical Record System (OpenMRS) in Rwanda	104862	460,400	ACACIA	Rwanda	Near Complete	Capacity Building

Project Name	Project #	Funding (\$CAD)	Region	Country	Stage	Theme
Uganda Health Information Network (UHIN) - Phase IV	104819	726,318	ACACIA	Uganda	Complete	Network Implementation
Open Architecture, Standards and Information Systems (OASIS) for Healthcare in Africa	104508	999,300	ACACIA	South Africa; Mozambique; Zimbabwe	Complete	Implementation Standards/Policy
Mozambique Health Information Network	103746	1,631,200	ACACIA	Mozambique	Near Complete	Network Implementation
Developer Network: Open Source Personal Digital Assistant Software for Health Data Collection	101974	204,300	ACACIA	N/A	Complete	Network Implementation
Public eHealth Innovations in Latin America and the Caribbean	105798	1,500,000	CEA/ICA	N/A	Inception	Assessment
Research and Capacity Building toward Improving Health Information Systems in Latin America and the Caribbean	106302	130,000	CEA/ICA	N/A	Inception	Capacity Building
Strengthening Health Information Systems to Support Post-Disaster Healthcare in Haiti	106147	520,000	CEA/ICA	Haiti	Mid-point	Implementation

Project Name	Project #	Funding (\$CAD)	Region	Country	Stage	Theme
Enhancing Nurses Access for Care Quality and Knowledge through Technology (ENACQKT)	104544	1,151,890	CEA/ICA	Barbados; Dominica; Dominican Republic; St. Lucia; St. Kitts; Nevis	Mid-point	Platform Network
Strengthening Community Health in Uganda	106312	98,400	ACACIA	Uganda	Mid-point	Assessment
Harnessing Mobile Phones for Prevention of Mother-to-Child HIV Transmission	105966	341,100	ACACIA	Nairobi, Kenya	Inception	Implementation
ICTs for Equal Access to Human Resources in Health in Francophone Africa	106015	327,800	ACACIA	Mali	Inception	Assessment Implementation
ICTs to support and evaluate the ARV (Anti-retroviral) rollout therapy in the Free State province, South Africa	102411	699,000	ACACIA	South Africa	Complete	Platform Implementation
Sharing Experience and Expertise on National Health Information Systems Strengthening	106275	50,000	Global	Global	Complete	Capacity Building
Pilot Project Using ICTs to Monitor Chagas' Disease in Argentina, Bolivia and Brazil	103818	599,000	CEA / ICA	Argentina; Bolivia; Brazil	Complete	Implementation
Punto J: a Portal for Youth-to-Youth Education on Health and HIV/AIDS - Phase II	103814	720,900	CEA / ICA	Dominican Republic; Mexico; Ecuador; Argentina; Peru; Bolivia	Complete	Platform Implementation
Regional Overview of Mobile	103369	82,250	CEA / ICA	N/A	Complete	Assessment Capacity Building

Telephony in the Health Services in Latin America and the Caribbean						
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Table 2: IDRC projects included in evaluation

14.5 Appendix E: Key Informant Interview Guide

Before the formal interview

- Record all interviews either using Microsoft Word Notebook, Skype or Built-in recorder for easy access on any PC or Macbook
- At the beginning of the interview, please state the following information
 - Name of interviewee
 - Organization
 - Role
 - Date, Time and Location
- Please obtain verbal consent from the interviewee that you can record this interview
- Provide a preamble of the purpose of this interview and fit within the broader evaluation of IDRC's eHealth portfolio

Group A: IDRC Program Leaders

Objectives

- To understand lessons learned from managing eHealth projects funded by the IDRC
- To understand the achievements of eHealth projects funded by the IDRC
- To understand the challenges experienced by IDRC in funding eHealth projects in developing countries
- To understand the perceived role that IDRC has played and the role that they should be playing in the eHealth sector in developing countries in the future
- To understand the vision for eHealth in developing countries in the next 5 years

Questions

1. Which grants did you manage and/or were involved in? (*Show interviewee list of projects and read out grant numbers*)
2. What would you say was the most successful outcome from each grant you managed and/or were involved in?
3. What lessons have you learned by managing eHealth grants? (*Go through each project, discuss region, and overall impressions – this will depend on which projects the individual has managed*)
4. What challenges did you face while managing your eHealth projects? What strategies did you use to overcome them?

5. If you could go back, what would you change about how each eHealth grant was managed, implemented and/or structured?

6. In the last 5 years, what do you think IDRC's contribution has been to eHealth in developing countries?

7. Amongst the donor landscape of eHealth in developing countries, what role do you think IDRC plays? Do you think that is how others perceive IDRC?

8. What areas of eHealth do you think hold the greatest promise to impact health outcomes in the next 5 years? (Ask them to rank)

- Telemedicine
- Networks
- Health Information Systems
- Disease Surveillance
- Electronic Medical Record
- Supply Chain Management
- Data Collection and Research
- eLearning
- Health Financing

9. In the next 5 years, what is your vision for IDRC's role in eHealth? What should stay the same, what should change, and what should be added?

Group B: External Stakeholders

Objectives

- To understand the perceived role that IDRC plays in the eHealth sector in developing countries
- To understand the largest contribution that IDRC has made to the eHealth sector in developing countries
- To understand the lessons learned from being involved in eHealth projects in developing countries
- To understand the vision for eHealth in developing countries in the next 5 years
- To understand where the largest opportunities are for eHealth in developing countries in the next 5 years

1. What is your organization's role in contributing to the eHealth sector in developing countries? What is the value of your organization's total investment into eHealth projects in developing countries?

2. How do you view IDRC's role in the eHealth sector in developing countries?
3. In your opinion, what has been the greatest contribution that IDRC has made to eHealth in developing countries?
4. What lessons have you learned from participating in eHealth projects in developing countries?
5. What is your vision for eHealth in developing countries in the next 5 years?
6. In your opinion, what do you think are the largest **opportunities** in eHealth in developing countries in the next 5 years? What are the largest **needs**?
7. In your opinion, where do you think IDRC should focus its eHealth research programming in the next 5 years?

14.6 Appendix F: eHealth Literature Review

A targeted literature review was conducted to identify key themes and emerging topics in the field of eHealth in developing countries. These findings will be used to contextualize the IDRC's eHealth portfolio to understand where the agency fits into the broader global landscape.

The following criteria were used to guide the search strategy of the literature review:

- Review of existing literature reviews on eHealth in developing countries published in the English language between years 2005 - 2010
- Topic areas: health information systems, mHealth, health policy, health governance, health equity, free and open source software, disease surveillance, electronic medical records, supply chain management, decision support, disaster response, health financing, and eLearning
- Focus on literature in low- and middle-income countries and identification of regional trends in Asia, Africa and Latin America / Caribbean

The review was conducted between September and December 2010 using the following electronic databases: Web of Knowledge, PubMed, Scopus, EMBASE, and The Cochrane Library. We only searched for documents that were considered as reviews by each of the databases. In cases where articles could not be located within databases, complimentary searches with the same inclusion criteria were conducted using Google Scholar. All searches were limited to articles published in English.

The search yielded a total of 8,878 articles. These articles were parsed for discussions on low- and middle-income countries or developing countries, which resulted in 628 articles. The abstracts of the 628 articles were reviewed, and around five to six articles were initially selected for each eHealth trend. Articles that were more organized and thorough were selected, grouped by trend, and reviewed for providing a broad view of the particular trend. In general, these articles were cited more often than others. From these, we selected thirty-four articles for further analysis (approximately 1-4 articles per eHealth trend), which are detailed in the following review.

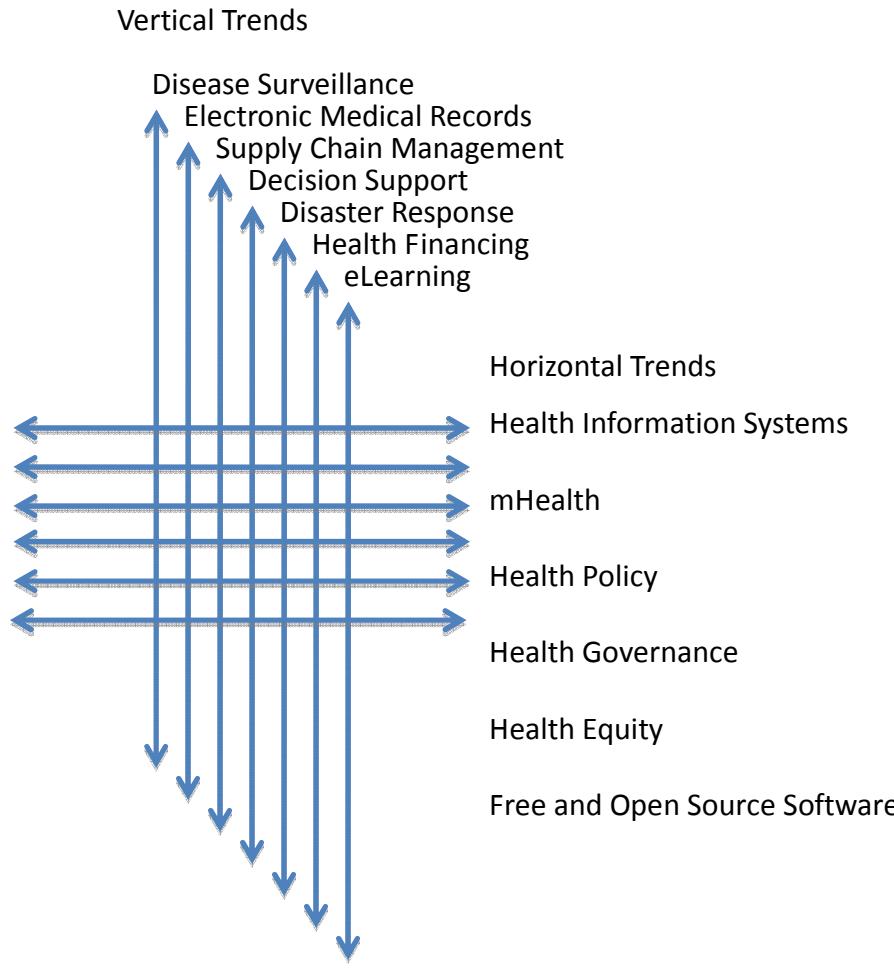


Figure 28: Vertical and horizontal eHealth trends identified in literature review

The literature review begins with an overview of the current state of eHealth research. This is followed by a description of general eHealth trends and a brief description of telemedicine. Then, in order to demonstrate the dimensions of the eHealth landscape, we deliver our findings from the literature review by acknowledging vertical and horizontal trends (as displayed above). Very few reviews resulted from keyword searches of the horizontal trends of eHealth; however, these topics were often mentioned in the reviews we have selected to describe the vertical trends. Because of this, we provide discussions on the horizontal trends as found through keyword searches across each of the reviews of the vertical trends. In essence, both trend directions need to be integrated to deliver health services to intended populations. Thus, we find that many of the trends overlap. This literature review is intended to provide an overview of key trends in eHealth to contextualize IDRC's current investments in the broader sector.

For each trend described, a consistent structure is used to logically guide the reader. When eHealth trends are encountered in the literature, their specific definitions are fairly loose, not

used consistently, exist as products of local vernaculars or author opinions, and often have and continue to evolve with time and technology advancement. Therefore, we begin each trend with a definition from the literature, when found, otherwise a description has been provided based on our experience in the eHealth sector. It is important, however, that the reader acknowledges the range of definitions for each trend in the field. This is followed by real-world examples of each trend and the challenges, barriers, and progress within each trend to achieve scale and sustainability. Then, we provide needs and recommendations made by authors of the selected reviews. Lastly, we discuss, where applicable, how IDRC's work fits into this trend.

14.6.1 Current State of eHealth Research

The current state of eHealth research exhibits few rigorous evaluations and more qualitative research when compared to quantitative. Blaya et al. performed a systematic review on evaluations corresponding to the implementation of eHealth activities (Blaya, 2010). They found few rigorous studies on the effectiveness and cost-effectiveness of eHealth systems in developing countries other than those involving data collection with PDAs. In addition, evaluations were linked to academic institutions rather than larger donors and were often more qualitative and descriptive though there is a growing collection of quantitative studies.

