

From Silos to Systems: An Overview of eHealth's Transformative Power



Rockefeller Foundation Report

Making the eHealth Connection:

Global Partnerships, Local Solutions

Bellagio Center Conference Series

President's Letter



The Rockefeller Foundation shapes and supports innovative solutions to some of the world's most critical challenges. Few of these solutions are more encouraging than those emerging in the field of eHealth. As wireless connectivity rapidly increases globally, information and communications technology unleashes the potential not only to improve the quality and efficiency of health care, but also to bridge divides between services and the people who most need them.

During the summer of 2008, the Rockefeller Foundation hosted *Making the eHealth Connection: Global Partnerships, Local Solutions*, a month-long conference series at our Bellagio Center. While gathered there, more than 200 experts, working across disciplines and sectors, set and championed a new agenda to expand use of technology in health systems—one crucial component of the global health community's strategy to make modern care more accessible and affordable for all.

This report, "From Silos to Systems," arises from that seminal convening. It advocates for stronger eHealth capacity, coordinated funding and policy, collaborative networks, public-private partnerships, and greater attention to interoperability. It informs our ongoing investment in projects including Rwanda's endeavor to develop a comprehensive, nation-wide eHealth plan and the Kigali Institute of Science and Technology's work to establish an eHealth center of excellence, which will serve as a national and regional anchor of research, teaching, and learning.

The Rockefeller Foundation's support for eHealth is part of our five-year, \$100 million Transforming Health Systems initiative, which helps low-income countries—beginning with Ghana, Rwanda, and Vietnam and Bangladesh—steer their fast-evolving health systems toward better performance and universal coverage. Our initiative also fosters professional stewardship of national health systems and engages the private sector in providing and financing health services for low-income families.

Almost a century ago, John D. Rockefeller, Sr., committed his foundation to addressing the diseases that he called "the supreme ill of human life." During subsequent decades, our predecessors led campaigns against scourges of the poor, including malaria and hookworm, and helped establish the field of public health in the process. They earned a Nobel Prize for their discovery of a yellow fever vaccine. They mobilized a worldwide effort to align public-private partnerships that accelerate the search for vaccines and medications to end HIV/AIDS, tuberculosis, and other illnesses.

Today, we forge boldly into the 21st century's second decade with our eyes fixed on a new generation of health challenges and opportunities. As the Foundation has since its inception, we nurture innovations that can help more people lead healthier, more resilient, and more productive lives. Because of dramatic advances in technology and communications, tools like eHealth can connect people and communities with better care at lower cost. We welcome and value your partnership in spreading their promise.

A handwritten signature in black ink that reads "Judith Rodin". The signature is fluid and cursive, with a large initial "J" and "R".

Judith Rodin
January 2010

© 2010 The Rockefeller Foundation, New York

Cover photo: Joel Selanikio/DataDyne.org

Inside photos: © Steve McCurry/Rockefeller Foundation (page 4), © Antony Njuguna/Rockefeller Foundation (page 5), © Jonas Bendiksen/Rockefeller Foundation (page 6), © Patrick de Noirmont/Asiaworks/Rockefeller Foundation (page 8), © Jonas Bendiksen/Rockefeller Foundation (page 10), © Peter Essick/Aurora Photos/Corbis (page 11), © Antony Njuguna/Rockefeller Foundation (pages 12, 14, 15), © Patrick de Noirmont/Asiaworks/Rockefeller Foundation (page 16), © Jonas Bendiksen/Rockefeller Foundation (page 17), © Paula Bronstein/Getty Images (page 18), © Antony Njuguna/Rockefeller Foundation (pages 20, 21, 24), © Patrick Zachmann/Magnum Photos (page 25), Antony Njuguna/Rockefeller Foundation (page 30), © Paul Morris/Time Life Pictures/Getty Images (page 31), © Chaiwat Subprasom/Reuters/Corbis (page 32), © Susan Meiselas/Magnum Photos (page 34), © Antony Njuguna/Rockefeller Foundation (pages 36, 37), © Patrick de Noirmont/Asiaworks/Rockefeller Foundation (pages 38, 39), © Antony Njuguna/Rockefeller Foundation (page 40), UN Photo/Joao Araujo Pinto (page 42), © Tim McCaig/istockphoto.com (page 46), © Bruno Barbey/Magnum Photos (page 47), © Antony Njuguna/Rockefeller Foundation (page 49), © Gary McNutt/Community to Community Productions (page 50).

Design: Amy Janello Sturge

Table of Contents

4	Introduction
10	The Path to Interoperability
14	Public Health Informatics
20	eHealth Capacity Building
24	Access to Information and Health: ICT's Transformative Impact
30	mHealth and the Future of Medicine
36	The Promise of Electronic Medical Records
42	"Glocal" eHealth Policy
46	Catalyzing Markets for Global eHealth
51	The Road Ahead
52	Making the eHealth Connection
	Overview
	Partners
	Participants
60	Contributors



eHealth: An Introduction

From Silos to Systems

Introduction

eHealth: An Introduction

Despite good intentions, health systems across the globe are unable to deliver high-quality, affordable services to all. Thirty thousand children die each day needlessly of preventable disease. Quality of care is substandard. Sick patients—if they can get to a clinic and afford treatment—face long waits. Critical health information is buried in thick medical files, and facilities are plagued with severe shortages of those who can heal. Inequities in the provision of health care are one of the greatest challenges we currently face as global citizens—and these demands are only amplified in the developing world.

Ill health handicaps not only people but economies and development. The World Health Organization (WHO) recently noted that countries, particularly those in Africa, will not develop economically and socially without substantial improvements in the health of their people. The economic shifts of the past few years have further contracted economic growth worldwide and affected developing countries unduly. The World Bank predicts a \$700 billion shortfall in emerging markets, for example. If anything positive can be said about the global recession, it is that it more deeply binds the fate of nations together and provides momentum for new and systemic approaches to persistent cross-border challenges.

Experts agree that it will take an unprecedented transformation to reverse the tide of failing health systems, particularly in light of shrinking resources that must now be used more efficiently. Fortunately, support is increasingly available through a set of breakthrough tools known as eHealth, commonly understood to be the innovative application of emerging information and communications technology in health systems.

eHealth includes a broad range of implements, such as electronic health records, information-gathering software, mobile devices, e-learning tools and horizon technologies that defy human imagination. Combined, these tools can narrow health disparities, equip health care providers and enable immense leaps in quality of care. For example, a nurse in a remote village—through her laptop and mobile phone—can now access information on the world's best treatments, previously only available to the rich and privileged, and can track and treat her patients using longitudinal electronic health records.



Growing numbers of experts believe that eHealth will fuel the next breakthroughs in health systems improvement, from Johannesburg to Jakarta. Recognizing both the promise and the challenges of these emerging technologies, the Rockefeller Foundation has launched an effort to identify new solutions to eHealth and health system improvement with a spotlight on low-resource settings.

eHealth Around the Globe

eHealth deployment is moving forward on every continent and often in low-resource areas where it might be least expected. Technological breakthroughs are happening precisely because the trials and health needs in these places are so pressing and solutions are so few. Some examples include telemedicine networks in Bangladesh; e-pharmacy projects in Malaysia; low-cost, sustainable electronic health records for HIV/AIDS patients in Kenya; and web-based communication tools



to decrease maternal and child deaths in Peru. In the industrialized world, meanwhile, multiple national initiatives are underway, such as the creation of an electronic health records system in Australia, the linking of interoperable health information technology in the United States, and the development of a single electronic health record for every individual in the United Kingdom.

Discussions about creating new eHealth systems are now truly transnational, transcending the boundaries of geography as well as the boundaries of organizations. Mounting evidence suggests that countries—regardless of their political leadership, gross domestic products (GDPs) or health-insurance systems—share common eHealth challenges. Among them are the need for clear business and funding cases, strong stakeholder engagement, documented best practices, cooperation between business and government, integration of local perspectives, affordable open-source options, and workable approaches to interoperability, privacy and security.

International agencies are beginning to ramp up eHealth activities as a way to improve global health, overhaul health systems and support the United Nations Millennium

Development Goals. The World Health Organization has adopted Resolution WHA58.28, which urges member states to develop long-term strategic plans for eHealth services. The 53-nation Commonwealth Secretariat and the Commission for Africa have established eHealth programs. The European Union has an eHealth action blueprint in place to achieve borderless trans-European health information systems by 2010. And the Group of Eight largest industrialized countries, plus Russia, have launched a Providing for Health Initiative, or P4H, as an international platform for dialogue and collaboration on health-systems issues, including eHealth.

Despite the wonders and continued progress of eHealth, an international public-private sector framework for understanding and moving forward on these issues is not yet in place. Consensus on how health technology can proliferate in the absence of traditional business models and methods for it to communicate across institutions or continents—known as interoperability—is not a reality in most places. Although incredible amounts of information about health can be electronically collected and analyzed, it is often not integrated for a complete picture of health. And policy options and funding to support eHealth projects are often inadequate and unaligned.

Making the eHealth Connection: Global Partnerships, Local Solutions

A key milestone in the Rockefeller Foundation's endeavor to improve health systems was the month-long *Making the eHealth Connection: Global Partnerships, Local Solutions* conference series held during July and August 2008 at the Foundation's Bellagio Center in Italy. For 50 years, the Bellagio Center has been a place for developing bold ideas and initiatives to "promote the well-being" of humanity, as John D. Rockefeller, Sr., intended when he established the Foundation itself in 1913. In keeping with this tradition, the eHealth conference series convened some of the world's best minds to collaborate on devising innovative methods of using the newest digital technologies to improve health care in developing countries—an area frequently referred to as the Global South.

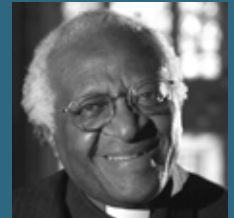
In a pivotal 2007 meeting in Pocantico, New York, worldwide health leaders made recommendations for addressing the challenges of global health systems. And at the *Making the eHealth Connection* conference, attendees took action on these recommendations. The event fell squarely within the Rockefeller Foundation's broader commitment to engage partners with diverse perspectives in meaningful alliances, while encouraging new products, processes and practices that empower beneficiaries to cultivate and spread progress in their communities and countries.

The *Making the eHealth Connection* conference occurred at a very important point in time, with wireless and mobile technology at a tipping point. Key countries in South America, Sub-Saharan Africa and Southeast Asia are committed to major eHealth endeavors. With countries including Brazil, Thailand, and Rwanda on board, other developing nations are poised to follow suit. Experts say that now is the optimal moment for eHealth to have the greatest impact, and they stress that agreed-upon direction at an international level is sorely needed.

Designed to be a consensus launching pad and a networking hub, the *Making the eHealth Connection* conference series provided a neutral, information-rich locale where passionate people and organizations could work together to begin to achieve real technology and health breakthroughs. Attendees explored pathways for new investment and new policies, coming away with a new determination to revitalize health systems in developing countries.

Ensuring that every voice would be heard, conference dialogue was shaped around the articulated needs of those who are active on the ground as health technology implementers, policymakers and funders in developing countries. Two hundred experts participated in the *Making the eHealth Connection* conference series, including representatives from 34 developing nations, 32 donors and 10 prominent print and online media representatives. Conference attendees were asked to offer their best ideas on eHealth knowledge development, capacity building, possible country-level technology investments, and the mobilization of key partners to build global momentum for stronger health systems through eHealth.

To organize the *Making the eHealth Connection* conference series, the Rockefeller Foundation joined forces with leading institutions in health, international development, and information and communications technology (ICT), including the American Medical Informatics Association (AMIA), International Medical Informatics Association (IMIA), Health Level Seven (HL7), Health Metrics Network (HMN), the Latin American and Caribbean Center on Health Sciences Information (BIREME), Partners in Health (PIH), the Regenstrief Institute, the Telemedicine Society of India, the United Nations Foundation (UNF), Vodafone Group Foundation Technology Partnership, the University of Washington's Center for Public Health Informatics (CPHI) and the World Health Organization (WHO).



The Most Reverend
Desmond Tutu,
Archbishop Emeritus
of Cape Town,
South Africa

*"eHealth is truly a
disruptive technology...
rendering former
geographic and economic
barriers meaningless."*

The action-oriented *Making the eHealth Connection* conference agenda included discussion in eight key areas, all designed to provide seasoned eHealth advice and road maps for delivery of health services and information in a fundamentally different way throughout the developing world:

- ▶ Public health informatics and national health-information systems
- ▶ Interoperability
- ▶ Access to health information and knowledge sharing
- ▶ Health informatics and eHealth capacity building
- ▶ Electronic health records
- ▶ Mobile health and telemedicine
- ▶ eHealth markets
- ▶ National eHealth policies

Each week, *Making the eHealth Connection* participants attended one of two parallel conferences with joint plenary and keynote speaker sessions. Subject tracks convened 25 to 30 world experts from important stakeholder groups—industry, donors, governments, researchers and civil society—to focus on a specific area of eHealth. Participants examined eHealth obstacles, potential solutions and successful sustainability models.

Outcomes from the conference were expected to inform both national and international eHealth agendas and result in ideas and products to drive a marked increase in eHealth dialogue and action.

From Talk to Action: A New eHealth Paradigm

Along with providing eHealth education and informing future eHealth dialogue, this booklet is intended to promote the findings of the *Making the eHealth Connection* conference within the broader health, development and technology communities. The booklet, organized by conference session, features agreed-upon recommendations for necessary actions and policy priorities that can guide the development and implementation of global, national, regional and local eHealth and health systems. These testimonials represent stakeholders' substantial commitment to improve health and decrease disparities by promoting innovative eHealth solutions.

Overall—through the signing of an official Belagio eHealth Call to Action that is being taken to global institutions, individuals and governments with the power to change eHealth policy and practice—*Making the eHealth Connection* conference participants



committed themselves to promoting and supporting the following:

- ▶ Timely, consensus-based global agenda setting
- ▶ A rational policy process for eHealth
- ▶ Adequate and coordinated funding
- ▶ Collaborative networks and action platforms
- ▶ Knowledge sharing and capacity building
- ▶ Interoperable eHealth demonstration projects

To date, more than 240 individuals have signed the Bellagio eHealth Call to Action, which was launched by Cape Town Archbishop Emeritus Desmond Tutu, who calls eHealth “a ray of light on the horizon for the health and equity challenges that plague humanity.”