Additionally, one article cites that even though the number of in-depth studies has grown in comparison to a decade ago and the “geographical coverage” of research on this topic is quite broad, the geographical coverage is quite narrow when taking into account authors’ countries and it appears as though the English world is generally speaking with itself (Walsham & Sahay, 2005). For example, China is considered by Walsham et al. to be severely underrepresented in the research (Walsham & Sahay, 2005).

14.6.2 General eHealth Trends

The WHO defines eHealth as “the use of information and communication technologies (ICT) for health to, for example, treat patients, pursue research, educate students, track diseases and monitor public health” (WHO, 2010a). However, many definitions exist, and in the first of an article series entitled “What is eHealth?”, Eysenbach describes eHealth as a term that many use, but few can provide a clear definition (Eysenbach, 2001). Acknowledging the need for a broad definition, the author then provides his own definition of eHealth:

an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology (Eysenbach, 2001).

Although Eysenbach's definition was published in 2001, the concepts that he captures have withstood the dynamically changing field of eHealth, which was originally referred to as "telemedicine" and has also been previously called "telehealth" (Wootton, 2009). However, at this time, telemedicine, defined as "health(care) at a distance", is a large arm of eHealth that exists as a cross-cutting theme (also discussed in Pagliari, et al., 2005) in many of the eHealth trends presented in this literature review (Wootton, 2009).

In general, eHealth efforts aim to improve conditions in the health systems of LMICs, which are characteristic of a human resource shortages in rural areas, a lack of timely and reliable data, unequal accessibility inadequately supplied health facilities, and limited resources (Lucas, 2008). In the literature, applications of eHealth found to demonstrate a positive impact include tracking patients to improve follow-up; treatment adherence monitoring; information transfer between and within institutions; patient registers; clinical and research data collection with PDAs; decision support systems; error reduction through laboratory information management systems and pharmaceutical inventory management systems (Blaya, 2010; Wootton, et al., 2005). However, Lucas reports that there is the concern that eHealth activities have a tendency to focus on "the most high-profile" conditions, which could result in a distortion of proper health resource allocation (Lucas, 2008).

Other reviews described articles on eHealth that relate to using the Internet and other ICT as patient-centered agents for behavior change. Interventions usually target individuals in particular risk populations (e.g. women of reproductive age) or those who have been diagnosed with diseases (e.g. HIV-positive patients), and there have been effective interventions within this area. For example, reminders sent to patients have demonstrated to elicit increases in treatment compliances, and individuals have reported higher satisfaction with knowledge received through eHealth channels regarding health issues. However, an area that needs to be explored more is the particular behavioral processes that effect improved health outcomes (Pingree, et al., 2010).

Trends in telemedicine, a cross-cutting theme across the eHealth sector, have been found to differ by region. For instance, a systematic review performed by IDRC researchers assessed 109 articles describing the use of telehealth specifically in Asian countries (Durrani & Khoja, 2009). The authors found that nearly 75% of the studies were descriptive, and categorized the articles into five categories: access (20% of the articles), quality (40% of the articles), cost-effectiveness

(12% of the articles), change management (7% of the articles), and policy topics (4% of the articles). Some of the Asian countries had incorporated telehealth into larger development activities; however, in total, telehealth was found to be a new field characteristic of slow development.

Challenges of implementing telemedicine solutions in underserved populations was addressed by a targeted review article that described a SWOT analysis (strengths, weaknesses, opportunities, and threats) conducted on 12 telemedicine projects at the organization Universitas' 21's eHealth project (Wootton, et al., 2005). Threats to the success of these projects included adoption and accessibility of telemedicine, including illiteracy, which can impede one's ability to use the technologies or keep up with technology updates. Other cited threats include resources that prevent long-term sustainability and potential reluctance of health professionals to provide telehealth services.

14.6.3 Horizontal Trends

The horizontal trends described in this section were found to impact and intersect with all vertical eHealth trends identified. These include: health information systems, mHealth, health policy, health governance, health equity, and free and open source software.

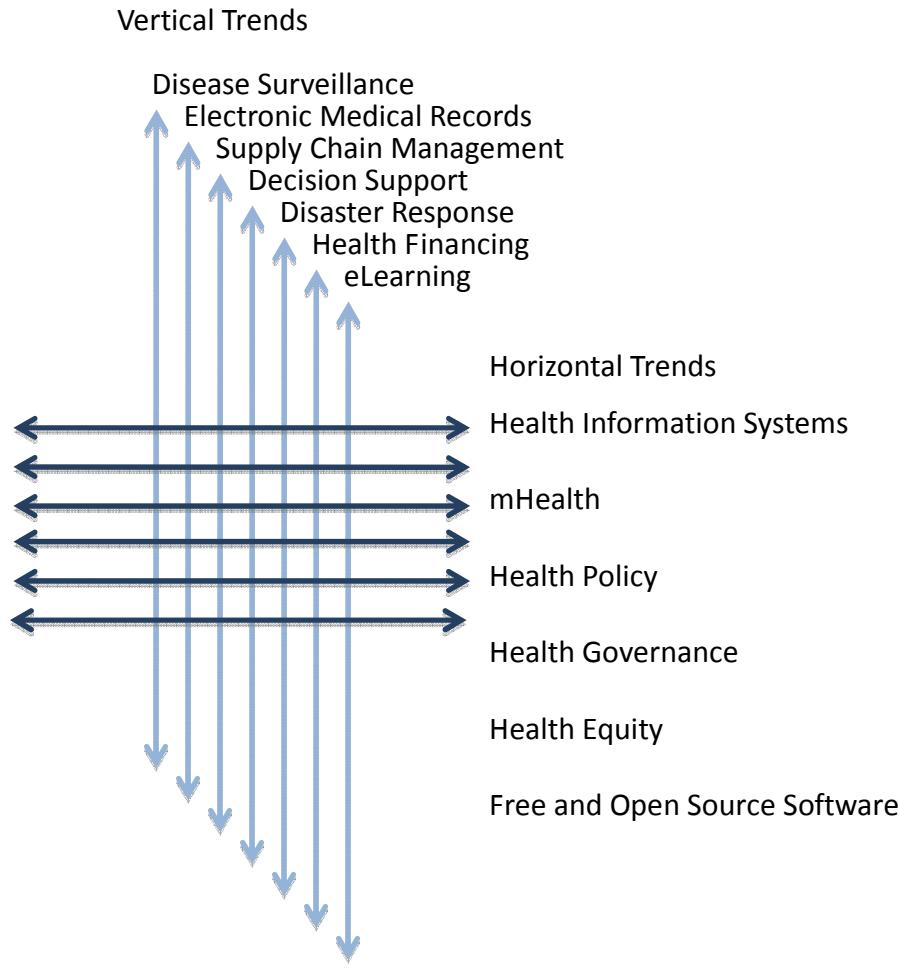


Figure 29: Highlighting horizontal eHealth trends identified in literature review

14.6.4 Health Information Systems

The first horizontal eHealth trend is health information systems (HIS), or “an integrated effort to collect, process, report and use health information and knowledge to influence policy-making, programme action and research”, including the infrastructure, technological and human components, networks, systems, and processes (Lippeveld, 2001; Braa, Hanseth, Heywood, Mohammed, & Shaw, 2007). Many countries in the developing world are placing resources and effort into strengthening their national HIS; however, these efforts are facing many challenges.

In the reviews on HIS, we find that challenges relating to privacy, security, information integration, scale, and sustainability are often discussed. Although it is inevitable for each country to confront its unique set of challenges and successes, one review discusses that the more commonly found challenges include coping with fragmentation, dealing with multiple data

sources, and lacking standards (Braa, et al., 2007). These issues are compounded by interoperability challenges when trying to design and implement enterprise architecture structures, which are the foundation of HIS. Hjort-Madsen reports that the challenges are as much technical, as political and economic, arising from the lack of umbrella coordination efforts among existing information systems and a lack of incentives for data and knowledge sharing (Hjort-Madsen, 2006). Also mentioned are challenges less foreseeable at the beginning of deploying strengthening efforts: scalability and standardization, particularly in the context of growing complexity issues, such as favored vertical programs (e.g. HIV/AIDS interventions) funded by international donors and the uneven development between urban and rural areas (Braa, et al., 2007).

In another review, Kuhn et al. mentions several important points in regards to identifying current developments, obstacles, and opportunities for HIS (Kuhn, Wurst, Bott, & Giuse, 2006). The authors note that further developments in HIS should include more ubiquitous computing, which “combines mobile and pervasive computing in order to surround the citizen or patient with technology that provides him or her unobtrusively with information and services dependent on the environment and the context”, and more personalized medicine and prevention; however, these developments are not without the need for stakeholder buy-in to address challenges of privacy, security, and knowledge management (to form the information in a way that it can be used). Other obstacles mentioned by the authors include integrating information from the different health care models that may exist within a country (e.g. private sector, public sector), ensuring users adopt the system successfully, and making sure that goal and objectives are clear. In regard to this last obstacle, the authors suggest creating a climate for effective exchange of ideas and experiences.

IDRC is supporting the advancement, and in many cases, leading the dialogue for designing an open enterprise architecture framework for eHealth in developing countries through projects such as the Open Architecture and Standards Information System (OASIS) being implemented in Kenya, Ghana, Mozambique, Rwanda and Uganda. In addition, in June 2010, IDRC funded a one-day workshop in Vancouver, Canada, which brought together researchers from North America, Africa, Asia, and Latin America to discuss HIS and enterprise architectures in developing countries.

14.6.5 Mobile Health (mHealth)

The mobile phone is a tool, which is increasingly being utilized to compliment eHealth activities. Referred to as mobile health or “mHealth”, the application of mobile phones to health delivery

is growing because of increased consumer penetration and expansion of network coverage. A recent policy white paper was conducted to address barriers and gaps of mHealth in LMICs (Mechael, et al., 2010). Study findings were categorized as relating to treatment compliance, data collection and disease surveillance, health information systems and point-of-care support for health workers, disease prevention and health promotion, and emergency medical response. In general, the main barriers and challenges were related to scalability and sustainability – both challenges resulting from limited evidence from which strong conclusions can be drawn about how the use of mobile phones can improve health outcomes and processes. However, the available evidence lacks cost-effectiveness studies, the measurement of clinical outcomes, and studies describing mHealth interventions involving HIV/AIDS, TB, malaria, and chronic conditions. Remarks regarding the lack of high quality studies in the literature have also been made in other reviews on mHealth (Kaplan, 2006). This lack of strong evidence inhibits the construction of global or national policies, strategies, and guidelines that could alleviate the challenges mHealth projects face regarding scale and sustainability.

A review conducted by Martins and Jones describes mHealth pilot projects as having to pay attention to new implementation challenges that require not only technological changes, but also behavior changes in the users at the individual and organization levels (Martins & Jones, 2005; Mechael, et al., 2010). One of these implementation challenges is privacy and security issues (the authors provide the example of ensuring the integrity of original records and protecting information in handheld devices and attacks on wireless systems). Training health professionals in the use of the mobile devices was offered in insufficient amounts, and the authors suggested that adequate education be paralleled with options for easier data entry and that follow-up training be provided. Problems commonly reported included small screen sizes, battery problems, and limited connectivity.

Similarly, another review of the literature found that SMS-based interventions returned positive short-term behavioral outcomes, but more research needs to be conducted to further evaluate prevention interventions using SMS with the features found to affect behavior change, which was previously discussed regarding the eHealth trend in general (Fjeldsoe, Marshall, & Miller, 2009).

Similarly, IDRC has funded pilot projects specifically studying the impact of mobile phone solutions on improving health outcomes. For instance, a project being executed in the Philippines, Pakistan and Indonesia is testing the effectiveness of sending safe motherhood messaging via SMS. Although small-scale in nature, cross-country studies are rare in the mHealth literature, and results may offer insights into scaling interventions. In other cases, projects were found to integrate mobile phones as an additional channel to collect data and view patient and health information as part of broader eHealth implementations.