Making the eHealth Connection recommendations about what must be done across countries and by those involved in eHealth include:

- ▶ Keeping in mind that the ultimate goal of eHealth should be to strengthen health systems and improve people’s health
- ▶ Documenting the impact of eHealth on access, affordability and quality of health services
- ▶ Supporting collaboration and innovation across resource-constrained countries and supporting learning between developing countries, with the understanding that the equator is not the dividing line for innovation
- ▶ Reducing donor fragmentation and harmonizing donor requirements and reporting
- ▶ Developing the ICT “business case” to increase donor and stakeholder involvement
- ▶ Strengthening stakeholder collaboration
- ▶ Providing funding for demonstration projects, reference implementations and adequate evaluation

Other recommended strategies to address common eHealth policy and organizational, technical, legal, financing and sustainability challenges conceived at the *Making the eHealth Connection* conference series are also highlighted in this booklet. These include:

WE-CAN⇒ Form a World eHealth Collaborative Network (WE-CAN) to enable eHealth ideas and priorities to flow from the bottom up and from the top down

GLOBAL eHEALTH CONVENTION⇒ Engage in a global eHealth convention process aimed at providing an overarching legal and regulatory framework for eHealth, beginning with interoperability issues

CULTIVATE INTEROPERABILITY CULTURE⇒ Promote government adoption of an interoperability and standards culture in relation to eHealth

OPEN STANDARDS/OPEN SOURCE⇒ Make open standards and open-source software freely available

UNIVERSITY-BASED INFORMATICS NETWORKS⇒ Create a network of regional health informatics centers, in resource-constrained countries, with mechanisms for collaboration between universities in the developing and the developed world

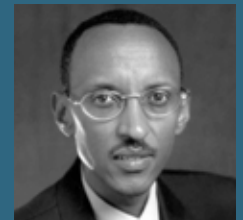
SHARED OPEN-ACCESS INFORMATION SPACE⇒ Create a shared space using social-network and open-access approaches to enable information producers, intermediaries and users to develop and share content, methods and technologies

mHEALTH ALLIANCE⇒ Seed a mobile-health alliance to track, leverage and shape the rapid growth in the mHealth sector

EMR TOOLKITS AND TRAINING⇒ Create an EMR toolkit and foster support for local EMR training and capacity building

NATIONAL eHEALTH COUNCILS⇒ Support National eHealth Councils and eHealth ambassadors/advocates, particularly from the developing world

GLOBAL eHEALTH ENTREPRENEUR COMMONS⇒ Design a global eHealth commons and an eHealth promotion network to support financing and matchmaking among eHealth entrepreneurs and donors



His Excellency Paul Kagame,
President, Republic of
Rwanda

“There has been a tendency in the past to consider ICT solutions as elitist, stand-alone projects that are implemented to the expense of more developmental pursuits. Rwanda’s eHealth experience illustrates the reverse; namely that ICT is a powerful tool and agent for drastically improving health care delivery to ordinary folks and even in the remotest parts of our country.”



The Path to Interoperability

From Silos to Systems

Chapter 1

Interoperability is broadly defined as the ability of two or more systems to exchange and use information. For health care, interoperability enables data and technology systems to work together across organizational boundaries for better individual and community health. Attaining true interoperability requires significant coordination and cooperation among stakeholders. While experts today concur that consensus-based health care interoperability rules and standards are needed, many questions remain about how to achieve this in both developed and developing nations.

The World Health Organization (WHO) and Health Level Seven (HL7) jointly convened *Path to Interoperability*, part of the Rockefeller Foundation's *Making the eHealth Connection: Global Partnerships, Local Solutions* Bellagio Center conference series. Participants discussed essential steps along the interoperability path and examined what is needed to promote interoperability in the developing world—to get the machines talking and to put patients at the center of their care.

eHealth Interoperability: Key Issues

Electronic health information exchange across institutions and borders is increasingly important, in light of the growing global disease burden and a mobile populace. Critical challenges in the process of meaningful data exchange are the lack of interoperable health systems and the lack of consensus on data standards. Several key issues are involved in moving toward more widespread health care interoperability. These include:

- ▶ Understanding interoperability needs in an organizational, geographic and health system context
- ▶ Finding consensus among key interoperability stakeholders, such as patients, providers, health care facilities, ministries of health, districts, technology vendors, donors and development agencies
- ▶ Providing avenues for developing nations (which are largely absent in current standards-development and interoperability discussions) to become more engaged
- ▶ Clearly articulating what technologies, policies, skills and leadership by government and industry are necessary to achieve interoperability
- ▶ Properly leveraging open, standards-based platforms and open-source collaborative models when needed



Interoperability Defined

Interoperability is a complex concept with a simple end goal: creating better health for individuals, communities, nations and the world. Interoperability involves the successful operation of many interlocking pieces at increasing levels of sophistication. True interoperability is a particularly difficult task if undertaken all at once. Participants at the *Path to Interoperability* conference recommended that interoperability in a health care context be tackled in distinct steps, starting from the most straightforward and moving toward the most intricate and multifaceted.

Interoperability Model

- LEVEL 1** Non-electronic data (e.g., paper, mail and phone calls)
- LEVEL 2** Machine-transportable data (e.g., fax, email and unindexed documents)
- LEVEL 3** Machine-organizable data (structured messages and unstructured content; e.g., indexed or labeled documents, images and objects)
- LEVEL 4** Machine-interpretable data (structured messages and standardized content; e.g., the automated transfer from an external lab of coded results into a provider's electronic , allowing data to be transmitted, or accessed without transmission, by health information technology (HIT) systems without the need for further semantic interpretation or translation)

Interoperability and Standards: Progressing on the Path

Path to Interoperability conference participants emphasized that interoperability should be treated as a direction rather than as the end point. Examples are already emerging of countries that have implemented information technology systems and worked toward integration, but been unable to progress fully or aggregate the data needed to contribute to the nation's health due to a lack of interoperability. What can be done to support a more robust vision of interoperability—one that is capable of being implemented across nations regardless of governance, health system structure, financing and disease burden? And how can these solutions address the large and complicated standards and interoperability issues in the developing world?

As a starting point, *Path to Interoperability* conference participants categorized interoperability imperatives and recommendations into seven distinct priority areas, based on the real-world experience of systems developers, implementers, ministries of health and donors in geographies such as Sub-Saharan Africa, Southeast Asia and Eastern Europe.

1. STANDARDS⇒ Despite the funding and energy put into standards making, interoperability remains a largely unsolved problem. eHealth-specific standards require



Sally Stansfield, MD,
Executive Secretary,
Health Metrics Network,
Switzerland

“There is an opportunity with the excitement that this [eHealth] series has generated for the world to come together to create a common architecture, a common approach. Once we have a framework in place and can share and compare information, there will be a huge new ability to innovate on the edges instead of having to reinvent wheels.”

consideration of business, clinical and technical issues. These factors make it difficult to obtain consensus on standards and data requirements in a timely fashion. Information and communications technology (ICT) and its value are established, yet without patient data and standards to enable data exchange or delivery at the point of care, these technologies remain largely moot in practice settings.

Some standards today are currently available free of charge, but others have associated fees. Required standards should be freely available to all through the development of a consortium for eHealth standards distribution in which standards bodies provide materials and resources at no or very low cost to qualifying developing countries and projects.

Developing nations should increasingly participate in standards-development organizations to form partnerships with developed country representatives and to have their voices heard in deliberations about the interoperability standards needed to exchange health data at the national, regional, district and clinic levels.

2. IDENTIFIERS AND REGISTRIES⇒ Identifiers are considered a building block of eHealth. The successful exchange of information and the use of eHealth will require unique identifiers for patients, providers, facilities and perhaps other parties that have yet to be determined. Most countries do not have patient identifiers in place, but *Path to Interoperability* conference participants recommended that identifiers be generated and used for the following categories:

- ▶ Patients
- ▶ Health care workers, specific to their roles
- ▶ Sites of health service delivery

Registries are considered a desirable and perhaps necessary component of eHealth. Registries support several needs, providing lists of persons with demographic characteristics, disease-to-family linkages and a variety of other functions. Registries also support patient tracking, which is often critical, as patients rarely

see the same provider consistently. Subsequently, registries and patient identifiers enable greater continuity of care, linking patient visits to multiple sites and multiple providers.

3. ENVIRONMENT⇒ The recognition of local culture, languages and indigenous medicine is critical for successful eHealth implementation and interoperability practices. These factors must be considered and woven into eHealth solutions.

4. GOVERNMENT⇒ There is no clear precedent for a government’s role in eHealth and the varying government structures among different nations do not lend themselves to a one-size-fits-all solution. Governments should consider creating a national body to oversee and house standards and interoperability work. Internationally, a model global interoperability resolution should be developed that encourages each nation to adopt a core set of standards for global eHealth interoperability. This would make it possible to share data using freely available standards and to support national data collection to improve health. To the greatest extent possible, nations should ensure that local eHealth standards are not contrary to established global standards.



5. RESOURCE DEVELOPMENT⇒ Many developing countries lack access to capital and human resources. Some nations have limited access to hardware, supplies, computers and printers. Salaries in the informatics field are generally low and training opportunities are limited, making it difficult to attract or sustain a sufficient workforce. At a higher level, government and health care industry leaders do not have the capacity or staff to participate in national or international standards activities and may have limited knowledge of standards. These challenges must be addressed.

6. TECHNOLOGY⇒ ICT purchasers should be educated and informed about the technical and business requirements that an eHealth system must satisfy. Governments, sponsoring agencies, or organizations may consider certifying vendors or ICTs that meet eHealth and interoperability requirements and publishing a list of such certified parties for potential purchasers.

Several current information technology (IT) initiatives involve developing countries. While many of these systems are effective, they fall far short in making a significant impact on the health of these countries. Planning effective eHealth systems and understanding the requirements for interoperability here will be a real challenge. The concept of appropriate technology should be a major focus. Whatever is done must have immediate value and include scalable, sustainable eHealth systems with simple user interfaces and, potentially, open architecture. An overarching framework for dealing with vendor issues, technology, system design and decision making is needed.

7. EDUCATION⇒ Educational tools should be created and presented to decision makers, especially in developing countries. Opportunities for informatics training, university partnerships and introductory virtual courses on topics such as standards, application development and eHealth are essential.

Conclusion

Most of the standards necessary to make valued progress toward systemic interoperability currently exist. Part of the problem is that there are duplicating and overlapping standards—and the need to identify a consensus set. Another concern is that not every nation has an equal seat at the standards-development table. Progress is being made in these efforts. Standards-development organizations are forming international collaborations. Experts are coming together to work on integrated eHealth systems in African countries. Donors are beginning to put a higher priority on understanding interoperability and how it can best be supported by their investments.

In addition, individuals—such as Eddie Mukooyo, MD, in Uganda’s Ministry of Health—are also stepping forward to exert visionary leadership. Dr. Mukooyo, who oversees his country’s efforts to deploy technology to connect medical personnel, is now actively engaging in conversations with the standards community. He shares Uganda’s eHealth story while gathering vital details about the most current standards and interoperability developments worldwide. Dr. Mukooyo observes that, “this knowledge transfer is absolutely critical in building a successful, interoperable health ICT system that works effectively both inside and outside Uganda’s borders. It offers the valuable opportunity to be vocal participants at the standards development table.” Uganda may very well be the harbinger of the future of interoperability.



Charles Jaffe, MD, CEO,
Health Level Seven,
United States

“There are a handful of breakthroughs in interoperability. The most successful ones are when we meet the needs of stakeholders in developing and developed countries. Vendors and end-users of technology have come to realize that this is a boundary that must be crossed before real information-sharing is possible and, even more important, for data re-use.”



Public Health Informatics

From Silos to Systems

Chapter 2

A January 2006 Davos World Economic Forum report cites the woeful state of the world's public health infrastructure as the greatest obstacle to progress on global health goals. Health information systems remain inadequate, making it impossible to monitor and improve the delivery of interventions in a timely and effective way. Fortunately, eHealth tools offer novel ways to improve public health by gathering data from disparate sources and rapidly transporting that data to health workers on the ground.

Public health includes responding to the health needs of individuals as well as populations. Prevention is a primary focus. The Internet, computer resources and mobile devices such as cell phones and personal digital assistants (PDAs) are increasingly available in the developing world. Public health professionals are adapting these technologies to the health care setting. The avenues of technology and public health meet at the intersection of public health informatics (PHI). PHI is the systematic application of information and computer science and technology to public health practice, research and learning. PHI strategies are increasingly used to obtain a complete picture of a population's health and risk status and to support effective public health data flow and decision making in both urban and remote locales.

To address these issues, the University of Washington's Center for Public Health Informatics (CPHI) and the World Health Organization's Health Metrics Network convened *Public Health Informatics*, part of the Rockefeller Foundation's *Making the eHealth Connection: Global Partnerships, Local Solutions* Bellagio Center conference series. Participants focused on methods of accelerating progress in the public health informatics field and widening the discipline's relevance in low-resource and developing-world settings.

Public Health Informatics: Key Issues

Internet cafes, computer centers, and mobile devices from cell phones to handheld PDAs are tools in regular use among many health workers and policymakers. The challenge for public health informaticians is how to enhance the delivery of high-quality, contextually relevant content, focused on a broad range of data (such as disease incidence, immunization rates, morbidity, mortality statistics, practice guidelines, research findings, protocols, maps and images) so this content can be used on the ground at the local, district and national levels.

There is great potential for public health informatics innovations to improve health, particularly in these areas:

- ▶ Communication among geographically dispersed health workers and consumers
- ▶ Delivery of public-health services by strengthening and streamlining data collection
- ▶ Support of primary and secondary prevention via electronic health records and improved laboratory systems
- ▶ Data collection for research studies, such as drug and vaccine trials
- ▶ Environmental health interventions, such as biosurveillance, road safety and geographic mapping systems applications

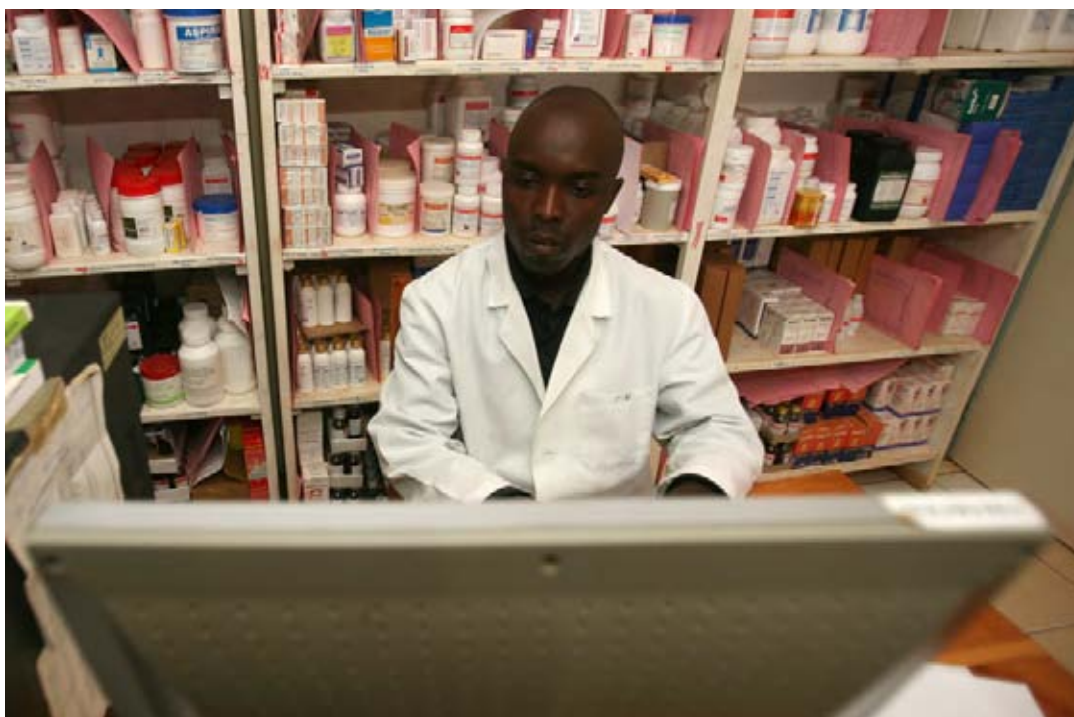
However, public health informatics impediments remain, including the following:

- ▶ A lack of integrated, interoperable health information systems to support decision making at all levels
- ▶ System fragmentation at the donor, NGO, ministries of health, clinics and hospital levels
- ▶ Capacity shortfalls in technical support and technology availability for day-to-day health information systems tasks
- ▶ Data stewardship challenges, including the need to provide incentives for people to collaborate on collecting and sharing accurate and useful data

- ▶ The one-way flow of information that is sent upward, but not back to health workers on the ground
- ▶ Too many vertical disease silos across health sectors
- ▶ Short donor-funding horizons and investments that are not long-term, coherent or consistent
- ▶ Inconsistencies between “industrial” IT solutions and on-the-ground realities
- ▶ A need for national ownership

Public Health and Developing Nations: The Potential of eHealth

The rapid expansion of eHealth interventions in developing countries offers the public-health sector many improvements and efficiencies. eHealth projects, focusing both on medical and public health practice, have introduced new methods of expanding connectivity; brought breakthrough technology tools and devices; facilitated provider education and consultation; and built applications designed to meet the needs of specific disease or practice data collection and analysis. Two examples of public health informatics breakthroughs are in the areas of lab and pharmaceutical data.



Laboratory Information Management Systems (LIMS)

A well-designed health management information system, constituting reliable, accurate and timely availability of data, is widely recognized as a cornerstone of a good public health system. A laboratory information management system, developed as part of a national health management information system (HMIS) in a public health setting, can support a variety of programs and functions, including epidemiology surveillance and monitoring; outcomes assessment; administrative activities (e.g., billing and utilization); program planning and evaluation; quality assurance; policy analysis; research; and information dissemination.¹

Increasingly, many nations are adopting integrated disease surveillance and reporting processes to improve public health outcomes. Through computerized data entry and the access and retrieval of reliable laboratory data, LIMS addresses important issues inherent in the laboratory, including sample tracking; quality-assurance activities; automated interfaces for laboratory equipment; the acquisition of specimens; the creation of work lists and test scheduling; the generation of aggregate reports; and the automated delivery of patient reports.



The implementation of laboratory-information systems in developed countries first occurred in the clinical-laboratory environment. Public health laboratories either developed their own non-standard systems using in-house IT staff, or purchased proprietary products that were oriented toward the clinical laboratory and then customized for public health needs. Both approaches had advantages and disadvantages, but increasingly, the need for information systems in public health laboratories has resulted in the availability of more proprietary products. Currently, the situation for international laboratories in resource-limited settings is similar. Laboratories are faced with developing their own systems using tools such as Microsoft Access databases or Epi-Info—but often without attention to standards for vocabulary and messaging.

Some laboratories are working with vendors whose primary product is focused on the clinical laboratory and modified to address public health laboratory needs. An open-source product used by six Association of Public Health Laboratories (APHL) member state labs is also under consideration in Vietnam and Kenya and may provide alternatives to in-house development or vendor-supported software using open-source approaches. Developing a reliable LIMS is certainly a complex undertaking. When implemented utilizing best informatics practices, however, the system can yield valuable and timely results for public health action.

The Health Metrics Network (HMN)² has been established to help countries develop the capacity and expertise for collection and analysis of health information. HMN, along with its partners, has developed objectives that will have an impact on the implementation of LIMS in resource-limited countries. Those objectives include the following:

- ▶ Creating a harmonized framework for country HIS development (the HMN Framework) that describes standards for health information systems
- ▶ Strengthening country HIS by providing technical and catalytic financial support to apply the HMN framework



Catherine Omaswa,
Chairperson, National
eHealth Committee, Uganda

“ICT is important for disease surveillance. We [in Uganda] are one of those who had ebola. It was good that mobile phones had already spread throughout the country ...within a short amount of time, it was possible to reach the Minister of Health, get a team together and get action.”

- ▶ Ensuring access to and the use of information by local, regional and global constituencies

The work of HMN and its partners will bring uniformity and a common framework that sets standards for health information systems and laboratory information systems and will be an important component of a country’s collective data systems.

Pharmaceutical Systems and Informatics

Without efforts to ensure that public health decision makers have accurate and timely pharmaceutical management information, there is a risk that significant resources could be wasted, poor-quality products could cause harm, and suboptimal use of medicines could adversely affect patient outcomes. Pharmaceutical systems informatics or efforts to understand and promote the effective organization, analysis, management and use of information in the pharmaceutical sector is providing important new avenues of innovation to address these challenges. Pharmaceutical systems informatics sits at the intersection of data, science, and technology and includes the basic functions of the pharmaceutical management framework, such as selection, procurement, distribution and use.

Medicines are an essential component of health care systems in developing countries, accounting for one-third or more of a government’s health services budget. It is common for 20 to 50 percent of the recurrent government health budget in developing countries to be used to procure drugs.³ The potential for medicines, including both drugs and vaccines, to improve the health of those in developing countries is widely acknowledged. For example, medicines are among the most important health interventions, their prominence illustrated by their rating by the Disease Control Priorities Project—an ongoing effort to produce evidence-based analysis and resource materials to inform health policymaking in developing countries—as some of the “best buys” in health. Medicines are used to vaccinate children; to prevent and treat childhood pneumonia, diarrhea and malaria; to attack the spread of HIV; and to treat tuberculosis patients.⁴

With the proclamation of the United Nations Millennium Development goals and the implementation of multinational programs such as the Global Fund to Fight AIDS, Tuberculosis and Malaria, both public and private donors to developing countries are making a new, concerted effort to improve access to medicines.



Like other parts of the world, developing countries need essential, quality-assured medications to be available continuously and distributed in a timely manner to those who require them. Stakeholders at every level need information to make decisions that affect the overall functioning of medication systems. For example, a good pharmaceutical management information system should alert staff to problems and trigger critical actions on multiple levels—whether the problem is related to the supply chain or to patients’ use of prescription drugs. Medication systems informatics could greatly benefit the following areas:

- ▶ **Prescribing.** Clinical decision support to facilitate evidence-based, rational and cost-effective prescribing
- ▶ **Dispensing.** Interpretation, translation and verification of medication orders, including informatics and technology in dispensing
- ▶ **Pharmaceutical care.** Chronic disease monitoring, assuring that patients adhere to their medications and that medication is persistent⁵
- ▶ **Administration.** Information flow and decision support with electronic medication administration and documentation
- ▶ **Patient monitoring.** Pharmacoepidemiology, pharmacovigilance and pharmacoconomics to enhance patient outcomes performed on a complete medication continuum

- ▶ **Education.** Promoting professional and patient education suited to cultural norms
- ▶ **Supply-chain management.** Beginning with procurement and proceeding to inventory control, order management and point-of-service delivery
- ▶ **Monitoring and evaluation.** Careful tracking of program performance

Overall, medication systems informatics enables more routine, systematic data collection and analysis, increased prevention of adverse reactions to medicines and support for scaling up treatment programs, which is particularly critical in resource-challenged regions with high disease burdens and co-morbidity.

Revolutionizing Public Health Informatics: Ingredients for Success

Public health informatics (PHI) is a rapidly emerging field with many successes, but additional initiative is required to expand the PHI community and its initiatives, particularly in the developing world. *Public Health Informatics* conference participants recommended the following critical steps to achieve success in these efforts:

- 1. COLLECTIVE VISION** → Create a shared sense of priorities for information and communication

technology (ICT) contributions. Adopt a broad ecological approach to health, using a systems view and framing the case for an integrated national public health information capability or for national health enterprise system architecture. To create a collective vision, local access to information tools and data is vital. This approach requires understanding eHealth in relationship to the needs of its primary users (health care workers) as well as of its secondary users (public health officers).

2. ARCHITECTURE⇒ Define the preferred public health information system architecture by taking into account local, district/regional and national needs. Include necessary components, connections, players, stakeholders and human resources at each of these levels. This architecture will inform personal health care, population-based services, and health policy at all levels. It will also leverage the most efficient ways to collect, organize and share routine health information. Such architectures are needed to guide countries in strengthening their own health systems and to guide developers in providing effective tools to help countries achieve this aim.

3. ARTICULATE IMPERATIVES FOR GLOBAL COOPERATION⇒ Identify the essential contributions that can and should be made by global partners in public health informatics organization.

4. REGIONAL HEALTH INFORMATICS CENTERS⇒ Establish a Network of Regional Centers in Health Informatics based in leading health universities located in resource-constrained countries. Create a long-term funded program plan for training, research and development at these centers. In the United States and other developed countries, these centers bring together researchers, developers, educators and health practitioners to work on challenging problems. Creating such centers at key health universities in resource-constrained countries would ensure that training and development are contextually and culturally appropriate and relevant to the needs and priorities of the nations in question. Centers like these would also provide a synergistic setting for faculty

(both from health schools and from computers science and information technology programs) to work collaboratively with ministries of health, public health agencies, nongovernmental organizations (NGOs), WHO programs, foundations and the private sector.

Models for such health centers exist now or are currently being developed. One is in Peru at Cayetano University, which has a long-standing relationship with the University of Washington's division of biomedical and health informatics training. A second is a newly created Center for Public Health Informatics at Mahidol University, in Bangkok, Thailand. To build necessary synergies and to test various approaches to center development, five to seven geographically dispersed regional centers should be the goal for initial planning and development.

Conclusion

Public health informatics tools are enabling practitioners, regardless of their location and resource level, to obtain a more complete picture of a population's health and risk status and gather information from disparate sources. Advancing public health informatics partnerships and centers of learning—and putting informed and complete technology tools in place—represents the next phase in the public-health revolution.

Notes

- 1 Becker SJ, Blank EC, Martin R, Skeels M. Public Health Laboratory Administration. In: Novick LF and Mays GP, eds. *Public Health Administration*. Gaithersburg, MD: Aspen Publishers; 2001: 623-645.
- 2 The Health Metric Network Framework 2nd Edition, January 2008. Available at: www.healthmetricsnetwork.org.
- 3 Falkenberg T, Tomson G. The World Bank and Pharmaceuticals. *Health Policy Plan*. 2000 Mar; 15(1):52-8.
- 4 Disease Control Priorities Project. Available at: www.dcp2.org.
- 5 Bisson GP et al. Pharmacy Refill Adherence Compared with CD4 Count Changes for Monitoring HIV-Infected Adults on Antiretroviral Therapy. *PLoS Medicine*. May 2008; Available at: <http://medicine.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pmed.0050109>.



eHealth Capacity Building

From Silos to Systems

Chapter 3

Capacity building is defined broadly by the United Nations Development Programme (UNDP) as “the creation of an enabling environment with appropriate policy and legal frameworks, institutional development, including community participation, human resources development and strengthening of managerial systems.”¹ There is a shortfall of 4.3 million health care workers worldwide. And capacity needs are often felt more acutely in those countries that have the greatest health disparities and that are less economically viable. Sub-Saharan Africa and Southeast Asia are unduly affected, plagued by workforce development issues, inadequate numbers of qualified health workers, the migration and departure of skilled personnel, weak infrastructure and a lack of resources.

As health service capacity deficits widen, eHealth tools are increasingly employed to address capacity shortfalls. These technologies provide electronic information and training links to rural and underserved areas and robust clinical data for informed decision making.

The American Medical Informatics Association (AMIA), in conjunction with the International Medical Informatics Association (IMIA), convened *eHealth Capacity Building*, part of the Rockefeller Foundation’s *Making the eHealth Connection: Global Partnerships, Local Solutions* Bellagio Center conference series. Participants focused on visionary solutions to boost the global health workforce and informatics capacity in the developing world.