14.6.6 Health Policy

Another horizontal trend prevalent in the eHealth literature is health policy. Mars et al. concluded that eHealth is absent from policy even when governments or international organizations support its use, and necessary on both global and local levels, eHealth policy demonstrates itself to be evolving (Mars, 2010). In contrast to developed countries, which have more policies for eHealth issues, the authors draw from a couple of rare cases of eHealth policy in LMICs and mention that developing countries are “in danger of being led...into adopting so-called international best practices, which may well be inappropriate for the developing world” (Mars, 2010). Emphasis on policy making at both global and local levels is also echoed in an article by Gerber et al. (Gerber, 2010). Dzenowagis describes that collaboration with national policy makers, specifically those involved with ICT policy, will be essential in linking the health sector into national ICT policy; however, lack of bandwidth, as well as reliable ICT infrastructure, within LMICs are “severe constraints” (Dzenowagis, 2009). Edirippulige et al. cites that the exclusion of the health sector in national ICT policy is a cause for the slow adoption of eHealth, and reasons the authors provide for this include: the lack of awareness of the benefits among policy makers, lack of evidence for the benefits, limited finance, prejudice, lack of expertise, and health system inertia (Edirippulige, 2009).

Many projects funded by IDRC have directly impacted national eHealth policy development, as described later in this report. One specific project being supported by IDRC is currently investigating the key privacy and security issues in eHealth in developing countries, with goals to develop a framework that will influence policy and decision makers. While grantees almost unanimously reported the need for additional support regarding influencing eHealth policy outcomes, trainings and workshops focused specifically on drafting eHealth policy briefs were found in the evaluation.

14.6.7 Health Governance

Another horizontal theme of eHealth is health governance, or “the actions and means adopted by a society to organize itself in the promotion and protection of the health of its population” (Dodgson, 2002). WHO in its report “Building Foundations for eHealth” describes how health governance encompasses four principles: accountability, participation, consistency, and transparency, all of which the report states are applicable to eHealth (WHO, 2006). In general, for the countries integrating ICT into national policies, governance is mentioned as an objective. Hennessy et al. (2010) describes the integration of e-strategies into governmental policies. The authors describe a handful of countries that have or intend to use ICT for improving governance: Burundi’s development policy includes the use of ICT for promoting good governance; Rwanda has a subplan entitled ‘e-government and e-governance’ within its development activities; and

Tanzania aims to use ICT for good governance and transparency in a nationwide eLearning initiative (Hennessy, 2010).

Particularly in regards to mHealth, data rights and governance in the health sector were discussed by Mechael et al. (2010). The authors suggest that governments, Ministries of Health, and HIS should ensure that data are used to benefit communities and that in the action of providing medical advice, there must be governance.

White et al. discusses the use of “data banks” for decision support tools to improve governance and that they are necessary for “successful development planning” (White, 2010). The authors cite several articles that describe tools used for improving governance or supporting governmental activities.

14.6.8 Health Equity

Health equity, a horizontal eHealth trend, can be considered as the “absence of systematic disparities in health (or in the major social determinants of health) between groups with different levels of underlying social advantage/disadvantage – that is, wealth, power, or prestige” (Braveman, 2003). Health equity was mainly addressed in the reviews relating to HIS. Braa et al. (2007) provides a description of how success in creating an HIS is achieved where ICT access is available not only between rural and urban regions, but also in both the private and public sectors. However, the difficulty of promoting equity in an HIS representative of a country’s population is much more complex. As an example, the authors exemplify how the apartheid era in South Africa set a fragmented and incompatible infrastructure upon which a more standardized HIS that collected data from all population groups was to be built. Additionally, Wootton et al. (2005) mentions that equity to health care access is “not the ultimate goal of a health-care system” but further investment will be necessary to assure telemedicine applications are available in underserved regions (Wootton, 2005).

Investigating health equity issues was a common future interest reported by grantees; however, only one project was found to focus specifically on this eHealth trend. Researchers in Mali are studying the impact of ICTs on achieving equitable access to human resources in health. Further, some projects were found to address gender equality issues in the evaluation of their eHealth studies.

14.6.9 Free and Open Source Software (FOSS)

Lastly, FOSS is an approach to eHealth that focuses on the way ICT tools are shared. Although free software and open source software are grouped together in this category, there are strong implications on their differences in terms of licensing agreements, current and future use, and access to source codes. In open source software, source codes are available to anyone;

whereas, in free software, the source code is not freely available, yet the software itself is available for anyone to use (Kalogriopoulos, 2009). In their literature search, Walsham et al. (2005) stresses that more research is needed on the distinctions and subcategories between free software and open software, and existing articles do not provide details.

In terms of open source software, Williams et al. mentions the use of an EMR system built on an open source platform to be a “useful and significant tool for developing countries” since it reduces costs, can be easily modified and tailored to local contexts, and opens up the opportunity to gain from collaboration (Williams, 2008). After detailing the open source systems for EMRs in Peru and Haiti, Fraser et al. (2005) describes that open source systems are cheaper for institutions with larger human resource capacity, and alternative options include commercial relational databases. In a systematic review of telehealth in Asia by Durrani and Khoja (2009), 14% of the 109 studies reviewed reported using open source software. Similarly, Stol et al. (2009) identified 27 studies describing 34 projects using open source software, and after in their review, they provide four points for future research, including aspects of open source software, taxonomy of open source software research, project diversity, and research methods.

IDRC has been a strong proponent of the FOSS approach, and has developed a reputation for advancing this eHealth trend. It has achieved this by not only funding the development of specific FOSS eHealth applications, but also forums for software developers to collaborate and meet face to face. The OpenMRS Developers Network is an example of a model that has advanced the development and adoption of a FOSS application, in addition to being replicated by other FOSS applications.

14.6.10 Vertical Trends

In addition to the horizontal categories, the eHealth solutions can be segmented into vertical trends, including: disease surveillance, electronic medical records, supply chain management, decision support, disaster response, health financing, and eLearning.

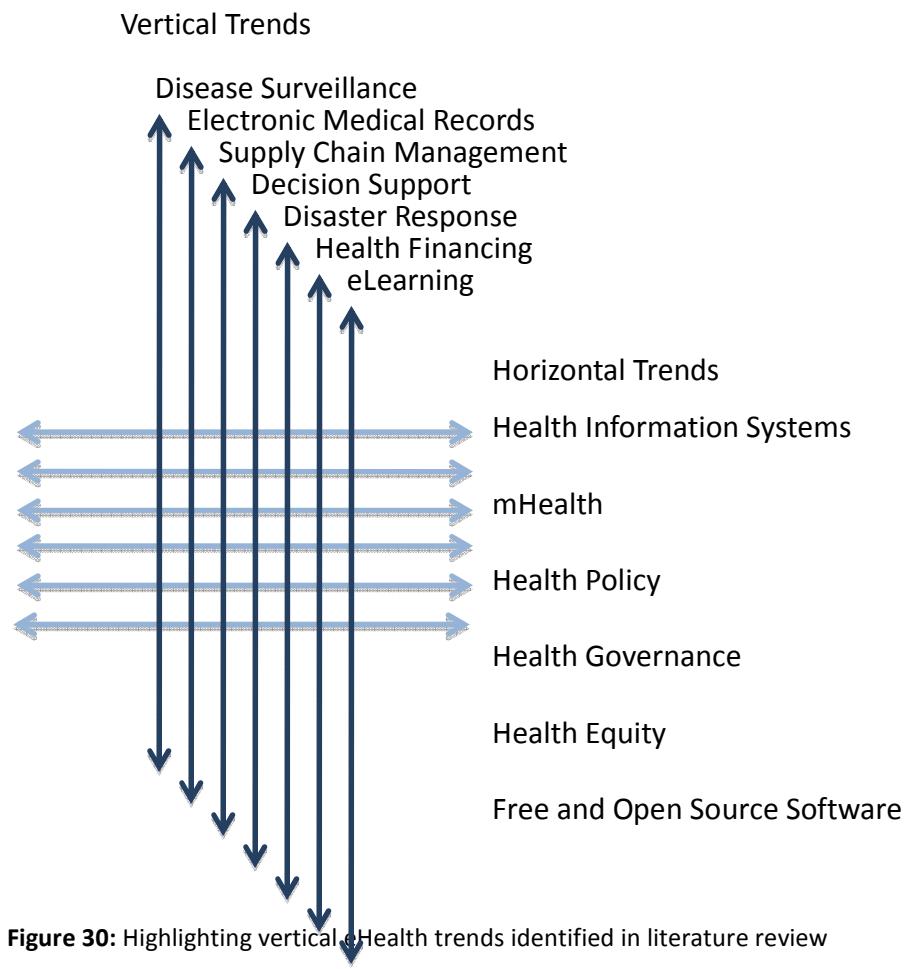


Figure 30: Highlighting vertical eHealth trends identified in literature review

14.6.11 Disease Surveillance

The first vertical eHealth trend is disease or public health surveillance. Whereas disease surveillance encompasses the surveillance of specific diseases (e.g. HIV/AIDS, avian influenza), WHO defines public health surveillance as (WHO, 2010b):

the continuous, systematic collection, analysis, and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice. Such surveillance can:

- serve as an early warning system for impending public health emergencies;
- document the impact of an intervention, or track progress towards specified goals; and

- monitor and clarify the epidemiology of health problems, to allow priorities to be set and to inform public health policy and strategies

In all of the bullet points above, electronic tools have been utilized to achieve these objectives. Demonstrating a global effort towards the concept of global public health surveillance, the 58th World Health Assembly, the decision making body for the WHO, adopted the revised International Health Regulations which provides the opportunity for mandating countries to coordinate their actions through a universal network of surveillance networks (Calain, 2007). However, although a global framework exists, a review of the literature suggests that many health systems in LMICs will have to address intrinsic difficulties in developing surveillance systems at national levels.

In another literature review, which assessed the experiences of both developing and developed countries in evaluating surveillance systems for communicable diseases, Sahal et al. identified some of these intrinsic challenges. (Sahal, Reintjes, & Aro, 2009). For instance, the authors found that the surveillance system in Uganda lacked standard case definitions, the capacity to confirm priority diseases, and performance reviews at the health facility and district levels. In Tanzania, five infectious disease surveillance systems work independently of each other, and if integrated, savings could result. In Ethiopia during an assessment in 1999, delayed identification and outbreak response were the results of issues with reporting in a timely fashion; however, with political support, “notable advances” were made by 2002. Mali and Ghana both experienced problems related to overcentralized surveillance systems, and particularly in Mali, accuracy of surveillance data was affected by the absence of private sector contribution. Additionally, conflicts and civil wars affected the functioning of some of the systems in developing countries (Sahal, et al., 2009).

To assess accessibility to information that can be used to improve national health surveillance systems, one review of six systems in five LMICs interviewed health personnel at various levels of corresponding Ministries of Health on system attributes, such as timeliness, accuracy, simplicity, flexibility, acceptability, and usefulness (Wilkins, Nsubuga, Mendlein, Mercer, & Pappaioanou, 2008). The authors found many complex problems regarding accessibility of information for decision makers, and the most commonly cited involved design of systems, the lack of ongoing training for the personnel, and process of disseminating data from the system (Wilkins, et al., 2008). Not receiving reports on time also contributed to problems in the surveillance systems, in addition to the use of multiple forms, unclear responsibilities or protocols, and a lack of motivation among personnel (Wilkins, et al., 2008). All systems evaluated were reported to be “unresponsive to local needs” and “unacceptable” (Wilkins, et al., 2008).

In order to have appropriate surveillance in place for disease prevention and control, suggestions made by the authors of the reviews described above include: (1) routinely evaluating the system, (2) using modern technology, (3) decentralizing the system, (4) involving the private sector, (5) developing human and material resources, (6) improving local ownership through responding to local needs and participatory design, and (7) including training of personnel and systems planning and financing of public health programs (Sahal, et al., 2009; Wilkins, et al., 2008).