Informatics and Capacity Building: Key Issues

Informatics is a scientific field that draws upon the information sciences and related technology to improve health care, biomedical and clinical research, education, management and policy. Global experts agree that significant capacity-building hurdles must be scaled in the developing world and that informatics and eHealth can be utilized to support these efforts. In taking action, however, key questions must also be addressed across nations and disciplines:

- ▶ What is the current health service capacity and workforce situation in developing countries?
- ▶ Who is the workforce? Are they frontline workers, nurses, laypersons, community health workers, physicians, nurses, midwives, librarians or other individuals?
- ▶ Do any particular technologies—handheld devices, cell phones, computers with auxiliary memory or the Internet—hold the key to a capacity leap? If so, what incentives can be employed to increase the use of these technologies?

- ▶ What sectors need the highest level of capacity-boosting aid?
- ▶ How can eHealth be integrated into degree-granting public health programs and other medical training opportunities?
- ▶ How should capacity-building opportunities and collaborative partnerships be targeted and prioritized in the developing world?

Informatics, eHealth and Capacity Building: A New Vision

A new model for capacity building in the developing world is emerging that leverages informatics and eHealth. Key building blocks for this new paradigm include the imaginative use of beneficial technologies in resource-constrained environments, the involvement of local health professionals in shaping workable solutions and the inclusion of workforce development imperatives into overarching strategic plans and policies. Executing this vision involves work by an international consortium of eHealth informatics specialists who can 1) support practice, education, training, policy and research; and 2) educate governmental

and national leaders about the importance of eHealth capacity and informatics.

A detailed road map for attaining this breakthrough capacity-building vision, recommended by *eHealth Capacity Building* conference participants, follows (page 22).

1. Create an international network of eHealth informatics practice, education, training, policy and research. Fervent pockets of eHealth and informatics activity exist throughout both the developed and the developing world, but experts often do not engage in valuable discourse and skills-sharing that is needed to harvest lessons and wisdom across experiments. Strategically growing an eHealth informatics network worldwide—but particularly in the developing world—will advance both thinking and practice. At the macro level, conversations between donors and funders about developing coordinated initiatives and collaborative work are critical, as are innovative avenues to create a resource bank of informatics experts who can be called upon. Health care standards organizations are also

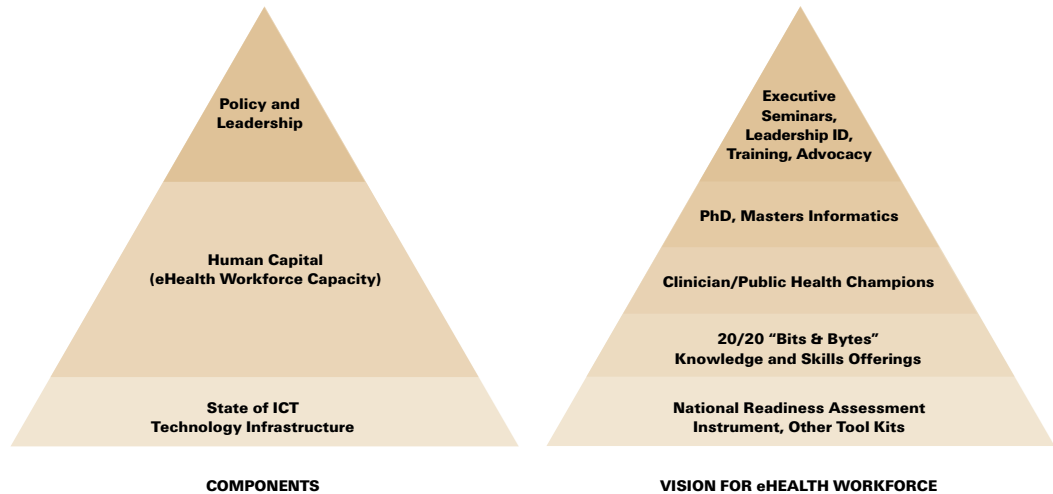




Paula Otero, MD,
Department of Medical
Informatics, Hospital
Italiano de Buenos Aires,
Argentina

*“I would take the e
out of eHealth. eHealth
is just health.”*

Global South Components of Needs and 20/20 Vision for Assuring eHealth Capacity From Silos to Systems



key venues for networking, which can provide affordable standards access and invaluable participation in standards activities.

Centers of Excellence are important anchors in international eHealth informatics networks. A Center of Excellence is commonly known as an exemplary academic program that promotes innovative research, teaching and learning practices that distinguish and establish it as a leader in its region and beyond. Because of strategic location and/or the absence of similar programs within a region, Centers of Excellence are uniquely positioned to be leaders in conducting nationally recognized research and in forging partnerships that serve community needs.

In relation to international eHealth informatics networks, Centers of Excellence provide avenues to develop formal and collaborative plans for education, training and research. This will create the next generation of leaders who will spread informatics knowledge, skills and values. In order to leverage these institutions, efforts should be made to accomplish the following:

- ▶ Identify existing informatics Centers of Excellence and facilitate their development as central resources for disseminating informatics knowledge and skills
- ▶ Establish relationships among Centers of Excellence and develop mechanisms for North-South and South-South collaboration and networking to share ideas and resources
- ▶ Develop additional infrastructure and boost the capacity of regional Centers of Excellence in informatics practice as well as applied informatics research

An international network of eHealth informatics can also be helpful in training. Network participants can work to develop core informatics success profiles for use in training, in seeding mentored projects, and in building local capacity as rapidly as possible. This includes identifying people in resource-poor countries who can provide mentoring and basic education in informatics; expert consultation that enables decision makers to make wise policy choices; and acquisition of informatics tools.

Collective networking and group thinking about impact measurement is also an advantage of a global eHealth informatics practice networks. Together, experts can develop and share ways to measure eHealth readiness and impact, using these measures for research in conjunction with implementation projects.

2. Educate government leaders about the importance of eHealth capacity and informatics to national health and economic development goals, cultivating and sustaining support for eHealth capacity and informatics activities. To succeed, eHealth capacity and informatics efforts must be a key national consideration in an atmosphere of competing economic, political and policy priorities. In achieving this, advocates must inform and teach government leaders about the importance of eHealth strategies in reaching national and regional health and economic development goals, while highlighting the overriding value of a trained, well-educated eHealth workforce that builds on what already exists. Political influence to secure eHealth support must be developed in national budgets. There must also be a grassroots advocacy strategy to make the eHealth capacity and informatics case to key stakeholders, politicians, rainmakers and senior health care professionals.

Champions must be cultivated at all levels in a country to support wise policy and strategic decisions. Effective strategies and policies should also be shared across national borders, so that those who have not yet formulated policies and strategies can benefit from the building blocks developed in neighboring countries. Business and industry must play a vital role in cultivating and sustaining high-level government support for eHealth capacity and informatics activities.

3. Develop a blueprint for initiating and executing activities in resource poor countries to rapidly create eHealth initiatives. Clear yet flexible blueprints for individual countries and for global priorities should be developed to jump-start eHealth, capacity, and informatics activity. Health care professionals should be actively engaged in the blueprint process. Blueprints should emphasize demonstrated, scalable solutions and the provision of working tools from which people can derive benefit quickly. Rapid dissemination of lessons learned in other projects and countries, while being sensitive to local needs, values, and personalities, must also be a priority.

Any eHealth, capacity and informatics blueprint should integrate with and add value to current programs directed toward eradicating disease.

Conclusion

The role of eHealth and informatics in addressing serious shortages of qualified health service professionals and in building health system capacity cannot be underestimated. An explicit focus on health informatics and eHealth capacity building is critical for improving health service quality and efficiency. Proper training and leveraging of lessons learned by an international eHealth informatics network and the creation of Centers of Excellence that are linked around the globe will immeasurably advance health care practice, education, training, policy and research.

Notes

- 1 United Nations Development Programme. Available at: <http://www.undp.org/>



Egonda Onyejekwe, PhD, Founder and CEO, EARTHMAP Foundation for African HIV/AIDS, Federal University of Technology, Nigeria

“I envision a day and time in Africa when time and space are irrelevant—when it is possible to deliver health services without silos and address a population exploding at a faster rate than the institutions that are set up to take care of them.”



Access to Information and Health: ICT's Transformative Impact

From Silos to Systems

Chapter 4

Information and communication technologies (ICT) combined with wireless and mobile devices, are strengthening the production, dissemination and global use of health information. The increasing capacity of information producers, intermediaries and users is triggering the explosive growth of easily accessible information. However, to take advantage of opportunities created by these technologies, it is imperative to overcome important inequities in access. Referred to as the digital divide, access inequalities dampen the power of open knowledge exchange and thwart improvements in health, health systems and health care, particularly in developing countries.

Key barriers inhibiting equitable health care information access, particularly in developing countries, include connectivity, language, copyright, economics, visibility, technological literacy, and culture (the need for information to be culturally acceptable and relevant within different settings and domains).¹

BIREME, the Latin American and Caribbean Center on Health Sciences Information, convened *Access to Information and ICT*, part of the Rockefeller Foundation's *Making the eHealth Connection: Global Partnerships, Local Solutions* Bellagio Center conference series. Participants identified catalytic ingredients for the establishment of equitable national and international policy. They also identified new strategies for promoting the inclusion of developing countries in global information flows.

Access to Information and Knowledge Sharing: Key Issues and a New Paradigm

As e-solutions to better and more equitable knowledge sharing are identified, key questions are emerging. These include:

- ▶ How can information access inequalities best be addressed? Does this require focused priority setting or a multipronged strategy?
- ▶ How can open-access information resources be more optimally leveraged and promoted?
- ▶ What strategies result in quality and consistency when it comes to online health information?
- ▶ How can flexible, user-focused, access models and tools be developed that incorporate unique national, local and cultural needs?

To address these and other challenges to enhancing eHealth, *Access to Information and ICT* conference participants agreed that a new environment is needed. Such an environment should enable producers, intermediaries and information users to develop and share content, methods and technologies for the global public good. The essential ingredients of such an environment include the following:

- ▶ Open-access tools
- ▶ Collaborative and social network-based approaches to information and knowledge sharing
- ▶ The development of greater national capacity, with recognition of culture and context
- ▶ Integration with primary health care activities
- ▶ Interoperability through the use of the most appropriate standards, methodologies and technologies

This enabling environment must encourage cooperative development and operation globally, increasing health information use and promoting actionable knowledge. To do so, it must include these elements:

1. OPEN-ACCESS INFORMATION AND KNOWLEDGE

TOOLS ⇒ Online information knowledge sources and tools developed and adapted by eHealth should be openly accessible and interoperable in order to fully achieve the objectives

of improving health. The mass digitization of information brought on by digital technologies has been accompanied by an expansion in intellectual property rights, such as copyrights, patents and trademarks.² This expansion makes it difficult and complex to fulfill the ideal of equitable access to information and knowledge. However, the growth of the open-access movement is managing this trend, helping to create a freer environment for innovation in health. Open access is defined as “free availability on the public Internet, permitting any users to read, download, copy, distribute, print, search or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself.”³

An open-access article, which is available to anyone with an Internet connection, is highly visible because Web search engines index open-access repositories and journals.⁴ Open-access articles are therefore more likely to be read and cited than articles in subscription-based journals that come with costs attached to them. This is particularly important for developing countries, whose scientific production faces barriers in becoming visible and accessible in the classic mainstream indexes.



Several initiatives in the developed world promote open access in the health-sciences domain, including the Biomed Central Public Library of Science and PubMed Central, which is spearheaded by the U.S. National Institutes of Health. Developing countries have also put into practice initiatives that promote open access. For more than a decade, in Latin America and the Caribbean, the Latin American and Caribbean Center on Health Sciences Information (BIREME) has been developing the Virtual Health Library (VHL), which includes several networks based on open access. A prominent effort in this regard is the Scientific Electronic Library on Line (SciELO) which enables developing countries to have free, full text access to scientific journals. Another important initiative promoted by the World Health Organization (WHO) in cooperation with private publishers is the HINARI (Health InterNetwork Access to Research Initiative) program, which provides free, or very low cost, online access to major biomedical literature related to local, not-for-profit institutions in developing countries. Nations entitled to free access to HINARI are those with a GNI per capita below US \$1250 (World Bank figures). Institutions in countries with GNI per capita between US \$1250 and US \$3500 pay a fee of US \$1000 per year per institution.

2. COLLABORATIVE AND SOCIAL-NETWORK APPROACHES TO INFORMATION AND KNOWLEDGE SHARING⇒

Traditionally, the processes of production, dissemination and utilization of information and knowledge were developed separately, in different locations, by diverse agents and institutions. A transition to a proposed social network-based enabling environment with intensive utilization of ICTs is recommended. This would:

- ▶ Allow a more effective integration of these processes
- ▶ Promote the establishment of flexible cooperative networks among producers, intermediaries and users of information and knowledge

The impact on health of collaborative spaces and online communities of practice is markedly changing the face of knowledge

dissemination and ICT-enabled communication.⁵ Knowledge is not static, but is a living entity that is continually being refined, revised and supplemented, requiring open access and social interaction. Social intelligence and collaborative spaces play a critical role in promoting knowledge exchange and knowledge building, helping to develop and implement culturally sensitive and contextually appropriate health interventions. To move beyond stovepipe approaches to global health improvement will require a plurality of solutions in meaningful contexts, a weaving of the empirical with the experiential, an integration of the vertical with the horizontal and vested community participation.

Among good examples of collaborative spaces and communities of practice for knowledge networking and exchange is the Global Alliance for Nursing and Midwifery Community of Practice (GANM), which includes more than 1,500 nurses, midwives, birth attendants and others from 132 different countries.⁶ Healthcare Information For All (HIFA), administered by the Global Healthcare Information Network based in the United Kingdom, is another case in point. HIFA's goal is to ensure that by the year 2015, every person in the world will have access to an informed health service provider and that "people will no longer be dying for lack of knowledge."⁷ Online Web conferences and meetings are also becoming a practical solution to bring people together online regardless of their geographic locations. Some solutions such aslluminate Live!™ Web conferencing software have been used successfully even in contexts with limited connectivity.

Each of these collaborative spaces has had significant impact on knowledge dissemination in the health realm.

3. DEVELOPMENT OF NATIONAL CAPACITIES⇒

The complexity and diversity of health problems in the developing world require a myriad of solutions. These challenges are local and context specific, strongly related to social determinants, such as economic and cultural factors, living and working conditions and individual behaviors.

A one-way importation of knowledge, frequently from the developed world, will not achieve the desired health improvements in developing countries, since knowledge dissemination as a unidirectional process fails to deal with diversity and disregards the importance of cultural and societal context. Altering the behavior of individuals, communities, and policy makers requires multi-directional considerations and involves flexibility and compromise.

The need to find adequate solutions according to local context requires developing countries to strengthen national capabilities and insert themselves in a conscious and sovereign way in the global flow of information. It is imperative that these nations become involved in international cooperative networks to produce, analyze and adapt this information to their specific needs. *Access to health information, as a social determinant of health, is a basic tenet of national growth and development.*

Instead of the unilateral transfer of knowledge, international and multilateral agencies should focus on technical cooperation activities in supporting national efforts to develop these capacities.

4. INTEGRATION WITH PRIMARY HEALTH

CARE⇒ Information and knowledge-sharing initiatives that implement a social networked enabling environment should be supported by wide community participation, appropriate technology and the integration of health promotion, disease prevention and medical care. Together with universal access, equity and social justice, these are the basic principles of primary health care (PHC), making PHC settings, actors and activities an ideal environment for the development of these initiatives.

The proposed social network-based enabling environment can help update the PHC strategy by supporting the following:

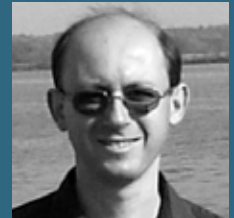
- ▶ The production and dissemination of information, knowledge and scientific evidence pertaining to local historical, geographic and cultural conditions

- ▶ Proactive participation by different segments of society in defining public policies and in generating, adopting and using health innovations through new forms of social organization such as networks of professionals and communities

As eHealth grows in its reach and sophistication, the ability of these tools to support health equity and to level the information and knowledge playing field is limitless. If used thoughtfully and in a context that recognizes national, regional, educational, cultural and other differences, knowledge sharing can expand in the health care sector, improving care through international cooperation.

Notes

- 1 Pandita N, Singh S. Barriers to Equitable Access to Quality Health Information with Emphasis on Developing Countries. In: *Making the eHealth Connection: Global Partnerships, Local Solutions*. Rockefeller Foundation's Bellagio Center in Bellagio, Italy, July 13 to August 8, 2008. [cited 2008 Nov 27]. Available from: http://www.ehealth-connection.org/files/conf-materials/Barriers%20to%20Equitable%20Access_0.pdf
- 2 Wilbanks J. Intellectual Property and Access to Information. In: *Making the eHealth Connection: Global Partnerships, Local Solutions*. Rockefeller Foundation's Bellagio Center in Bellagio, Italy, July 13 to August 8, 2008. [cited 2008 Nov 27]. Available from: <http://ehealth-connection.org/wiki/images/a/a3/WilbanksJohn-2008.pdf>
- 3 Open Society Institute Budapest Open Access Initiative Definition. Available from: <http://www.earlham.edu/~peters/fos/boaifaq.htm>
- 4 Lyon B. Access to Equitable Access to Quality Health Information with Emphasis on Developing Countries (narrative, with case studies). In: *Making the eHealth Connection: Global Partnerships, Local Solutions*. Rockefeller Foundation's Bellagio Center in Bellagio, Italy, July 13 to August 8, 2008. [cited 2008 Nov 27]. Available from: <http://ehealth-connection.org/wiki/images/2/21/RoyalJulia-LyonBecky-20080717.pdf>
- 5 Abbott, P, Urra P. Knowledge Networking: Social Networks to Share, Create, Disseminate and Use Information, and Knowledge to Enhance Health. In: *Making the eHealth Connection: Global Partnerships, Local Solutions*. Rockefeller Foundation's Bellagio Center in Bellagio, Italy, July 13 to August 8, 2008. [cited 2008 Nov 27]. Available from: http://ehealth-connection.org/wiki/index.php?title=Knowledge_Networking:_Social_networks_to_share_%2C_create%2C_disseminate_and_use_information%2C_and_knowledge_to_Enhance_Health
- 6 Abbott, P., Coenen, A. Globalization and Advances in Information and Communication Technologies: The Impact on Nursing and Health. *Nursing Outlook*, 56:238-246.
- 7 Healthcare Information For All. Available at: <http://www.hifa2015.org>.



Alvaro Margolis, MD, MS,
Vice President for
Latin America and the
Caribbean, International
Informatics
Association, Uruguay

*"Information is necessary
to make informed
decisions about health.*

*The importance of
technology to aggregate
information for the
patient is so important
for safety and efficiency.*

*This is not spending
money but investing
money [in technology]
to get a return in health
and efficiency."*

Bellagio Center Declaration on Access to Information and Knowledge Sharing

Making the eHealth Connection: Global Partnerships, Local Solutions, a month-long conference series at the Rockefeller Foundation Bellagio Center in Italy, in 2008, addressed key issues for advancing eHealth and improving health in the developing world.

We, the participants of the conference on the theme of Access to Health Information and Knowledge-Sharing, organized by the Caribbean, the Latin American and Caribbean Center on Health Sciences Information (BIREME) with the support of the Rockefeller Foundation, during the week of July 20 to 24, agreed to the following summary report on the conclusions of the meeting.

Recognizing that:

- 1) Health information and knowledge are social determinants of health since inequities in access to information and knowledge generate and/or increase health inequities. This creates unjust, unnecessary and avoidable differences in the health conditions of individuals and population groups.
- 2) Health information policies should be part of health policy in order to strengthen the use of information, knowledge and evidence in decision making.
- 3) eHealth comprises health promotion, disease prevention and care to improve health conditions and equity. Involving different stakeholders with different interests and needs, this requires a plurality of solutions in meaningful contexts.
- 4) National and global research programs are essential to identify information needs, to recognize barriers to the access, translation and use of information and to evaluate the impact of information and knowledge-sharing interventions on health outcomes.
- 5) The implementation of global eHealth initiatives should be based on partnerships involving various national and international players.
- 6) eHealth must be used to overcome barriers to access and barriers to the use of quality health information. It must also be used to facilitate the convergence of initiatives, products and solutions.

- 7) Priority should be given to settings where the production of information and knowledge is weak, and where access to it is limited.**
- 8) The information and knowledge sources and tools developed and adapted by eHealth should be openly accessible and interoperable via adequate methods and technologies.**
- 9) Information and knowledge sharing should be implemented through community participation, appropriate technology and the integration of promotion, prevention and care as a primary health care approach.**
- 10) Human resource capabilities should be expanded to incorporate skills for health information and knowledge management and sharing that meet the needs of different users, applying appropriate standards, methods and technologies.**

We commit ourselves to mobilizing efforts and resources toward the creation of an environment that will serve the global public good and that will enable producers, intermediaries and users to develop and share content, methods and technologies. This new environment will increase the use of health information and promote knowledge sharing with a focus on international cooperation for the development of health-information infrastructure and human resources.

We call for the creation of a task force with representatives from key stakeholders and donors. This task force should establish a plan of action for the implementation of this health information and knowledge sharing.

We urge national and international organizations, funding agencies, the private sector, governments and institutions to become our partners in this endeavor.



mHealth and the Future of Medicine

From Silos to Systems

Chapter 5

Mobile electronic health tools such as cell phones and telemedicine technologies are rapidly transforming the face and context of health service delivery around the world. Currently, there are more than 3.5 billion mobile phones in use across the globe—a figure that is set to double in the next decade. At the same time, telemedicine’s role in clinical care, education, research and training in the health sector continues to grow from continent to continent.

Mobile phone use, in particular, is exploding across the developing world, offering the opportunity to leapfrog other applications and services on both the health and technology fronts. As United Nations Foundation President Timothy E. Wirth emphasizes, the power of these technologies to improve health and the human condition cannot be underestimated: “Modern telecommunications, and the creative use of it, has the power to change lives and help...solve some of the world’s biggest challenges.”

Mobile health information technology (mHealth) typically refers to portable devices with the capability to create, store, retrieve and transmit data in real time to improve patient safety and the quality of care. The flow of mobile health information is characterized by portable hardware coupled with software applications and patient data that travels across wireless networks. Data transmission is realized by technologies common in everyday life, including Bluetooth, cell phone, infra-red, WiFi, and wired technologies, all of which operate as part of a network. mHealth deployment is diverse. A clinician can use a mobile device to access a patient’s electronic health record (EHR), write and transmit prescriptions to a pharmacy, interact with patient treatment plans, communicate public health data, order diagnostic tests, review labs, or access medical references, for example.

The United Nations Foundation, the Vodafone Group Foundation, and the Telemedicine Society of India jointly convened mHealth and Mobile Telemedicine, part of the Rockefeller Foundation *Making the eHealth Connection: Global Partnerships, Local Solutions* Bellagio Center conference series. Participants focused on methods for harnessing the spread of mobile technology and its power to transform health and information exchange.

mHealth and Mobile Telemedicine: Key Issues

Experts predict that the impact of mHealth is likely to be more far-reaching than other developments, such as nanomedicine and genetic therapy, as it will create an urgent need to review the way health care is financed and as it will blur the boundaries between professional medical

help and so-called “do-it-yourself” medicine. Key issues as mHealth moves forward, particularly in developing world settings, include the following:

- ▶ mHealth markets and scaling
- ▶ Imperatives for national-level health data collection processes through mobile devices
- ▶ Exploring critical success factors and incentives for local implementations
- ▶ Given mHealth's rapid progression, the immediate seeding of a multi-sector partnership dedicated to designing, funding and advancing mobile service projects

Also at play are these issues:

1. INFORMATION ACCESS AND USE⇒The management of information emerges as an important challenge. Key to the successful implementation of mHealth is the availability of the right information at the right place, at the right time and in the correct form. Medical practitioners and patients must be free to roam and to utilize different access devices (in terms of both communication

characteristics and display and processing capabilities). New challenges will arise, however, regarding the secure and reliable delivery of information from a variety of sources and in a multitude of formats (from plain messages to multimedia content). Critical to the successful handling of supporting information are monitoring devices, health care databases, communication networks and access devices.

2. COMMUNICATION NETWORK SOPHISTICATION⇒The variety and complexity of mHealth application scenarios calls for the combined use of wireless technologies (both short- and wide-range), wired communication backbones and the Internet in a seamless, secure and reliable way. The employed wireless technologies include Bluetooth, wLAN, WiFi, GSM/GPRS, UMTS and satellite communications (VSAT, DVB-RCS). The difficulty of achieving operational compatibility between the telecommunication services, terminals and devices continues to be a challenge for mHealth applications.





Although high-speed digital communication infrastructures are gradually gaining ground, it is often the case that the regions that would benefit the most from electronically delivered health care are underserved in terms of telecommunication capabilities. High-speed communication networks are still far from being a reality in many remote rural areas in developing countries. This limits the options for telemedicine, as many services can only function well under specific conditions related to communication capabilities. Many telehealth applications rely on high-speed broadband IP networks to deliver high-quality, timely and converged voice, video and data.

3. ACCESS LIMITATIONS⇒ mHealth employs a multitude of both wired and wireless-access devices, e.g. portable PCs, cellular phones and personal digital assistants (PDAs). Each one of these appliances has its own limitations, in screen size, processor power, memory, bandwidth and battery life. The service capabilities of each device vary depending on these characteristics.

Clinicians should be particularly aware of the access limitations of the devices employed, what amount of information they can provide and how well they can display it. Screen size and digital imaging technologies are particularly important in some highly visual telemedicine applications, such as tele-radiology, tele-dermatology and tele-pathology. Fortunately, technologies currently available provide excellent pixel density and resolution with a high rate of diagnostic agreement between digital and real images, as demonstrated in the scientific literature.

4. UNIFYING INFORMATION SOURCES⇒ Ideally, the entire medical profile of a patient (medical history, results of laboratory tests, etc.) should be retrievable at the point of care at the touch of a button. Yet, the decentralized multi-actor nature of health care and the wide distribution of relevant data sources have produced a patchwork, in terms of content and database implementation, that makes access to and retrieval of data from repositories a real challenge. Consequently, new mobile health applications must focus on the integration and exploitation of heterogeneous scientific information databases in a seamless way. This will enable the storage, updating, search and retrieval of useful information.

mHealth and the Transformation of Health Service Delivery

Telecommunications growth in developing countries over the past five years has been tremendous. In 1998, India and China had less than 1 million and 25 million mobile subscribers, respectively. By early 2008, both countries were adding 8 to 10 million subscribers per month. This outpaces the United States, where growth is around 1.6 million subscribers per month, and Japan, where the corresponding figure is less than 1 million. In fact, the majority of mobile-subscriber growth over the next 10 years will come from the developing world. In 1998, developed nations accounted for more than 76 percent of mobile subscribers worldwide. By 2018, only 19 percent of mobile subscribers are expected to come from developed nations.

One of the most important areas that mobile technologies are primed to affect in both developing and developed countries is health care. Mobile technologies do two things well: compress time and distance. Thus, they connect, enable, and empower participants in the health care ecosystem to reduce costs and errors while increasing productivity, access, and efficiency. *mHealth and Mobile Telemedicine* conference participants concluded that mobility and mHealth will affect health care delivery in the following critical areas:

1. GLOBALIZATION OF HEALTH SERVICE

DELIVERY⇒ In an interconnected world, health service delivery will be much more decentralized and much more widely distributed. The local clinic might be responsible for monitoring vital signs, but the analysis and prognosis might come from a physician thousands of miles away. You might be lying on a bed in Kuala Lumpur, but your surgeon could be in Stockholm on video conference with experts from Cambridge and Chennai. Real-time translation capability would mean language will not be an issue in the future.