IDRC supported the development of sophisticated disease surveillance systems in India and Sri Lanka, in addition to being a long-time funder of the Uganda and Health Information Network, which is a platform designed for disease surveillance that are integrated into national health information systems. This platform was then expanded to Mozambique.

14.6.12 Electronic Medical Records

Electronic medical records (EMRs), also known as electronic health records, automated health records, and computer-based patient records, are records that (1) contain “all personal health information belonging to an individual”; (2) are “entered and accessed electronically by healthcare providers over the person’s lifetime”; and (3) extend “beyond acute inpatient situations including all ambulatory care settings at which the patient receives care” (WHO, 2006). Depending on the country or context, the records may be available within one institution or several institutions (WHO, 2006).

Examples of EMR systems being developed in LMICs include: Kenya’s ARMS system, previously called the Mosoriot Medical Record System (MMRS), which serves 60,000 patients, uses two computers running Microsoft Access on a network, and has solar power back up; Peru’s open-source, web-based system, which is connected to an Oracle database that serves 4300 patients; and rural Haiti’s EMR system, which can serve 4000 patients and is essentially the same system as Peru’s with the addition of an offline client that supports data entry and review (Kalogriopoulos, Baran, Nimunkar, & Webster, 2009). In Kenya, having patients register at arrival and carry around a paper form during their visit resulted in reductions in visit time, waiting time, and patient-provider time; however, more time was needed for clerks to transcribe the data. The system in Peru resulted in a 17% reduction in errors, and the system in Haiti reflects the integration of an EMR system in rural areas that may lack infrastructure and adequate human resources (Kalogriopoulos, et al., 2009).

In addition to describing different types of EMRs, EMR components, and existing EMRs, another review article describes how implementing an EMR system in a developing country can be quite expensive and will confront downsides, such as population demographics, the location of health facilities which will need to extract EMR information, and electricity availability and consistency (Kalogriopoulos, et al., 2009). However, transitioning from paper-based medical records to EMRs has many benefits. Some of these include improvements in: the legibility of clinical notes; decision support for drug ordering, including allergy warnings and drug incompatibilities; reminders to prescribe drugs and administer vaccines; warnings for abnormal laboratory results; support for program monitoring, such as reporting outcomes, budgets, and supplies; and management of chronic diseases; decreased chart pulls; lower transcription costs; reduction of medical errors and improvements in quality of care and patient safety standards (Poissant, Pereira, Tamblyn, & Kawasumi, 2005).

Similar to the reviews covered in the HIS trend in the literature, several suggestions were common, such as EMR projects should keep in mind the potential for scaling up the service to support other aspects of patients more holistically (e.g. other diseases and related medications), as well as information that may come from other sectors of the health system servicing patients.

IDRC has supported a few projects related to the development of EMRs, in addition to developing human resources capacity to manage EMR development within a country. An electronic health record developed to support the roll-out of antiretroviral treatment in the Free State in South Africa led to creating one of the largest patient registries in the world. Further, support of training young professionals in Rwanda on EMR software platform, OpenMRS, played a role in influencing the government to roll-out the program nationally and support the training of an eHealth workforce.

14.6.13 Supply Chain Management

Another vertical trend of eHealth revolves around logistics or supply chain management. One definition of logistics in the humanitarian context is “the process of planning, implementing, and controlling the efficient, cost-effective flow of and storage of goods and materials as well as related information, from point of origin to point of consumption for the purpose of meeting the end beneficiary’s requirements” (Tomasini, 2005). One review found that the literature on supply chain management emphasizes the “relationship between information flows and the responsiveness or efficiency of resource flows” (Day, Junglas, & Silva, 2009). However, in practice, many organizations neglect developing logistics and instead focus on fundraising opportunities (Kovacs & Spens, 2007). In a comprehensive review of the literature, White et al. reports that operations research literature exists for Africa and Asia as regions, though no

extensive reviews appear to exist capturing the South America region (White, Smith, & Currie, 2010). The authors critique that the majority of the operations research in infectious diseases focuses on HIV and they comment that not only does this literature neglect other diseases with high burdens but also that describing HIV operations appears to be overworked. Operational research addressing maternal and child mortality is also scant, though data appear to exist in official records.

Most reviews found were related to humanitarian relief, which is a more complex topic because of the need to coordinate information and supply flows among different organizations and agencies in an unpredictable and urgent environment. Although eHealth in the context of disaster response is reviewed as a separate trend, we discuss the supply chain management aspect here. One report provides examples of emergencies and natural disasters where ICTs were able to deliver information in a coordinated manner and to collect information for coordinating supplies and assistance (Coyle, 2009). In an article reviewing literature to gain insight for management support systems during relief operations in Sudan, it was observed that during periods when the international nonprofit sector experienced large growths and an increase in aid, the supply chain capacity was slow to adapt, leading to waste and inefficiencies (Beamon & Kotleba, 2006). Additionally, standard logistics models were seen to break down when more organizations were involved and when large natural disasters would occur, often resulting in inefficient redundancies. Day et al. described in their review that although supply chains can quickly form, information flow hinders coordination efforts (Day, et al., 2009).

IDRC recently funded a project in Haiti to support post-disaster development of ehealth systems in the region, which will include research of supply chain management as a key issue.

14.6.14 Decision Support

ICTs have been used for data collection, which often then feeds into a decision support system to provide health professionals with information that can improve patient care. Blaya et al. describe how decision support systems have implications for “lack of trained clinical personnel, especially in rural areas” (Blaya, et al., 2010). The authors report three rigorous quantitative evaluations on clinical decision support systems. One system for newborns on mechanical ventilation used by nurses resulted in higher performance and better judgment, particularly after training on the system was provided. The second evaluation conducted in Tanzania on an electronic version of Integrated Management of Childhood Illness (e-IMCI) demonstrated that health workers were more likely to complete the electronic questionnaire used for IMCI than the paper booklet. Lastly, the authors described how the Early Diagnosis and Prevention System in India not only resulted in stronger patient satisfaction when clinical visits were preceded by a computer operator, but also an increase in the number of patient visits (Blaya, et al., 2010).

IDRC has directly and indirectly supported the development of decision support systems. Directly through funding the development of a comprehensive patient management system for HIV/AIDS patients in the Free State province in South Africa, which integrated laboratory results into patient records for improved follow-up, and indirectly through supporting FOSS platforms on which decision support modules and applications were built.

14.6.15 Disaster Response

In terms of natural disasters, ICTs are increasingly being used during recovery efforts (Chib & Komathi, 2009; Coyle, 2009). Through case studies in Asia, an article by Chib and Komathi discusses how information dissemination and organization are facilitated by communication technologies not just during disaster response, but also in pre-disaster and post-disaster stages, such as disaster preparedness, mitigation, and recovery (Chib & Komathi, 2009). In their review, they delineate approaches of ICT use for disasters into two categories: “procedure-based” (the stages of planning effective responses with ICT) and “community-oriented” methods (plans that center on the involvement of the community and its needs). Chib and Komathi conclude that in order for the true benefits of ICT use in disaster management, attention must be given to what the authors call “vulnerabilities”, or “inherent factors inhibiting communities from accessing, adopting, and realizing the benefits from technology implementations” (Chib & Komathi, 2009).

IDRC recently funded a project in Haiti to investigate how eHealth systems can be used in the country to improve disaster relief in future emergency situations and be part of the development of new health systems being designed through recovery efforts.

14.6.16 Health Financing

Another vertical trend of eHealth is health financing, which was found to intersect eHealth activities most at mHealth. In terms of financing for mHealth, Mechael et al. (2010) provide five recommendations:

1. Stakeholders should take on different yet coordinated roles
2. Sustainability of funding needs to be explored creatively
3. Cost-benefit knowledge base must grow for mHealth interventions
4. Open communication and sharing must be encouraged by funding partners
5. Innovative business models must be integrated for sustainability

Additionally, although there are increasing uses of mobile payments and banking in LMICs with implications for health, there is nearly no discussion of this intersection in the articles from the literature review. However, in the review conducted by Mechael et al. (2010) on barriers and gaps in mHealth, one project in Uganda was described to use mobile banking and payments for

health financing. The project, Claim Mobile, exchanges updates between management and providers and has reported a reduction in errors and claims paperwork (Mechael, 2010).

IDRC has thus far not supported health-financing initiatives as it relates to eHealth, but it is a new strategic direction being explored with the health financing team.

14.6.17 eLearning

eHealth technologies are also additionally being used for continuing professional development and facilitating learning and education – “eLearning”. Benefits cited emphasize that ICT use as a complementary tool instead of a stand-alone tool can be quite powerful for educational purposes; however, some limitations include “diminished opportunities for face-to-face contact and increased opportunities for academic dishonesty” (Rowe, 2008). However, it has been noted that because of types of technology or infrastructure, culture and local context, and previous knowledge or literacy levels, the transfer of eLearning resources from developed countries to developing countries have often failed (Kohn, Maier, & Thalmann, 2010; Rowe, 2008).

In a review of literature that aimed to assess quality of education processes in low-income country schools, Barrett et al. points out that the attention is being directed towards the harder-to-reach populations that have been “historically excluded from formal education” (Barrett, et al., 2007). The authors mention that ICTs have the potential to improve teaching and learning; however, they emphasized the important relationship among teachers, learners, and materials, since materials had been “carefully designed to meet learners’ needs in their particular environments” (Barrett, et al., 2007).

As part of the IDRC’s PAN-Asia region, Valk et al. conducted a review on the use of mobile phones for improving educational outcomes (Valk, Rashid, & Elder, 2010). Challenges included only being able to send text messages in English and lengthy educational clips too large to be sent over the mobile network. Providing the best indication of the benefits, feedback from the participants was positive, and they mentioned that the program turned the learning process from instructional to collaborative (Valk, et al., 2010).

One report was obtained regarding the CEA/ICA region. Submitted for Project e-SAC preparatory activities, a report provided an overview of various incentive mechanisms applied to stimulate innovation to inform the e-SAC project (Lombardo & Cortinois, 2010).

14.6.18 Summary of eHealth Literature Review within the Context of Evaluation

The eHealth trends described above have considerable overlap, and the reviews cited reflect large gaps in knowledge and few standards in practice in a rapidly expanding field. In this section we look at articles that provide background and perspective on eHealth evaluation, including four articles published in 2009 and 2010 in *PLoS Medicine* to provide background and perspective on eHealth evaluation.

Dávalos et al. conducted a comprehensive review of the literature and found very few articles reporting the use of economic evaluations in informing telemedicine projects (Dávalos, French, Burdick, & Simmons, 2009). Of the articles reported by Dávalos et al., results generally were ungeneralizable; methods were not uniform; costing analyses were often the focus, instead of economic analyses accounting for broader economic benefits from multiple perspectives; studies capturing telemedicine projects in the long-term are scant; and data are often not appropriate for a reliable economic evaluation or studies include small sample sizes (Dávalos, et al., 2009). Research guidelines for conducting a cost-benefit analysis of a telemedicine program in a setting where many competing health priorities compete for limited resources are included in the article.

The first article by Catwell and Sheikh argues the need for “continuous systematic multifaceted evaluations” of eHealth, and after acknowledging the necessity and complexity of evaluating eHealth, the authors provide a framework for this process while stressing the importance of evaluating eHealth interventions during all stages of design, development, and deployment (Catwell & Sheikh, 2009). The second article by Bates and Wright focuses on the opportunities and challenges in creating “robust international cross-cultural eHealth research”, while examples of “successful collaborations” between developing and developed countries are provided (Bates & Wright, 2009). The authors also take an approach that contrasts local levels to international levels of eHealth, and they discuss how local implementation of ICT lacks standardization, which hinders broader collaborations from working as readily (Bates & Wright, 2009). The authors suggest facilitating eHealth evaluation through (Bates & Wright, p. 3, 2009):

- “Promoting education about the importance of conducting eHealth research”
- “Developing coherence in description of eHealth interventions”
- “Agreeing on common outcomes measures”
- “Improving reporting, indexing, and systematic reviewing of the literature on eHealth”

The third and last article in the series tackles the “tricky” questions in eHealth evaluation: quantitative or qualitative; patient-level or system-/organization-level; formative or summative evaluators (Lilford, 2009).

As a response to this series, the authors of the fourth article, argue that “assumptions, methods, and study designs of experimental science” are not as appropriate in evaluating eHealth interventions than one that can account for the “personal, social, political, and ideological components” (Greenhalgh & Russell, 2010). The authors provide ten “guiding principles” as alternatives to those mentioned in the first three articles (Greenhalgh & Russell, p.4, 2010):

“Think about your own role in the evaluation”

“Put in place a governance process (including a broad-based advisory group with an independent chair) that formally recognises that there are multiple stakeholders and that power is unevenly distributed between them”

“Provide the interpersonal and analytic space for effective dialogue (e.g., by offering to feed back anonymised data from one group of stakeholders to another)”

“Take an emergent approach. An evaluation cannot be designed at the outset and pursued relentlessly to its conclusions; it must grow and adapt in response to findings and practical issues which arise in fieldwork.”

“Consider the dynamic macro-level context (economic, political, demographic, technological) in which the eHealth innovation is being introduced”

“Consider the different meso-level contexts (e.g., organisations, professional groups, networks), how action plays out in these settings (e.g. in terms of culture, strategic decisions, expectations of staff, incentives, rewards) and how this changes over time”

“Consider the individuals (e.g., clinicians, managers, service users) through whom the eHealth innovation(s) will be adopted, deployed, and used”

“Consider the eHealth technologies, the expectations and constraints inscribed in them (e.g., access controls, decision models) and how they ‘work’ or not in particular conditions of use”

“Use narrative as an analytic tool and to synthesise findings”

“Consider critical events in relation to the evaluation itself”

The different approaches represented by each of these four articles reflect the difficulties in creating an effective evaluation of an eHealth intervention

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14.7 Appendix G: Literature Review Key Terms

Trend	Search Terms
eHealth	ehealth, electronic health
Telemedicine	telemedicine, telehealth
Networks	ehealth, electronic health AND networks
Health Information Systems	health information systems, health management information systems, health information and management systems
Electronic Medical Records	electronic medical records, electronic health records
mHealth	mhealth, mobile health, mobile phones AND health
Data Collection or Decision Support	health AND data collection AND software, electronic
Disease Surveillance	disease surveillance, public health surveillance
Supply Chain Management	supply chain management, logistics
eLearning	elearning
Disaster Response	disaster response, disaster relief, emergency response AND ehealth, electronic health, mobile phones, mhealth
eHealth policy	policy AND ehealth, electronic health, mobile phones, mhealth
Health Governance	governance, stewardship, health systems AND ehealth, electronic health
Health Financing	health financing, health systems financing, health insurance, mobile payments, mobile banking, social protection, health planning AND ehealth, electronic health
Health Equity	equity, inequity AND ehealth, electronic health, mobile phones, mhealth
Free and Open Source Software	open source, open source software, free software, free and open source software AND ehealth, electronic health, mobile phones, mhealth

Table 3: Literature review key terms

All searches were conducted between September and December 2010 in Web of Knowledge, PubMed, Scopus, EMBASE, The Cochrane Library, and Google Scholar databases. All searches were limited to reviews published in English between 2005 and 2010 (inclusive).

14.8 Appendix H: Key Informant Interview List

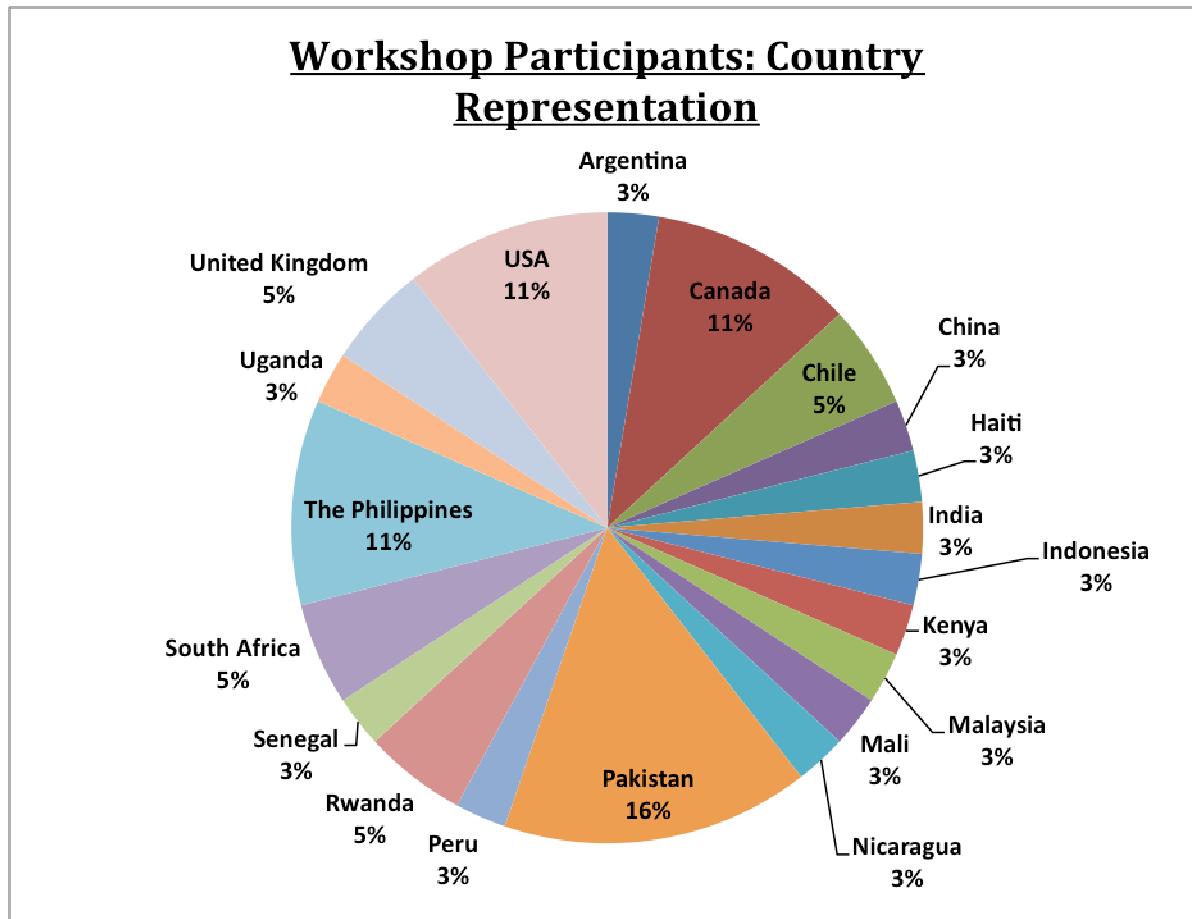
Name	Organization	Role	Group
Laurent Elder	IDRC	Program Leader PAN-ASIA	A
Heloise Emdon	IDRC	Program Manager ACACIA	A
Robert Geneau	IDRC	Senior Program Officer GHRI	A
Renee Larocque	IDRC	Program Officer GHRI	A
Ben Petrazzini	IDRC	Program Leader CEA	A
Ramata Aw Thioune	IDRC	Senior Program Officer Women's Rights and Citizenship ACACIA	A
Nicole Genereux	IDRC	Regional Partnership Officer RHE	A
Sharmila Mhare	IDRC	Program Leader GEH	A
Michael Clarke	IDRC	Director, ICT4D	A
Chaitali Sinha	IDRC	Program Officer, IDRC GEH	A
Matthew Smith	IDRC	Program Officer, eSAC Collaborating Officer	A
Sue Godt	IDRC	Program Officer, GEH	A
Marie-Gloriose Ingabire	IDRC	Senior Program Officer, GEH	A
Aku Kwamie	IDRC	Program Officer, NEHSI	A
Karl Brown	Rockefeller Foundation	Director of eHealth	B
David Aylward	mHealth Alliance	Executive Director	B
EJ Ashbourne	The World Bank	Director	B
Chris Bailey	WHO	Head of eHealth	B
Adam Slote	USAID	mHealth Strategic Planning	B
Fredrik Kristensen	NORAD	eHealth Innovation Consultant	B
Paul Biondich	OpenMRS	Team Leader	B

Table 4: Key informant interview list

14.9 Appendix I: Lessons Learned Workshops – Aggregated Findings

14.9.1 Participant Representation

The workshop invited IDRC grantees from each region the organization operates in, including: Africa, South and Southeast Asia, Latin America and The Caribbean. Overall, 38 participants attended the workshops, which took place in Capetown, South Africa, Colombo, Sri Lanka and Managua, Nicaragua. The graph below highlights the range of countries represented at the workshops.



14.9.2 Significant Outcomes

- a) New eHealth technology solutions

Across regions, IDRC grantees have acknowledged the organizations willingness to support research teams to assess, design, develop and test new and innovative eHealth solutions.

Software and systems have been developed to support a variety of health system needs, including: patient registration and tracking with electronic medical records, disease surveillance to predict potential threats, decision support to improve patient, mobile health for data collection and health promotion, and eLearning to increase capacity of health professionals and improve accuracy of diagnosis.

Software developed in the Africa region has been found to be more technically advanced and integrated into national health information systems, in comparison to PAN-Asia and LAC, which have been more focused on simple technologies and internal and external capacity building. IDRC has supported projects such as Uganda Health Information Network (UHIN) and Open Architecture Standards and Information Systems through multiple phases of growth and development, which may account for this discrepancy between regions.

In speaking with external key informants in the eHealth sector, it was found that when individuals were familiar with IDRC work, they referenced projects and researchers in the Africa region.

b) Capacity building

Capacity building was reported as a significant outcome by projects in all the regions. IDRC funding has led to building organizational capacity, human resources capacity, and partner and stakeholder capacity.

In the Africa region, capacity-building outcomes reported were focused on training community health workers on various eHealth solutions. Although projects in the PAN-Asia and LAC region reported similar outcomes, internal organizational strengthening, in terms of working with international organizations refining financial management systems and improving research skills, was more strongly reported by projects in these regions.

c) Better understanding of local context

Projects in all the regions reported a deeper understanding of the local context and realities as a significant outcome of their research. Grantees consistently expressed the necessity to understand the social and political issues of the context to successfully implement an eHealth solution. Many were thankful and excited for having the opportunity to conduct research that would specifically be relevant to and impact the region they worked in.

d) Improved health outcomes

Projects reporting improved health outcomes as a significant outcome was sparse across all the regions, and overall, small in impact. For instance, project 105966 reported influencing five HIV-positive pregnant women to deliver at a hospital, in comparison to home, for improved and safer care. While relevant and representative of preliminary results, IDRC has to consider cost-benefit of its investments.

However, the projects have brought forth a number of useful lessons and insights into designing and implementing eHealth solutions, which will inform and equip future projects with the capacity to more attentively focus on this objective.

e) Created eHealth awareness

Projects in all the regions have led to creating increased awareness of eHealth. In Africa, this meant awareness amongst higher authorities and government; in Pan-Asia this meant awareness amongst health providers and institutions, and in LAC this meant awareness amongst researchers and programming partners. Projects in each region have been not only featured in academic literature and conferences, but also mainstream publications.

f) Attracted additional resources

Projects in the PAN-Asia region specifically reported IDRC funding leading to attracting additional financial resources, in comparison to projects in the LAC region, which reported IDRC funding attracting additional resources (i.e. mentorship, staff). While a few projects in the Africa region have successfully attracted additional funding to expand projects, this was not reported as a significant outcome, but rather as a challenge.

g) Influenced policy outcomes

Projects reported influencing policy outcomes in the region to varying degrees. In Africa, strategic eHealth policy decisions have been influenced, such as the decision to expand a program nationally. In comparison, policy outcomes in the PAN-Asia and LAC regions have included increased collaboration and engagement with government authorities, and a commitment to consider project findings in national health information and/or health system strategies.