2. REMOTE CARE AND MONITORING⇒ Given the cost of access and administration, there will be significant investment in sensor technology near or on the patient. There will also be significant funding of the communication infrastructure that connects both medical data from sensors and the patient to physicians and their staff. For example, the German firm Biotronic has developed a phone that communicates with a pacemaker using close-range radio frequency and then transmits data over a cellular network to the physician in real time.^{1,2,3} Remote care will revolutionize how expertise and drugs are delivered in rural parts of the world. They will also decrease the cost of equipment and care.

3. ALERTING⇒ The mHealth solutions that will be most replicable will be those that are both straightforward and ubiquitous. A simple alerting capability can help reduce costs and increase efficiency in every country. From reducing the number of missed appointments and missed medications through proactive patient monitoring⁴ to alerting end-users in the case of an epidemic or an emergency, messaging and alerting technologies will remain an integrated part of the health care system for years to come.

4. EARLY DISEASE DETECTION⇒ There is plenty of research to show that if a disease is detected and treated early, costs and morbidity rates are greatly reduced. If the impact of the therapy can be monitored in real time and adjusted as needed, markers in the human bloodstream can allow physicians to follow

the disease and transform medical prognoses into more evidence- and performance-based treatments.

5. DATA COLLECTION AND RECORD MAINTENANCE

⇒ Current health care interactions often require that patients fill out countless forms and other paperwork. By automating data collection for patient trials or monitoring and digitizing the medical records for further processing, significant cost savings can be realized. Enormous computing power and Gbps (Gigabits/second) network connections would mean data can be collected, analyzed, and understood in real time from almost anywhere on the planet.

6. WELLNESS AND INFORMATION AWARENESS

⇒ We now have the potential for instantaneous access to information and the capacity to use devices to monitor and record vital signs at the touch of a button. This ease of use can increase the desire of individuals to stay fit and healthy as well as improve preventative regimens. In addition, the ability to network with friends, family and patients with similar experiences will help create a better environment for sharing information.

7. GUIDANCE IN EMERGENCY RESPONSE

⇒ The effectiveness of medical responses to emergencies is determined by speed and by the level of clear communication. By coordinating with application platforms and operators, command centers can issue very specific guidance, informing end users about what to do, which route to take, how to contact authorities, and, based on real-time modeling, what to expect in the next few minutes or hours.

8. PREVENTING PHARMACEUTICAL COUNTERFEITING AND THEFT

⇒ A major challenge, especially in developing countries, is that medications are essentially a form of currency for criminals. Sensors (monitored remotely) placed on drug shipments can help ensure that a medication reaches its intended destination without tampering. Sensors can also help maintain or monitor the environmental conditions necessary for certain drugs to be effective.



Karl Brown, MIA,
Associate Director,
Applied Technology,
Rockefeller Foundation,
United States

“The potential for developing countries to become centers of innovation for eHealth is exciting. They don’t have to contend with all the legacy issues, can start with best practices and there is such energy and talent devoted to this problem. I think the sky is the limit as far as what the potential outcomes will be.”

9. MODELING AND PREDICTING DISASTERS⇒

Significant effort must be put into modeling and predicting emergencies, from disease epidemics to terrorist attacks to wildfires to earthquakes. How will an evacuation plan be directed? How will affected citizens be informed? What if the sensor networks fail? And how will modeled data be fed into a real-time emergency response system?

mHealth in Practice: Indonesia's Mobile Telemedicine System

The United Nations Development Programme has endowed a new mobile-health initiative in Sukabumi, Western Java, in Indonesia. It is run by the Institut Teknologi Bandung, the Health and Medical Bureau, district authorities, three hospitals and 71 community health centers. The system utilized in this project employs existing Internet communication equipment and has been operating with the primary objectives of telediagnosis, remote consultation and the collection and recording of patient information. Medical instruments

are installed and used depending on the differing needs of various locations and situations. In addition, the patient information system records the name of the disease and the findings of the physician, the diagnostic tests used to measure the grade of illness, the results of these tests and the type and method of treatment.

The system can also record information such as the patient's address, occupation, marital status and age. In the hospital or doctor's office, data sent in various formats can now be processed collectively. Data exchange can be performed via both pocket radio GSM/CDMA cellular phones and fixed-line telephones. The exchange of information can occur with dedicated software based on the Transmission Control Protocol/Internet Protocol (the basic communication language of the Internet), and the means of communication can be adapted to the local infrastructure.

This ongoing pilot project has allowed people in rural areas and other locales far from hospi-



tals to receive periodic medical examinations using cellular phones. Furthermore, the staff of small hospitals can now receive critical information formerly available only in larger medical settings, such as specialists' diagnoses of rare diseases or advice about the treatment of advanced illnesses.

Conclusion

mHealth holds great promise for better public health and medicine in both the developed and developing worlds. There is a rapidly growing mhealth eco-system, but moving from proof of concept demonstrations to effective deployment of these technologies requires overcoming a series of challenges. The conclusion of the mHealth week at Bellagio was to establish an "mHealth Alliance," which was announced in February, 2009, at the Mobile World Congress. The purpose of the Alliance is to foster mHealth, build partnerships, undertake advanced trials, and advocate for appropriate public policies. Its mission is to help drive mHealth to sustainable scale at the farthest reaches of wireless networks. The Rockefeller Foundation, the United Nations Foundation, Vodafone Foundation, and the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) are the founding donors. The Alliance is rapidly attracting support from a wide variety of quarters as it begins to implement its strategic focus on both information and implementation.

Notes

- 1 The Emerging Personal Health Information Network, Inside Edge, September 2007, Volume 13, Number 8.
- 2 We will also see health care-specialized devices with wireless connectivity like the ones from CardioNet, a United States-based company.
- 3 Many phones already have biometric sensors for authentication. We will be using these same sensors and additional ones to monitor vital signs and transmit them. Some of the innovative concepts being worked on are measuring heart rate with a cell phone and using the measurement for authentication for other purposes like banking and payments. Pharma companies are likely to use bar codes and NFC (near-field communications) to provide more information on labels and drugs so users can just scan the labels from their cell phones and get relevant information or instructions.
- 4 Research shows that poor adherence leads to increased drug resistance. For example, if a patient with tuberculosis takes treatment once a week rather than the prescribed regimen of twice a week for the duration of the treatment, the risk of a positive culture at 12 months is five times greater. Source: The Role of Mobile Phones in Increasing Accessibility and Efficiency in Healthcare, The Vodafone Policy Paper Series, Number 4, March 2006.



Anand Narasimham, PhD,
Co-Founder and Chief
Technology Officer,
Voxiva, Inc., United States

"All over Africa and Asia, countries started putting in networks with high-density coverage for voice and data. The tables have turned. The developing world has very advanced infrastructure for communications whereas many parts of the developed world are playing catch-up."



The Promise of Electronic Medical Records

From Silos to Systems

Chapter 6

Electronic medical records (EMRs) are increasingly deployed in countries across the globe. They enable critical, real-time information services that empower both patients and health care workers. Just a few years ago, the use of EMRs in resource-poor, developing nations was experimental at best. Few organizations believed that using EMRs was realistic in these regions and fewer still had deployed such systems. Times are rapidly changing. Information technology is more widely available in resource-poor areas, and it is allowing health advocates to tackle difficult challenges such as managing HIV/AIDS and drug-resistant tuberculosis. Successful EMR projects are now operating in such diverse locales as Zambia, Peru, Haiti, Rwanda, Kenya and Malawi. Future expansion is predicted. The global market for electronic medical records is expected to grow an astounding 23.8 percent by 2012, including EMR projects in both the developed and the developing world.

The Regenstrief Institute, Inc., and Partners In Health jointly convened *The Promise of Electronic Medical Records: An Overview*, part of the Rockefeller Foundation's *Making the eHealth Connection: Global Partnerships, Local Solutions* Bellagio Center conference series. Participants made recommendations for the broader use of EMRs in the developing world.

Electronic Medical Records: Key Issues

An electronic medical record is defined as a longitudinal collection of electronic health information that provides immediate, authorized access to person- and population-level data to support efficient health service delivery processes.¹

While EMRs hold great promise, few studies have been conducted to measure the actual impact of using them to improve the quality, access or affordability of health care, particularly in developing countries. And much work remains to determine the right mix of ingredients for a workable, culturally appropriate EMR. Other key questions also relate to electronic medical record technologies used in developing countries. These are:

- ▶ What should be built into EMR systems (e.g., reports, patient summaries and analyses needed by local teams)?
- ▶ What is the appropriate level for EMR systems to be deployed—national, district or clinic?



- ▶ What collaborative EMR approaches can be used to improve data quality, collection and tracking?
- ▶ How can EMRs be funded and what incentives can increase their usage?
- ▶ How can EMR infrastructure, technical support and capacity-building challenges be overcome?

Open-Source EMRs and the Developing World

Open-source environments enable computer programming code for a technology to be freely available for everyone to use and to customize for their purposes. The intent is to encourage the development of products that are more understandable, modifiable, replicable, reliable and accessible. Open-source software allows interested individuals to produce a new software version, share it with others, and/or market it. Implementers use open-source strategies because they can be cost effective, adaptive in addressing local needs and flexible in design, development and distribution. They enable governments and communities to play a central role in meeting the demands of health care services.

The Open Medical Record System (OpenMRS®) is one example of how open-system software principles and tools can be success-

fully deployed in challenging environments such as Africa and South America. OpenMRS is a multi-institution, nonprofit collaborative led by the Regenstrief Institute, Inc., a world-renowned leader in medical informatics research, and Partners In Health, a Boston-based philanthropic organization with a focus on improving the lives of underprivileged people worldwide through health service and advocacy. These teams nurture a growing global network of individuals and organizations all focused on creating medical records systems and implementation networks that enable system development and self-reliance within resource-constrained environments. OpenMRS has been implemented in several African countries, including South Africa, Kenya, Rwanda, Lesotho, Zimbabwe, Mozambique, Uganda and Tanzania.

OpenMRS is an application that enables the design of a customized medical records system by those with no programming knowledge. It provides a common framework to build medical informatics efforts in developing countries. OpenMRS is based on the principle that information should be stored in a way that makes it easy to summarize and analyze, with minimal use of free text and maximum use of coded information. At its core is a concept dictionary that stores all diagnoses, tests,



procedures and drugs—as well as general questions and potential answers. OpenMRS is designed to work in environments where many client computers access the same information on a server. It aims to provide comprehensive information for programmers, developers, medical records implementers and users. When combined with standards consensus, consistency, clinical mapping and knowledge modeling, OpenMRS can achieve positive health care outcomes. It is just one example of EMRs successfully and efficiently improving health in the developing world.

Migrating Towards a Robust, Integrated EMR Framework: Essential Ingredients

Progress toward broader deployment of integrated, workable eHealth solutions in the developing world requires many important actions. These include creating an implementation toolkit; developing adaptable, interoperable and scalable software; and fostering communities to support local grassroots initiatives, while linking them to other projects and organizations that can provide technical, financial and training support. A cradle-to-grave approach supported by project tools is necessary to achieve effective results.

Participants in the *Electronic Medical Records* conference made recommendations for the creation of a new toolkit that could support the effective assessment, implementation and ongoing support of electronic medical records. Toolkit elements would be featured live on a wiki-enabled Web site so that critiques and modifications would be made and would be visible online. Recommended tools include the following:

1. POLITICAL ⇒ Tools must address the political climate of the environment so that key stakeholders and motivators are clearly identified. This includes assessing the regulatory environment and governmental issues. Any legal or political constraints need to be identified up front.

2. ENVIRONMENTAL ⇒ The physical environment is a key constraint in the deployment of technology and could be a critical component defining or limiting the sophistication of the solution to be tapped. Assessments for tapping and stabilizing energy or power sources are essential, as is gauging the accessibility of the community served. Other considerations, such as temperature and humidity, may have a major effect on the technical solution that may be utilized.



Aamir Khan, MD,
Executive Director,
Interactive Research and
Development, Pakistan

“One of the biggest challenges we face for patients with HIV/AIDS or tuberculosis is continued care over long periods of time. Previously, there were no tools to monitor across sites and multiple visits. But now, with open source medical records, we can bring all of this information together in a way we could not have dreamed of before.”



3. SOCIAL⇒ Social tools assess human relations and associated dependencies including required staff. The project owner, along with everything else that is needed to successfully run and manage the project, will be identified. Readiness of the users is a key success factor. The creation of a communications plan, regardless of how rudimentary it might be, is also essential to the success of a project roll-out. The initiation of a training program is also vital. Critical considerations include training, staffing and planning tools that take turnover into consideration.



Evidence in developed countries demonstrates that involving potential EMR users from the beginning is crucial for gaining acceptance of the necessary changes. This could be as simple as announcing the project in the health care facilities as early as possible. It could be as involved as inviting future users to be part of the system design and implementation. By the time equipment and software arrive at a health facility, future users should already have at least some knowledge of their benefits.

4. TECHNOLOGICAL⇒ An information strategy is developed, followed by a needs assessment to help map what features and work flow are

needed. Required technology solutions emerge once these activities are completed. A tool to perform a gap analysis must then be used, since customization of standard solutions is usually required. Tools needed for configuration, scaling, deployment and implementation should be considered.

5. EVALUATION⇒ Donors require confirmation and evidence that their investments are making a difference. Therefore, implementers will need tools to measure the baseline (at the onset of the project) and the project's progress against that baseline. They will also need a mechanism for reporting results. Evaluation data, even if only from an exploratory assessment, may also be crucial in winning from the support of local staff. Capacity-building education and training around evaluation methods is also critical, as consistency in reporting is of paramount importance.

6. PERCEIVED VALUE ASSESSMENTS⇒ Assessment tools measuring success objectives are important for ongoing project viability. Unless the users see value for the systems that have been installed, they will not use them.