14.9.3 Challenges and Opportunities

a) Technical

Infrastructure and reliable and affordable network connectivity is still cited as a challenge in all regions, especially rural areas to implementing eHealth solutions. In the African and LAC regions, the difficulty and time commitment to developing software from scratch was acknowledged as a challenge, noting the lack of existing applications that can be applied in multiple contexts. However, given that the costs of technology are continually decreasing, and there is increased competition and more support for open-source solutions, participants were confident that software and applications will become easier to develop and deploy, and increase the level of eHealth innovation.

b) Project Management

The complexity of research teams funded by IDRC was a key finding in this evaluation. Project teams often consist of multiple stakeholders across multiple countries with leaders that have multiple professional roles. Consequently, coordinating amongst partners in different time zones, organizing face-to-face meetings, and maintaining dedication was a challenge cited consistently by projects in all regions. Participants in the LAC region suggested a need for increased training and awareness of project management skills and collaboration tools.

c) Human Resources

In the African and PAN-Asia regions, the lack of available local skilled capacity, ranging from management to software developers to community health workers was reported as a challenge to implementing health informatics projects.

d) Funding

The challenge of available funding on the ground in accordance with scheduled activities was reported by projects in the African and PAN-Asia region. Transferring funds from IDRC to research teams has especially been an issue for the PANACeA network and its partners. Projects in the African region, which are receiving funding from multiple sources, noted the challenge and additional time required to adhere to the different reporting requirements requested by donors. Increased coordination amongst donors was suggested. Participants from the African and PAN-Asia region were found to also face barriers raising financing for implementation of solutions beyond the research component supported by IDRC.

e) Policy

The lack of an enabling policy environment for eHealth solutions was remarked by projects from all regions. Specifically, the lack of standards and frameworks threatened the ability for projects to achieve scale and sustainability in the long run. Many projects noted the challenge of securing government participation and commitment for continued presence and appropriation. Some stated that network model (i.e. PANACeA) was the ideal way to lead eHealth policy efforts and represent interests across the region.

f) Local Context

Developing a sound understanding of the local context was reported as a challenge by projects in the African and PAN-Asia regions. Oftentimes, it was found that the focus of the funding was on technology development, versus establishing a solid understanding of the socio-cultural dynamics in which the proposed solutions were being deployed. Cultural issues such as disease stigma and language barriers were identified as specific challenges.

g) Research

Projects in the LAC region noted the challenge of designing a sound research project, specifically, how to find a balance between research depth and breadth in a way that still informs the evidence base in a meaningful way. Participants suggested engaging more institutions and disciplines to overcome this challenge, and continue to work towards developing a research culture in the region focused in measuring the health impact of eHealth solutions.

14.9.4 eHealth Vision

a) African Region

Participants at the Lessons Learned workshop in CapeTown, South Africa, almost unanimously favored the “Vision for eHealth in Africa” session, citing that it instilled hope for the future and provided a broader view of what to aspire towards.

The group began by discussing the need for an open and collaborative eHealth enterprise architecture that could be shared, modified and adopted across the region, in addition to continue investing in appropriate infrastructure where needed, and leveraging existing infrastructure where appropriate.

Participants believed that the research community should continue developing a strong evidence base for eHealth, and consider evaluating eHealth options using a total cost of ownership model. These activities should be supported by establishing national eHealth strategic planning committees and local innovation labs and developing a toolkit of reusable processes and materials for planning and requirements.

Investing in human capital was cited as a significant priority. Specific suggestions included establishing schools and training programs with regional curriculums and certificate programs to create capacity for more eHealth professions, and continue to expand training of trainer programs.

To foster an enabling environment for eHealth, participants recommended developing an eHealth policy framework by aggregating existing eHealth policies and common dictionaries and standards to facilitate interoperability. This type of collaboration could best be facilitated if donors coordinated funds, so that funding was obtained from a common basket.

b) Asia Region

In the PAN-Asian Region, there was an overarching sense that the next 5 years would be some of the most dynamic for eHealth given the heightened interest and momentum gained in the past year.

To begin, participants advocated that the first thing that they would like to see in terms of eHealth is guidance at the Global level on how countries should be approaching eHealth at the national level. This included: guidelines and incentives that encourage partnerships between industries, development of an eHealth certification & accreditation, e-human resource service, and enterprise architecture

As a follow on, participants envisioned that each country would have its own eHealth Strategy to align technology with health priorities that would also look specifically at supporting the enabling environment through a focus on improving health outcomes, developing of an enterprise architecture, and solidifying an eHealth budget.

To move from pilots to scale, the vision was to promote universal access to basic infrastructure, but to make sure that the enabling environment was in place to capitalize on advancements in eHealth innovation and proven interventions. The following aspects were highlighted as components for advancing scale and sustainability: alignment between technology and health through an eHealth strategy, investments in universal access to both health & technology infrastructure, and a focus on affordable, accessible, attainable, empowering, and equitable technologies and mechanisms for implementation

Participants highlighted a vision for greater engagement by the general population and direct to consumer support within eHealth activities. This includes: community participation in design, development, and use of eHealth, gender engagement in the design, development, and use of eHealth and policies that address privacy & security concerns

The gap in demand and ability to provide and support eHealth is widening. One vision element that was highlighted to address this is the development of an eHealth curriculum to advance training and create an eHealth ready workforce- both in terms of users but also in terms of designers, programmers, and implementers.

In order to achieve the vision of universal access, participants reported the need for better engagement amongst industries (public, private, user, and commercial) to facilitate interoperable eHealth solutions. Further, participants felt that while there are bodies that were created to lead in the coordination and sharing of information- that there wasn't a cohesive and active platform at the global level that PANACeA could connect with between eHealth meetings and conferences. Their vision to address this was the development of the "Global Forum for eHealth Knowledge Sharing & Networking", which would serve as a repository of materials and dynamic platform for policy-makers, practitioners and researchers to engage both physically and virtually in networking and information exchange.

To achieve these recommendations, participants requested further support from IDRC and eHealth stakeholders, specifically:

1. Donor alignment across global and regional eHealth strategies that support collaborative policy development
2. Facilitate the creation and reuse of culturally appropriate content
3. Support further development of the PANACeA network
4. Create innovation and incubation laboratories to test new ideas
5. Increase funding support for studies that investigate the socio-cultural aspects of e-Health (e.g. gender equity)
6. Establish capacity building programs & standardized curriculums
7. Support the development of regional and national eHealth strategies
8. Establish a global eHealth resource center that includes fora for knowledge sharing & advocacy

c) LAC Region

The participants' vision for eHealth in the LAC region centered around that idea that in the future, technology as a key tool for health care will be ubiquitous and "just the way we do things".

They envisioned an integrated community of practice, where trained professionals (both doctors and technicians) will be working in multidisciplinary teams, and the eHealth community of practice will have reached critical mass. This would subsequently enable the dynamic exchange of ideas and information across the region.

eHealth would support high quality clinical care, providing reliable data for patient care, disease surveillance, program management and evaluation. The prevention of epidemics of contagious and non-contagious diseases would be a significant priority. Further, health departments would use ICT not only to enter information, but also to promote public two-way communication and participation. Governments would make open standards a legal requirement and promote open source software. Participants believed that the research tools and capacity needed to measure the health outcomes and impacts achieved through these technology applications would be readily available.

In order to realize this vision, participants recommended IDRC to "stay the course", meaning to continue to fund eHealth in the LAC region. In addition, they urged IDRC to maintain its commitment to rigorous, developmental evaluation and active knowledge translation among the NGOs, organizations and governments working to build intercontinental capacity for eHealth in the Americas. Other recommendations included continued investment in local capacity building in eHealth technologies and research, as well as in efforts to strengthen collaboration, disseminate eHealth results and promote their replication. Along these lines, the identification of elements that contribute to sustainability and of ways to convince governments

of the importance of eHealth were also mentioned as necessary to supporting the vision.

Two more specific recommendations made were that IDRC should (1) support the analysis and detection of priorities (epidemics) in health in the coming years and the research that promotes their control by applying ICTs and (2) encourage IDRC-funded projects to use open standards and open source and to spread the word in LAC about how their use has affected other countries such as Canada, Brazil, and Australia.

Finally, IDRC was encouraged to continue past practices of being participative with grantees and seeing the projects they fund as catalysts to larger change.

14.9.5 IDRC Support

Participants across the regions requested additional support from IDRC, such as:

a) Dissemination

Disseminate project findings using IDRC distribution channels to increase resource mobilization and attract financing to continue project, implement research findings, scale etc.

b) Policy Support

Leverage IDRC contacts and network to interact with policy makers, and make IDRC eHealth projects known. Further, support multi-year grants to strengthen the evidence base of one idea, which will increase the likelihood of influencing policy change. Lastly, support the collaborative development of an eHealth policy framework for projects and countries to adopt.

c) Strengthen local capacity

In the LAC region, participants were seeking training in advanced research methods, however, in the African region, it was suggested that IDRC promote the use of local software developers, support local incubation labs, and provide resources for projects to bring and train Masters students.

d) Resource Mobilization

Projects requested resources such as technical assistance to create business plans, policy briefs and organizational structures, experts to support designing research protocols and opportunities to collaborate with like-minded organizations, grantees in the same and/or different geographies.

e) Collaboration and Knowledge Sharing Tools

To overcome the challenge of coordination and project management, participants requested access to tools for document sharing and online meetings. The suggestion of IDRC “study trips” to visit similar projects in different geographies was made.

f) Financing

Participants requested IDRC to consider refunding new phases of projects, and/or support to implement research findings.

14.9.6 Future Research Questions

Participants were asked what future research questions they would be interested in investigated. The following is a combined overview from all of the regions.

a) Policy and Standards

- Can a prototypical blueprint for health IT guide the development of eHealth applications? (i.e. miniaturizing the WHO Framework for Integrated Health Systems into six pillars, that compacted into a HIS)
- How can we develop inter-jurisdictional health policies to allow eHealth to work at its full global potential?
- What is the process of integrating ehealth issues and concerns into current e-governance frameworks – in terms of funding, institutionalization and implementation?
- How can potential privacy and security innovations in developing countries be leveraged in developed countries, as a form of ‘technology transfer’
- What are the privacy and security dynamics at play during emergency situations?

b) Technology

- What are alternatives to unreliable wireless connectivity and/or current network infrastructure? How much will it cost? How will it be sustained? Will it cause class divide?
- What are some application specific eHealth systems that could be developed from the existing e-Prescription eHealth system for implementation in hospitals (e.g. maternal health, tropical diseases etc.)?
- Can a clinical governance engine built into existing EHRs empower healthcare workers to provide better services?
- How can disparate clinical applications interface with one another to share patient information?
- How to encourage and promote the use and development of open source systems in Latin America?

- What are the benefits and limitations of providing health information over the web?
- How does eHealth make the functions of the central/district health centers easier?
- How can ICT be deployed in a “Data to Action” cycle (data collection and analysis; data interpretation; information use and applied knowledge)
- What is the role of mobile phones for the transfer and communication of medical information from the periphery to the centre?
- What are the features of an integrated health information architecture that supports health information and data management?
- What is the role of open source tools for development of hospital information systems in order to produce reliable information
- How do we enhance access to medical / clinical information using mobile phones for CHWs?
- Do audio-visual tools make CommCare easier to use for illiterate CHWs?

c) Scale and Sustainability

- How can we develop a framework to extend our project into other hospital departments, and hospitals in other countries?
- What other areas, besides human disease, can bio-surveillance be expanded into to? (i.e. agriculture, food safety, pest control etc.)
- When seed funding for ten community health centers is provided, how can we develop a model to scale to 50 additional “self-funded” community health centers in 3 years?
- How can we test and incubate sustainable eHealth business models in the developing world context?
- What are the indicators of readiness for eHealth in a healthcare organization in a developing country to ensure adoption and sustainability?
- What is the appropriate time horizon needed to support incremental innovation in eHealth programs?
- How can we create a low-cost, scalable model of an eHealth system to improve health in rural areas of developing countries and influence policy?
- Can these disease surveillance systems be extended to other pathologies monitored in the country?
- How can elearning be used to extend the reach of nurse training and upgrading programs?

d) Social, Cultural, Political

- What are the gender dimensions of eHealth?
- How can we address social inequities in access to health through the use of eHealth?
- What social systems need to be in place to support the technical systems used for collaboration?
- What measures can be taken to mitigate the power dynamics being caused by rapid data sharing?
- How do you introduce eHealth into a dysfunctional HIS?