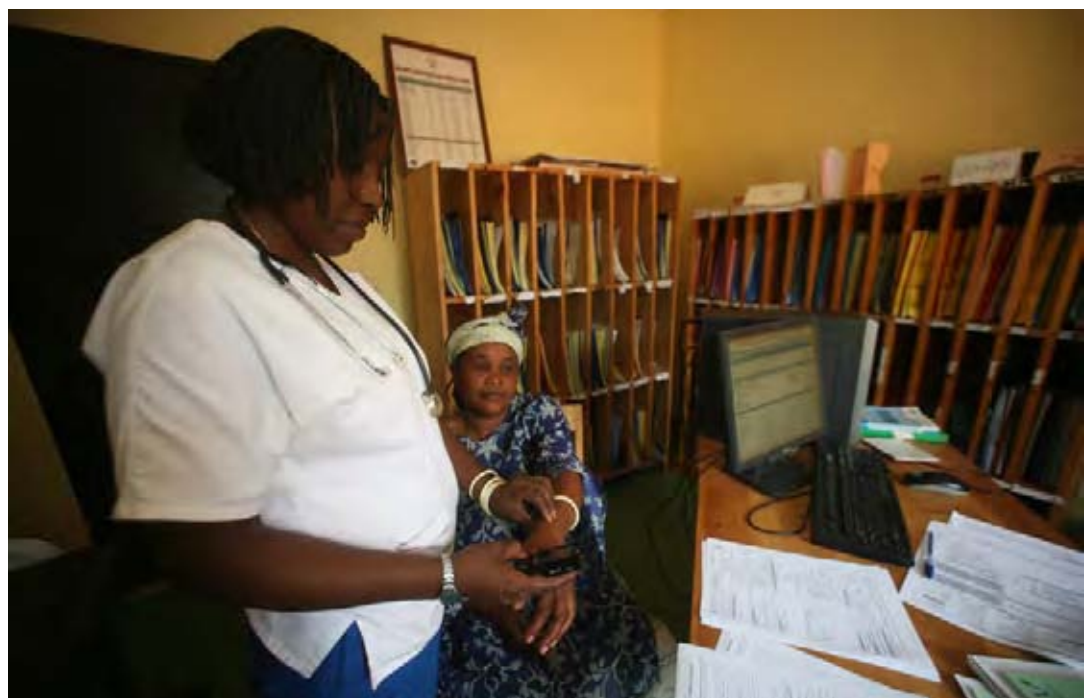
7. SUPPORT⇒ Before, during and after the systems are installed, support for the users is required in the form of education and

training as well as technical support for creating patches, fixing bugs, and releasing new initiatives.

Seeding and Sustaining EMR Solutions: Collaborative Action Networks

The most successful EMR projects prioritize a direct, supportive working relationship with developers, implementers and end users in the countries where systems are deployed. These community-based networks simultaneously meet the specific needs of end users and aim to teach proficiency in software and project approaches in order to encourage self-maintenance.

The Health Information Systems Project (HISP), based largely in Norway and South Africa, has particular experience with such efforts. HISP describes the evolution of "collaborative action networks" within its community as the focal points of implementation growth within a given country. The OpenMRS community has also had success with such networked approaches, and has built a robust community of worldwide development expertise. Instead of exerting a primarily top-down approach to large-scale implementation, these efforts enable communities to form around solving larger problems. A



Collaborative Action Network (CAN) such as this could offer support for eHealth and EMRs in the developing world. A CAN approach acknowledges challenges in developing environments. These include:

- ▶ Insufficient human capacity—both from an expertise and an ownership perspective
- ▶ Mistrust within developing environments about the motivations of individuals/organizations who come in and deploy systems from “outside;”
- ▶ A legacy of failed top-down technology deployment attempts

WE-CAN (World eHealth Collaborative Action Network)

EMR conference participants envisioned the formation of a World eHealth Collaborative Action Network (WE-CAN) to enable support for ideas to flow both from the bottom up and from the top down. CAN organizations can be formed at many different levels and are self-organizing around an idea, a work requirement or a system. CANs can interlink and/or subsume one another. They embody the concept of a community of communities.

Guidance and leadership for WE-CAN should incorporate developing world country representatives, existing or emerging collaborations (project level CANs), industry leaders, donors and others. The goal of WE-CAN would be to create a global marketplace for eHealth through collaboration, best practices and standards-based interoperable systems.

What is needed to create and sustain the WE-CAN initiative includes:

- ▶ Governance body: A board of directors or secretariat to provide basic guidance and support of the community.
- ▶ Online technologies: A series of technologies (wikis, blogs, forums, mailing lists, etc.) that allow communities to self organize.
- ▶ Face-to-face meetings: Opportunities for communities to meet with one another are central to community growth and coordination.
- ▶ Community mandate: The notion of WE-CAN needs to be supported and understood

at the highest levels in order for it to succeed. Therefore, educating decision makers will be essential.

- ▶ Core support for CANs: As these self-forming organizations are asked to serve greater functions for the world, they will need resources to properly scale their endeavors. They will need appropriate management, financial resources and mentorship opportunities.
- ▶ Reference implementations: In-country demonstration projects or reference implementation of one or more EMR systems using state-of-the-art techniques and principles will help facilitate the application of current thinking and a harvesting of lessons learned. These should be supported by in-country Centers of Excellence.

Conclusion

Canadian eHealth pioneer Richard Alvarez observed that “the last 12 months could be dubbed the international year of electronic health records, as electronic health information systems have been identified as a critical ingredient for reinvigorating health care in country after country.”²

The promise of electronic medical records in the developing world is great. With cooperation for the greater good, innovative collaboration networks can abandon top-down approaches in favor of workable, customized solutions built on lessons learned. Conference participants noted an old African saying: “I am who I am because of who we all are.” Apply this principle to the promise of EMR and the number and intensity of initiatives will continue to grow.

Notes

- 1 U.S. Institute of Medicine, *Patient Safety: Achieving A New Standard of Care*, November 2003.
- 2 Alvarez, R. Health Care Has to Move into the Hi-Tech Age. *Bull World Health Organ* [online]. 2005; 83, 5: 323-323.



Sherrilynne Fuller, PhD,
School of Public Health
and Community Medicine,
University of Washington,
United States

“We are facing a generation in the Global North and South that is increasingly comfortable with mobile phones and computers. We need to bring those who are ‘born digital’ into the equation now. They absolutely need to be at the table.”



“Glocal” eHealth Policy

From Silos to Systems

Chapter 7

eHealth is now recognized as a key enabler for supporting health systems the world over as they strive to deliver good health and wellness. Policy is a unifying element in eHealth. Developed appropriately, it can help clear a path for sound adoption of technological solutions and enable countries with similar challenges to share resources and lessons learned across international borders.

eHealth policy is concerned with solutions that support capacity building and provide services that improve health outcomes. Policy boundaries are defined by socio-economic, financial, cultural and institutional conditions; by human and material resources; and by organizational and managerial models. While health may be a domestic matter, the networked nature of eHealth creates a new paradigm for it, as a global matter. Local and national development of eHealth policy must occur in a global context, and vice versa—or from a “Glocal” perspective.

To advance dialogue and consensus in the global eHealth arena, the World Health Organization convened National and Global eHealth Policy, part of the Rockefeller Foundation’s *Making the eHealth Connection: Global Partnerships, Local Solutions* Bellagio Center conference series. Participants were asked to form new ideas and frameworks that support the proliferation of sound and sustainable eHealth policies in the developing world and internationally.

Glocal eHealth Policy: Key Issues

eHealth policy is a new and rapidly expanding field. Nearly 100 eHealth policy issues have been identified to date. Yet progress in resolving these issues in developing countries and on the international stage lags far behind. Achieving needed consensus on these issues and advancing to the next stage of eHealth policy development requires answering some key questions:

- ▶ What eHealth policy issues and gaps exist?
- ▶ How can the full spectrum of eHealth policy issues, from local to global, be captured?
- ▶ What eHealth policies already exist? Are they applicable in developing-world contexts?
- ▶ Which global outcomes indicators can provide evidence and insight to guide policy development?
- ▶ Which organizations should take the lead in eHealth policy development on the regional, national and global level? How can cooperation between these bodies be encouraged?

eHealth Policy: Conquering the New Digital Divide?

eHealth policy has been defined as “a set of statements, directives, regulations, laws, and judicial interpretations that direct and manage the life cycle of eHealth.”¹ The idea of having an eHealth policy is still relatively new, yet more than half of the countries in the world already have some form of eHealth policy, strategic plan, road map or action plan, however basic or nascent. This number is expected to rise above 85 percent within three years. Early eHealth policy adopters include Australia, Canada, China, Croatia, Denmark, Finland, Iran, Malaysia, Malta, New Zealand, Russia, Singapore, South Korea, Sweden, Taiwan, Tanzania, Thailand, the United Kingdom, Vietnam and the United States.²

eHealth policies, strategies, and road maps already drafted cover a wide range of issues, but there is little commonality in what the policies aim to achieve. This is in part due to different levels of maturity in the eHealth field, the fact that issues that have already been addressed in one nation may still be a goal to be achieved in another, and different interpretations of terms such as an electronic medical record. Issues including standards, interoperability and data security are often stated as important components of eHealth policy, but in reality, these issues are being dealt with at an international level by other agencies and are ever-changing as technology evolves.

In the developing world, eHealth expectations and requirements are somewhat different. The developed world looks to provide services like eCards and grapples with how to reduce the health care costs of an aging population by introducing home care and keeping people out of hospitals. Meanwhile, the developing world is examining how to find ways of overcoming extreme shortages of health care workers and improve rural health care, while at the same time improving or implementing electronic health information systems. What seems perfectly acceptable and correct in the developed world, in terms of data quality and patient confidentiality, may be major impediments in the developing world.

Attention needs to be directed toward inter-jurisdictional policy issues that will enable and facilitate patient mobility, data mobility and sharing, both across international borders and regional boundaries within countries.³ Developing countries already find themselves disadvantaged in respect to access to eHealth, human resource capacity and economic capacity. They require assistance with the creation of relevant policies and strategies. They also need standards appropriate to their socioeconomic conditions and infrastructure. Crafted effectively, eHealth policy will draw developing countries into the fold and enable them to further engage with the international community and enjoy the benefits of global eHealth.

eHealth Policy Issues: Emerging Consensus

Discussions between ministers of health and technology on different continents are bringing common eHealth policy issues to the surface. A recent eHealth literature review also brings fundamental eHealth policy points into focus. It reveals that eHealth policy elements of concern to countries around the globe fall into nine categories:

NETWORKED CARE: Enhances the ability of providers, departments, organizations and jurisdictions to work in a coordinated environment to improve care of the population, by

- ▶ Creating an enabling environment
- ▶ Sharing information, knowledge and practice
- ▶ Making the transfer of information easier
- ▶ Making the transfer of information safer
- ▶ Overcoming challenges for networked care

INTER-JURISDICTIONAL PRACTICE: Deals with the transfer of information and the provision of care between different jurisdictions, by

- ▶ Addressing professional portability
- ▶ Tackling challenges and discrepancies in inter-jurisdictional practice

DIFFUSION OF eHEALTH ADDRESSING THE DIGITAL DIVIDE: Supports the use of eHealth among the neediest populations to improve health services, by

- ▶ Increasing penetration of services
- ▶ Developing “open” policies

INTEGRATION INTO EXISTING SYSTEMS: Enables integration of eHealth projects and programs with the regular services, by

- ▶ Achieving broader goals through integration
- ▶ Facilitating integration
- ▶ Identifying and involving the stakeholders
- ▶ Overcoming challenges with integration

HANDLING INNOVATION AT DIFFERENT LEVELS: Grows the capability of institutions to implement eHealth successfully, by

- ▶ Assigning definitive roles
- ▶ Managing change brought by new technologies and ideas
- ▶ Assessing technologies

POLICY GOAL SETTING: Guides institutions in defining policies for eHealth, by

- ▶ Making eHealth feasible
- ▶ Making policies flexible
- ▶ Providing effective governance
- ▶ Creating guidelines for different stakeholders

EVALUATION AND RESEARCH: Generates evidence for adoption of eHealth, by

- ▶ Evaluating the impact of eHealth
- ▶ Assessing new technologies

INVESTMENT: Introduces business models for eHealth adoption, by

- ▶ Using eHealth for commercialization purposes: It is a natural phenomenon that many institutions will use eHealth to increase their clientele and thus grow their businesses. Proper policies are needed to regulate these efforts so that the elements of care and benefit to the population are not lost.
- ▶ Engaging in public-private partnership: Realizing the kind of investments required in implementing eHealth programs, it may be useful to explore public-private partnership models for eHealth. Clear policies and guidelines to implement such partnerships would be beneficial.

- ▶ Advertising cross-border sale of drugs: The use of eHealth has encouraged inter-jurisdictional provision of care, including the order and sale of medicines. It is necessary for governments to design policies that could regulate and guide the use of eHealth for such purposes, and control malpractice and fraud.

ETHICAL ISSUES: Fosters the adoption of eHealth, by

- ▶ Addressing consent for care in eHealth: Laws differ in many areas on obtaining consent for care before transferring patient information online, or before arranging video-conferencing sessions. Clear policies to guide such consent can benefit health care institutions and providers.
- ▶ Dealing with liability issues (medical malpractice liability): Policies regarding liability issues are extremely important, especially in the cases of inter-jurisdictional care.
- ▶ Figuring out medico-legal issues: Policies regarding medico-legal issues in eHealth are also crucial, and must be developed before such programs are implemented.
- ▶ Affirming the patient’s right to access information: Policies regarding a patient’s right to access his or her own information is an important matter for eHealth decision makers.

Moving Forward: Planning for eHealth Policy Success

To address varied, complex and multi-jurisdictional eHealth policy challenges, a five-step framework was developed by *National and Global eHealth Policy* conference participants to push eHealth policy and better health forward:

1. GLOBAL eHEALTH CONVENTION ⇒ The goal is to swiftly prepare a global legal and regulatory framework for eHealth, and to seek intergovernmental endorsement of the convention. The convention itself would establish high-level, core eHealth principles that could then be implemented in national legislation and international resolutions. The World Health Organization is seen as a principal body to move this initiative forward. Interoperability and cross-border provision of medical services are the critical areas of focus for the convention.