- What are the gender issues, if any, involved in ICT adoption amongst female nurses and data capture staff?

e) Partnerships

- How to encourage local organizations to develop and/or maintain eHealth systems in developing countries, and have them work together and with international organizations?
- How do eHealth acceptability studies influence telecom operators to invest in appropriate technology platforms?

f) Health Outcomes

- How can eHealth / mHealth contribute to improving health outcomes in target populations (e.g. maternal health, street youth)
- Does eHealth / mHealth lead to improved patient outcomes? Improved system efficiencies? Enhanced human resources utilization?
- How does IT contribute to the promotion of healthy behaviors, especially sexual and reproductive health and HIV/AIDS prevention?
- To what extent does the use of ICTs for disease surveillance of Chagas lead to early detection, treatment and cure of the disease?
- To what extent does eHealth warning systems improve treatment compliance for children?
- What are examples of patient relevant eHealth / mHealth solutions in the developing world?
- Crowd-sourcing Tuberculosis: Can a larger group of experts give more accurate and timely diagnosis than face-to-face methods?
- Can a simple SMS-based reporting system combined with mobile money reimbursement prevent maternal mortality?
- Will allowing patients to access their personal medical records via SMS or Web lead to making more informed decisions?
- Impact of ICT on reduction of maternal mortality

14.10 Appendix J: GEH Workshop Notes

Agenda

Day 1: Thursday, February 3, 2011

Objectives

- a) To develop a shared vision amongst the team of what eHealth integrated into GEH and GEH lenses integrated into eHealth means.
- b) To discuss concrete ways that mainstreaming can and should be approached.

Participants: GEH team, Michael Clarke (for end of session), Katherine Hay, Hima Batavia, Patty Mechael.

9:00am - 9:20am	Introductions, overview of the day Step 1: Bringing a GEH lens into eHealth existing projects This step will entail taking a concrete example of a project and discussing what integrating this project into the GEH portfolio will look like. <i>Background work: The team familiarizes themselves with the e-SAC project through background reading prior to the session.</i>
9:20am - 9:30am	Chaitali describes the project (5 min) and answers any questions on the project from participants in terms of what has happened to date (questions for clarification).
9:30am - 9:45am	Each participant is given the following scenario and asked to take 15 minutes to reflect on it (individually): <i>"You have just been given this project as part of your portfolio and encouraged to better integrate governance and equity issues into this project. What positive connections do you see to build on? What are the kinds of ideas you might want to bring into this project? What are the steps you would take to do so? How could you best introduce these ideas to the project partners? What might they see as opportunities or challenges when considering these ideas/suggestions?"</i>
9:45am - 10:15am	In plenary – each person share their reflections.
10:15am - 10:30am	BREAK
10:30am - 10:40am	Step 2: Bringing eHealth lenses into GEH existing projects

Again – using a concrete example, the group will explore how the integration could happen in practice.

Background work: The team familiarizes themselves with one GEH project through background reading prior to the session.

Marie-Gloriose describes the project (5 min) and answers any questions on the project from participants in terms of what has happened to date (questions of clarification).

10:40am - 11:00am	Each participant is given the following scenario and asked to take 20 minutes to discuss it (in pairs): <i>"You have just been given this project as part of your portfolio and encouraged to better integrate eHealth issues into this project. What positive connections do you see to build on? What does eHealth offer in the way of new frameworks, ideas? What are the steps you would take to do so? What would you want to learn / do to be better able to support the success of this project? How could you best introduce these ideas to the project partners? What might they see as opportunities or challenges when considering these ideas/suggestions?"</i>
11:00am - 11:30am	In plenary – each group shares a few ideas they discussed.
11:30am - 11:40am	Emerging Patterns and Ideas? Sharing back the clusters of 'what' and 'how' ideas on mainstreaming.
11:40am - 11:50am	End of Session Tour de Table Each person in the group shares an 'aha' moment or a positive insight that they are now taking into the mainstreaming process.
11:50am - 11:55am	Timeline Thoughts on the overall timeline of this work. It's a process not an event. Where do we want to be in 6 months, 1 year, 3 years? Review of the set of 'next steps' below, add any other points, and set a time to come back to them.
11:55am - 12:00am	Closing comments

Next steps (after the meeting)

- Review the notes from the meeting to explore the clusters of ideas on what to mainstream and how to mainstream;
- Explore how to ensure these ideas are integrated into the GEH prospectus;
- Highlight from the meeting, questions related to eHealth that could be integrating into future GEH project proposal reviews;
- Generate a list of ideas on how the mainstreaming will happen.
- Identify key stages where it will be important to ask how mainstreaming is going, learn from mainstreaming processes, and adjust the mainstreaming effort.

Day 2: Friday, February 4, 2011

Objective: To present the key findings and results from the evaluation of IDRC's eHealth portfolio from the last 5 years in order to allow the group to absorb and question the findings and explore how to use the evaluation findings to improve ongoing and future IDRC programming and processes.

Participants: GEH team, ICT4D colleagues, Katherine Hay

9:00am - 9:15am	Introductions & Overview of Review [Chaitali Sinha]
9:15am - 9:25am	Presentation of Results [Patty Mechael and Hima Batavia]
9:25am - 10:15am	Individual/group exercise feedback on the evaluation report and how it should be used.
10:15am - 10:45am	Break
10:45am - 11:45am	Use of Evaluation (Group exercise (60 min)). <i>Activity:</i> Break into groups of 4-5 people. Each group should identify 3-5 most useful findings they are taking away (whether programmatic, thematic, or operational), and discuss how s/he as an individual can work to address them in his/her role, how their team, and how a cross-collaboration of teams might make use of them. Each group will nominate a person to share discussion highlights in plenary.
11:45am - 12:00pm	Concluding remarks from Sharmila and Chaitali.

**Findings from this workshop have been included in the main body of the report*

Summary of Findings

On the first day of the workshop, participants were guided through an exercise which allowed them to imagine the positive connections, ideas, challenges, opportunities and next steps to incorporate a GEH lens in an eHealth project and an eHealth lens in a GEH project. Participants were provided with project documents for eHealth project “eSAC” and GEH project “Shield” in advance to prepare. The following table is a summary of the findings that were shared during the plenary session.

ESAC	Shield
Positive Connections <ul style="list-style-type: none"> Looking at the system of partners and actors to understand change is already in line with a system approach. See a connection there. Aspect of <i>equity</i> is there – focus on capacity development is also a connection. Issues of G,E, strengthening are implicit but can be made more explicit. Call for proposals has equity as a central focus. Connection on ‘practice and action.’ Young professionals in different regions 	Positive Connections <ul style="list-style-type: none"> Good opportunity to connect networks of health financing networks with ehealth networks Opportunity for ehealth to gain from drawing on health research
Project ideas: <ul style="list-style-type: none"> Find a way to connect in community and other groups (broaden out partners involved) at all stages. (people who are marginalized, implementors in the health system, decision makers, innovators) – look at building linkages among these groups. Try to ensure strong country ownership. Support strengthened connections with government (at local, national, and regional levels). “Turning around the ownership” Trying to bring in a more holistic approach to thinking about health systems. Question / flesh out some of the conceptual framings. “Low cost doesn’t necessarily mean equitable – bringing focus and questions on equity and low cost. Bring in a lens / discourse on exclusion - because of technological comfort / competencies. Also understanding the impact of exclusion. 	Project Ideas: <ul style="list-style-type: none"> Use of ehealth can be a means to facilitate participation (radio, internet) – thinking about engagement avenues via ehealth Being able to convince – using ehealth tools to visualize and convey findings in interesting ways. Tools can be looked at to collect data. May be more efficient / low cost. Exploring role of ICTs in gathering data through National Health surveys (strengthen the data) E-learning component The feedback loop that can be built in can verify the data as it’s collected. Mobile airtime can be used to pay for / compensate for things – space to explore. Consider mobile phones – sending health claims etc – is a common tool, “tool of equity.” Looking at how this plays out in different contexts (urban / rural). Taking a systems approach to health information systems – also looking at what is lacking re: implementing universal coverage.

	<ul style="list-style-type: none"> • Examine linkages with e-government programs. • Explore ways of strengthening communications, collaborative work on documents. • Using ICT analysis to get better understanding on equity issues – using technology in a very conscious way to address / examine equity.
Next Steps: <ul style="list-style-type: none"> • Structural changes – advisory group – bringing in people • Get someone on the eSac team who has a gender / social analysis lens. (staffing) • Finding space in design to bring in ideas: Reviewing the call – involving people in the call. ‘Clarifying concepts’ in the call. Creating space for looking at exclusion in project design. • Have the groups define how equity can be improved through the work and revisit through the project. • Group visioning: <i>Orient outcomes / outputs around change on the ground around equity. (creating shared vision)</i>. • Monitoring ownership. <i>What gets measured is what gets done. DE offers an opportunity to bring in a GEH lens.</i> • Raising questions: <i>on who has access, around inclusion.</i> • Feeding in lessons on policy making 	Next Steps: <ul style="list-style-type: none"> • Support organic communities emerging in the two projects through e-lists etc. • Explore how other groups are doing it – how to link them (e.g. Equinet and other ICT related partners) • Have them map out how they are using it (<i>mapping leads to owning, clarifying</i>) • Plug ideas into existing structures in the project: committees, listservs, entry points. • Resource issues? Should we have a pot of funds for partners to capitalize / experiment with ideas above?
Challenges / Opportunities: <ul style="list-style-type: none"> • Trying to retrofit lenses under projects well under way – need to negotiate with partners – it’s their project. • Resistance of existing partners (U of T) to re-design / retrofit. • Capacity of staff to have that influence. Young team – difficult to influence policy. • Building team dynamic. 	Challenges / Opportunities: <ul style="list-style-type: none"> • Avoiding silos or <i>projectized approaches</i> – ensuring that it builds on national systems. • Avoiding putting ICTs everywhere • Having eyes open re: technical issues – need to explore that up front (data storage, access, systems)

14.11 Appendix K: Analysis Tables

Table 5: Analysis of project partners

Project	Region	Partners	NGOs	Government	Academia	Industry
104508	ACACIA	Medical Research Council	X			
		University of KwaZulu-Natal			X	
		University of Zimbabwe			X	
101974	ACACIA	D-Tree International	X			
		Dimagi, Inc.				X
		Pathfinder International (Tanzania)	X			
		BRAC	X			
		The Youth Corp	X			
		The Millennium Villages Project (Tanzania)	X			
		Interactive Research and Development (Pakistan)	X			
102411	ACACIA	HIV-1 Molecular Virology and Bioinformatics Unit Doris Duke Medical Research Institute	X			
		Africa Centre for Health and Population Studies Nelson R Mandela Medical School			X	
		University of Kwazulu Natal			X	
		UCT Lung Institute			X	
		University of Toronto Institute for Clinical Evaluative Sciences (ICES)			X	
		Free State Department of Health		X		

103746	ACACIA	AED-SATELLIFE, Inc., (USA)	X			
		Ministry of Health, Moçambique (MISAU) (Mozambique)			X	
		Ministry of Science and Technology (MCT) (Mozambique)		X		
104819	ACACIA	AED-SATELLIFE (USA)	X			
		Uganda Chartered HealthNet	X			
		Makerere University Faculty of Medicine			X	
		Uganda Min of Health		X		
104862	ACACIA	Partners in Health (PIH)	X			
		Rwandan Information Technology Authority (RITA)		X		
		Rwanda Ministry of Health		X		
		Treatment and Research of AIDS Center	X			
		National University of Rwanda			X	
		Kigali Institute of Science and Technology	X			
105293	ACACIA	TRAC-CIDC			X	
		Kigali Health Institute	X			
		Partners in Health (PIH)	X			
		RITA		X		
		Nursing Council of Rwanda	X			

		Ministry for Research, Science and Technology in the President's Office, Rwanda		X		
		Voxiva, Inc.				X
		OASIS Project (HealthNet, South Africa)	X			
105708	ACACIA	Jembi (HealthNet) eHealth Research and Innovation Platform Medical Research Council	X			
		School of Computer Science, University of KwaZulu-Natal			X	
		D-tree International	X			
		Partners in Health	X			
		Universidade Eduardo Mondlane			X	
		University of Zimbabwe Meraka Institute, Council for Scientific and Industrial Research			X	
		Millennium Villages Project, Earth Institute, Columbia University			X	
		Department of Epidemiology, Mailman School of Public Health, Columbia University			X	
		Dimagi, Inc.				X
		Cell-Life	X			
		Rockefeller Foundation	X			

		Novartis Foundation for Sustainable Development	X		
		United Nations Foundation	X		
105720	ACACIA	Ministry of Health and Medical Prevention (MSPM)		X	
		OASIS program	X		
105966	ACACIA	University of Nairobi			X
		University of Manitoba			X
106275	ACACIA	MARC-HI	X		
		University of Kwazulu Natal			X
		Zilics			X
		ecGroup			X
106312	ACACIA	Ministry of Health Uganda		X	
		Uganda National Association of Community and Occupational Health	X		
		College of Health Sciences (Makerere University)			X
		AED SATELLIFE Center for Health Information and Technology	X		
		Global Youth Partners (GYP)	X		
103814	CEA/ICA	UNFPA (República Dominicana)	X		
		CECAFEC (Ecuador)			
		Fundacion HUESPED (Argentina)	X		
		Fondo de Poblacion de las Naciones Unidas	X		
		Coalicion Mundial de Jovenes sobre sida (GYCA) (Bolivia)	X		
		Universidad Federal de Ouro Preto,			X

		Universidad Federal de Minas Gerais,			X	
		Centro de Investigación René Rachou – Fiocruz	X			
		Instituto Oswaldo Cruz - Fiocruz and Fundación Municipal de Salud de Berilo	X			
		Bolivian Ministry of Health		X		
		Universidad Nacional de Córdoba (UNC)			X	
104544	CEA/ICA	University of Saskatchewan			X	
106147	CEA/ICA	PIH	X			
		ITECH	X			
		The Brigham and Womcns Hospital Division of Global Health Equity	X			
		University of Washington Dept of Global Health			X	
104161	PAN-ASIA	Health Telematics Unit University of Calgary			X	
103360	PAN-ASIA	Angeles University Foundation (Phillipines)	X			
		Aga Khan University (Pakistan)			X	
		University of Calgary (Canada)			X	
		Primary Care Doctors Organization (Malaysia)	X			
		Molave Development Foundation Inc (Phillipines)	X			
		Angeles University Foundation (Phillipines)	X			
105130	PAN-ASIA	IITM-RTBI	X			

	Carnegie Mellon University		X	
	National Center for Biological Sciences University of Alberta		X	
	Lanka Software Foundation	X		
	Sarvodaya	X		

Project	Study Design	Sample Size	Methods	Publications	Met research objective?	Supporting materials	Health outcome	
							Types of diseases	Reported?
ACAIA-104508	Operations/ Implementation new technology/ Pre Post	of NA	Mixed	Yes -2	NA	18 conferences, Publications, mentions	NA	No
ACAIA-101974	Feasibility Study	NA	Mixed	Yes -3	Yes	13 conferences, Publications, mentions	NA	No
ACAIA-102411	Operations/ Implementation new technology/ Pre Post	of ~77,000	Mixed	Yes -5	Yes	15 posters, presentations, Publications, Standard M&E reports, quarterly progress reports and policy briefings	HIV/AIDS	Yes
ACAIA-103746	Feasibility Study	NF	Mixed	No	Yes	3 presentations Standard M&E reports, key informant interviews	NA	No
ACAIA-104819	Cost-Benefit/ Pre Post	NF	Mixed	Outcome map	Yes	M&E reports	TB, HIV, STI Quality of patient care	Not formally
ACAIA-104862	Operations/ Implementation new technology/ Pre Post	of 10	Mixed	Yes -3	Yes	16 presentations, publications, mentions and M&E reports	eHMR	Yes
ACAIA-105293	Operations/ Implementation new technology/ Pre Post/QI	of NF	Qualitative	No	NA	NA	eHMR and elearning for HIV/AIDS pts and staff	Yes
ACAIA-105708	Operations/ Implementation new technology/ Pre Post/QI	of NF	Mixed	No	NA	14 conferences meetings	Process improvement; infrastructure development prioritization	Yes
ACAIA-105720	Operations/ Implementation new technology/ Pre Post/QI	of NA	Mixed	No	NA	NA	MCH and epi surveillance	No

Project	Study Design	Sample Size	Methods	Publications	Met research objective?	Supporting materials	Health outcome	
							Types of diseases	Reported?
ACAIA-105966	RCT	856	Mixed	No	NA	NA	HIV/AIDS -PMTCT	Yes
ACAIA-106015	Pre Post/QI	NF	Mixed	No	NA	NA	Obstetrical emergencies	Yes
ACAIA-106115	Assessment	10-15	Qualitative –key informant interviews Literature/Legal review	No	NA	NA	No	No
ACAIA-104862	Operations/ Implementation of new technology/ Pre Post	10	Mixed	Yes -3	Yes	16 presentations, publications, mentions and M&E reports	eHMR	Yes
ACAIA-105293	Operations/ Implementation of new technology/ Pre Post/QI	NF	Qualitative	No	NA	NA	eHMR and elearning for HIV/AIDS pts and staff	Yes
ACAIA-105708	Operations/ Implementation of new technology/ Pre Post/QI	NF	Mixed	No	NA	14 conferences meetings	Process improvement; infrastructure development prioritization	Yes
ACAIA-105720	Operations/ Implementation of new technology/ Pre Post/QI	NA	Mixed	No	NA	NA	MCH and epi surveillance	No
ACAIA-105966	RCT	856	Mixed	No	NA	NA	HIV/AIDS -PMTCT	Yes
ACAIA-106015	Pre Post/QI	NF	Mixed	No	NA	NA	Obstetrical emergencies	Yes
ACAIA-106115	Assessment	10-15	Qualitative –key informant interviews Literature/Legal review	No	NA	NA	No	No
ACAIA-106275	Assessment	NF	Inventory/Key	No	No	No	NA	No

Project	Study Design	Sample Size	Methods	Publications	Met research objective?	Supporting materials	Health outcome	
							Types of diseases	Reported?
			informant interviews					
ACAIA-106312	Hypothesis generating	NF	Mixed	NA	NA	NA	NA	No
ICA-103369	Assessment Hypothesis generating	NF	Mixed	Yes -1	No	No	NA	No
ICA-103814	Interventional/ pre-post	NF	Survey, epi parameters/indicators (2ndry data)	Yes -3	Yes	4 publications and conferences	HIV/AIDS	Yes
ICA-103818	Pilot/ feasibility study/ pre post	NF	Secondary data indicators	Yes -1	Yes	Publication	Chagas	Yes
ICA-104544	Interventional/ case-control	NF	Mixed	No	No	No	HIV/AIDS Hypertension Diabetes	Yes
ICA-105798	Systematic Review	NA	Literature review	Yes -1	Yes	Publication and internal meetings	NA	No
ICA-106147	Assessment	NA	Surveys	No	No	No	Electronic med Records	No
ICA-106302	Systematic Review	NF	Literature review Key informant interviews	No	No	None	No	No
ACAIA-104161	Pilot Feasibility Study	NA	Mixed	Yes -1	No	None	No	No
PAN-103360	Systematic Review	NA	Literature review	Yes -1	Yes	Conferences, publications, policy development	No	No
PAN-105130	Interventional research	NF	Case-control	Yes -3	Yes	15 conferences, Publications, mentions	Communicable disease outbreaks	Yes

Table 6: Analysis of project research design and outcomes

	Increased technical ICT capacity	Increased eHealth research capacity	Use of mobile technology for health skills training	Cooperation with local universities	Tools for scale-up and cross application
ACACIA_102411		X (South Africa)			X (South Africa)
ACACIA_106275	X (South Africa)	X (South Africa)			
ACACIA_106015		X (Mali)	X (Mali)	X (Mali)	
ACACIA_105720		X (Senegal)	X (Senegal)		
ACACIA_104508	X (Africa)	X (Africa)		X (Africa)	
ACACIA_105708	X (Rwanda)				X (Rwanda)
ACACIA_104862	X (Rwanda)			X (Rwanda)	X (Rwanda)
ACACIA_103746	X (Mozambique)				
ACACIA_101974	X (Africa)				X (Africa)
ACACIA_106115					X (Global)
ACACIA_105293			X (Rwanda)		
ACACIA_104819			X (Uganda)		X (Uganda)
ACACIA_105966		X (Kenya)			
ICA_106302	X (LAC)				
ICA_104544		X (Caribbean)	X (Caribbean)		X (Caribbean)
ICA_103814		X (LAC)	X (LAC)		
ICA_106147					X (Haiti, post-disaster scenario)
ICA_105798					X (LAC)
ICA_103818					X (LAC)
ICA_103369					X (LAC)
PAN_105130					X (India and Sri Lanka)

Table 7: Analysis of project capacity building outcomes

Project	Policy Brief	Document highlighting gaps and opportunities	Policy guidance for scale-up	Policy-related research question
ACACIA_102411	X (South Africa)			
ACACIA_106115		X (Global)		
ACACIA_105708	X (Rwanda)			X (Rwanda)
ACACIA_104862			X (Rwanda)	
ACACIA_105966				X (Kenya)
ACACIA_104508	X (Africa)			
ICA_105798	X (LAC)			
ICA_106302	X (LAC)			
ICA_104544		X (Caribbean)		

Table 8: Analysis of project policy-related outcomes

Projects	Objective of gender analysis	Region/Country
ACACIA_102411	Increase leadership positions for women in the delivery of ART therapy	Africa (South Africa and other countries)
ACACIA-104862	Increase participation of women in careers in software development	Africa (Rwanda)
CEA/ICA_10454	Raise the profile of the nursing profession	Caribbean
PAN-ASIA_104161	Increase use of e-health technologies for women	Asia

Table 9: Analysis of project gender inclusion

Document	Region/Country	Project	Status
Policy Brief: Monitoring ART Programs in South Africa: Lessons learnt from a 5 year researcher-government partnership in the Free State.	South Africa	ACACIA_102411 ARV treatment data-collection system	Completed
Targeted outreach briefs for decision makers. Landscape analysis that will inform policy makers and highlight opportunities in the region.	LAC	ICA_106302_eHealth Research and Capacity Building in LAC	End of project July 2011
Roadmap for further research and a set of policy and tools	Africa, Asia, LAC	ACACIA_106115_Review of health information and medical privacy issues in developing country contexts	End of project Feb 2011
Targeted policy communication document based on applied research findings	LAC	ICA_105798_Public eHealth solutions in LAC region	End of project Jan 2013
Comparative case study for policy makers highlighting the similarities and differences in the region and their impact on the uptake and utilization of technology in policy areas (quality of care, professional competencies, health informatics)	Caribbean (Dominican Republic, Barbados, St. Lucia, St. Kitts-Nevis)	ICA_104544 Assess the role and impact of innovative ICTs in the Caribbean	End of project Jan 2011
Documentation and evaluation of technical training program, software tools, and policy implications for scale-up and replication	Rwanda, Africa	ACACIA_105708 open access systems in Africa for eHealth	End of project Sept 2011
Documentation of the lessons to provide policy guidance for scaling up the initiative beyond the pilot phase and for wider application in Africa	Rwanda, Africa	ACACIA_104862 OpenMRS in Rwanda to track HIV patient care and follow-up	End of project not clear (According to May 2009 report, this output is in progress, no final report...)
A report capturing learning on collaborative electronic medical record systems in a post-disaster situation	Haiti and other post-disaster situations	ICA_106147	End of project Sept 2011
Integrate and evaluate all the lessons learned and formulate policy briefs	South Africa, Mozambique, Zimbabwe, Rwanda	ACACIA_104508 Promote in-country capabilities to create HIS in Africa	Complete

Table 10: Overview of policy documents produced by projects