2. eHEALTH POLICY TOOLKIT⇒Conference participants recognized an urgent need for an eHealth toolkit that would offer relevant information to ministries of health on policy issues, such as standards and interoperability, data stewardship, governance and institutional responsibilities, finance and budget planning and human health resource needs. This toolkit should be in both paper and online form and consistently updated.

3. eHEALTH EDUCATION⇒There is a significant lack of understanding in relation to eHealth. Raising awareness among all stakeholders about what eHealth is, and what it can do, is a critical and urgent issue. Of equal importance is consistency in the messaging. To address this need, an integrated advocacy, communications and marketing plan should be established that will make the case for eHealth.

4. NATIONAL eHEALTH COUNCILS⇒There is great value to be gained from each country having a resource that provides a broad perspective on eHealth with representation from diverse stakeholders. This body could advise or assist in eHealth policy development and the provision of technical advice. It could also help with implementation, evaluation and monitoring. Conference participants agreed that the formation of national eHealth councils was the most appropriate mechanism. These could be national in scope for small countries, sub-national for large countries, or even linked through the creation of regional clusters or the joining of established regional entities. Conference attendees recommended forming networks of eHealth ambassadors who are respected individuals at local, regional or national levels. These ambassadors could knowledgeably promote the application and integration of eHealth solutions.

5. STAKEHOLDERS⇒Another highlight of *National and Global eHealth Policy* conference discussions was recognition of the complexity of the eHealth arena, and the number of stakeholders that must be involved in decisions and actions related to implementation and integration of eHealth solutions. Stakeholders include:

- ▶ International agencies and bodies
- ▶ Community and community-based organizations (CBOs)
- ▶ Special-interest groups and religious groups
- ▶ Government and government-supported organizations at all levels and all sectors
- ▶ Politicians, legislators and parliamentarians
- ▶ NGOs /BINGOs (Big International NGOs)
- ▶ Donors
- ▶ Private-sector organizations
- ▶ Academia
- ▶ Professional associations
- ▶ Health service providers
- ▶ Regulatory bodies at various levels
- ▶ Standards development organizations
- ▶ Media and opinion makers
- ▶ Judicial bodies
- ▶ Research and development institutions at all levels

Addressing eHealth policy issues will be a complex process. A common vision can unite diverse stakeholders.

Conclusion

In order for eHealth policy to progress, experts from around the globe must engage in an active dialogue that provides consensus-based answers to complex questions and puts conceptual policy frameworks into practice. The overall goal is to speed the implementation and integration of appropriate eHealth solutions into health care environments, particularly within a developing world context. Nothing could be more important for improving global health, revamping health systems and supporting the United Nations Millennium Development Goals.

Notes

- 1 Scott RE, Chowdhury MFU, Varghese S. TeleHealth Policy: Looking for Global Complimentarity. *Journal of Telemedicine and Telecare*. 2002;8(Suppl 3):55-57.
- 2 Scott RE, Chowdhury MFU, Varghese S. TeleHealth Policy: Looking for Global Complimentarity. *Journal of Telemedicine and Telecare*. 2002;8(Suppl 3): 55-57.
- 3 Scott RE, Chowdhury MFU, Varghese S. TeleHealth Policy: Looking for Global Complimentarity. *Journal of Telemedicine and Telecare* 2002;8(Suppl 3): 55-57.



Ticia Gerber, MHS/HP,
United States

“People think of policy very differently. Policy can be law, regulation, process or a way to put in place incentives that drive the private market. It is not just government top-down solutions. This is good news for eHealth because we have many levers with which to effectuate positive change.”



Catalyzing Markets for Global eHealth

From Silos to Systems

Chapter 8

Facilitating an ecosystem of well-functioning eHealth markets around the world is a critical step in health improvement and system transformation. Unfortunately, cultivation is falling short, with information technology markets proving difficult to both quantify and catalyze, particularly in the developing world. Initial estimates by the Boston Consulting Group peg the global eHealth products and services market at \$96 billion, with 95 percent of this market in industrialized countries. Nearly half of the developing world markets, estimated at \$4 billion, are in only four countries: Brazil, Russia, India and China.

Definitional issues and fragmentation complicate efforts to nurture eHealth markets. eHealth covers a broad swath of territory, from electronic medical records (EMRs) to telemedicine and mobile-health interventions. Health 2.0 technologies that enable user-generated content, SMS social networking tools, and peer-to-peer platforms are also increasingly placed under a widening eHealth umbrella. And eHealth is perceived differently, depending on the audience. A well-functioning market may ultimately be described as one that facilitates a platform for integrating the myriad of eHealth technologies, donors and systems into a coherent whole that drives efficiencies and improves health outcomes.

The Public Health Institute convened *Catalyzing Markets for Global eHealth*, part of the Rockefeller Foundation's *Making the eHealth Connection: Global Partnerships, Local Solutions* Bellagio Center conference series. Participants provided an overview of eHealth markets in the developing world and outlined novel collaborative approaches to leapfrog over the legacy eHealth environments found in many nations.

Catalyzing the Global eHealth Market: Key Issues

Successful eHealth markets enable better coordination of services, data integration and the development of evidence-based practices. In order for this to occur, however, eHealth entrepreneurs must possess a clear understanding of market size and key problems that proposed business models will attempt to solve, and be able to formulate a vision of business model sustainability in markets where purchasing power is often perceived as too low to support eHealth enterprises.

Challenges in seeding and growing eHealth markets are notable and must be addressed through innovative partnerships that span the globe. When undertaking this task, key issues and barriers must be considered:



- ▶ Lack of awareness about the costs and benefits of eHealth solutions
- ▶ Absence of business-case studies demonstrating potential eHealth models and their promise for health system transformation
- ▶ Fragmentation of the eHealth market on both the supply and the demand sides, with most global health programs being driven by vertical or disease-driven programs that create numerous silos
- ▶ Lack of a coherent, transparent enabling policy environment that supports eHealth market development (e.g., a process that supports funding, data handling, privacy and interoperability)
- ▶ Shortage of private-sector involvement from multinational and information technology (IT) companies based in the developing world due in part to perceptions of market inadequacy

While on the surface, market barriers appear to be formidable, businesses are successfully developing products and services for eHealth markets in the developing world. A growing roster of players is working in the field.

Collaborative Markets for Global eHealth

Concerted action is needed to change the current eHealth market environment in a way that drives innovation and health system transformation. *Catalyzing Markets for Global eHealth* conference participants concluded that the open-source software community and other e-commerce mechanisms can be adapted to develop new organizational processes that may achieve breakthroughs much faster and with a more diverse group of players. If the right system of solutions and institutions is put into place now, many of the eHealth difficulties encountered by developed nations can be avoided in developing countries and greater health benefits derived.

The challenge is to transcend the current tendency to create analog institutions appropriate to the non-digital problems of the past, and move toward new forms of networked organizations. Academics Elinor Ostrom and Charlotte Hesse highlight the concept of a commons, a shared resource governed by a new set of institutional relationships and ethos.¹ The recent theoretical work in this area, coupled with public-private partnership experiences, creates an important foundation for new types of institutions and partnerships that can facilitate collaborative markets, meet



Chris Elias, President and CEO, Program for Appropriate Technologies in Health, United States

There is a demand for better health services and technology and an increasingly affordable set of technologies to meet that need. Unlocking the eHealth markets is not so much creating markets as aligning the different pieces and making connections so that the markets work.”

the outstanding needs of entrepreneurs, and generate new opportunities downstream from the commons.

Lessons from the IBM and Apache software’s experience illustrate how an eHealth commons might work. When IBM recognized that the market for hardware had matured and would not be the source of sustained revenue growth in the future, it began shifting its business model to focus on open-source software such as Linux and the Apache Software Foundation. Through the donation of approximately \$10 million of code and 400 programmers’ labor, IBM accelerated the growth of open-source code, driving demand further downstream for higher-margin Web-based consultative services. In essence, IBM made a strategic investment in the commons to grow the overall market.

The global eHealth market might therefore explore the concept of the collaborative market, the notion of the commons for sharing resources, and expertise that might enable the growth of the market for everyone. The eHealth market might also explore foundational building blocks, such as open standards, common architectures and interoperability. This framework would allow both open-source and proprietary systems to operate. The issue is not one of open source versus proprietary, but rather how to build an eHealth commons that lays the necessary conditions for the market to grow and actually drive healthy outcomes.

eHealth Commons: Core Ingredients

An eHealth commons, *Catalyzing Markets for Global eHealth* conference participants concluded, is needed to strategically bring together key actors around shared resources (common standards, shared vision on system architectures, facilities for demand aggregation, donor-aligned financing pools, etc.). This would enable markets to grow and would support a vast ecosystem of eHealth players. A global eHealth commons would likely possess these elements:

- ▶ Financing and matchmaking functions between entrepreneurs and donors

- ▶ An architectural function that addresses open standards, architectures, interoperability and systems integration
- ▶ Smart social networking and an open-innovation portal to bring together disparate eHealth players
- ▶ A business model advisory and best practices repository
- ▶ Demand aggregation where the World Health Organization (WHO), ministries of health and other e-services could come together to coordinate platforms
- ▶ Research and evaluation tools that can inform eHealth policymaking
- ▶ The global eHealth commons could address users or stakeholders in the global eHealth field: entrepreneurs and companies, policy-makers, informatics professionals, public health professionals and citizens.

eHealth Commons: Developing World Framework

Catalyzing Markets for Global eHealth conference participants emphasized that the following issues should be considered in the creation of an eHealth commons:

1. CREATE VALUE PROPOSITIONS FOR DIVERSE INDUSTRY PLAYERS, INCLUDING COMPETITORS⇒

Operating in the eHealth arena entails coordinating the development of common standards and architectures that enhance interoperability and help reduce uncertainties for industry and entrepreneurs while simultaneously giving policymakers the necessary toolkits to make the right decisions with vendors and others.

2. STRUCTURE THE COLLABORATIVE MARKET AS A THIRD PARTY WITH INDEPENDENT MANAGEMENT⇒

This third party should adopt an agnostic but strategic view on eHealth matters, with criteria framed around sustaining the growth of the public good (i.e., health outcomes and transforming systems, sustainability of enterprises to drive innovation and health equity in the broadest sense.)

3. EXPECT THAT THE PRODUCT, TERMS OF TRADE, AND MARKET STRUCTURE OF THE COLLABORATIVE MARKET WILL EVOLVE⇒

A collaborative market and commons can be designed

with a focus on today's problems and realities. There is a strong need to exercise foresight and strategic thought to identify leapfrog opportunities and an overall innovation strategy that can attract the best in the field to the overall cause.

4. ALIGN DONORS⇒The eHealth commons must become a central space where a spectrum of donors such as multi- and bi-lateral donors, venture capitalists, foundations and governments can come together and build shared investment platforms that reinforce eHealth goals for common standards, architectures and interoperability. Donors are important agents in the eHealth value chain. They should be seen as having the foundational ability to enable eHealth markets. One tangible donor alignment tool is software development that facilitates the integration of the eHealth value chain by focusing on a series of strategic alignments, including the alignment of the following:

- ▶ Philanthropists to innovation
- ▶ Policymakers to entrepreneurs
- ▶ eHealth information with researchers, philanthropists, social/entrepreneurs, donors and the private market



5. INCREASE CAPACITY OF SOCIAL ENTREPRE-

NEURS⇒As with the public sector, there is a need to build capacity among social entrepreneurs to absorb capital, obtain information on available technology solutions, receive adequate technology training to manage software systems, exchange business model insights, and be vocal in the policy arena so that policymakers do not overlook local social entrepreneurs when framing new policy agendas for eHealth. In addition, an eHealth promotion network could integrate needs across the demand and supply chains, acting as a clearinghouse of tools, frameworks, and knowledge to facilitate market growth. Within the eHealth commons framework, the network would vet proposals from social entrepreneurs and match their identified needs with the right stakeholders in the network.

Conclusion

Experts estimate that a country-level investment of 2 percent of health care expenditures on IT can generate a significant health-system benefit. With the proper market and innovative financing solutions, developing countries have the opportunity to cultivate some of the world's most innovative and effective eHealth solutions. Collaborative markets, entrepreneurial commons, solid business case studies, better donor and financier matchmaking, smart social networking, and strategically addressing current constraints in the eHealth supply and demand chain are all keys to success.

Notes

- 1 Hess, C, Ostrom, E. *Understanding Knowledge as a Commons: From Theory to Practice*. Cambridge, Mass: MIT Press, 2006.
- 2 Ibid, p. 6.



Beatriz de Faria Leão, MD, PhD, Health Standards Architect, Zilics Health Information Systems, Brazil

“We must now be able to share patient information across the planet. To think more globally, we need donors who have the ability to put people together and channel resources in the right direction, governance bodies that reflect what is needed and integrate different initiatives, and technology that is sharable and interoperable.”



The Road Ahead

The goal of the four-week *Making the eHealth Connection* conference was to foster partnerships among groups of thoughtful, committed participants—many of whom were from the developing world—and to help them establish frameworks and agreements that will advance health systems by enabling a global eHealth movement. With many new ideas sparked and strong ties formed among conference participants, most of whom had never met or collaborated before, the outcomes of the conference will inform both national and international eHealth agendas for years to come.

Many seeds for new partnership, business, funding and policy models grew out of conference conversations. Each day these new ideas are propelling eHealth and better health systems forward. Two imperatives were mentioned most ardently and frequently by conference participants from all professional walks of life:

- ▶ The need to move from silos to systems—seeking out person-centered, user-driven, integrated, collaborative, sustainable, scalable, reusable and in-country demand-driven eHealth solutions
- ▶ The need to be daring in eHealth visions for the developing world, realizing that much can be done with limited resources and a lot of ingenuity

By turning these ideas into practice, the eHealth movement truly can be a great equalizer between rich and poor, healthy and ill. We are already seeing examples of how the thoughtful implementation of eHealth around the world is leading to improved health systems and health, particularly for emerging economies.

As *Making the eHealth Connection* participant Nolwazi Gasa of the Development Bank of Southern Africa so eloquently put it during her time at the Rockefeller Foundation Bellagio Center conference, “The cost of doing nothing on eHealth is far greater than the cost of doing something. Be a facilitator and owner of the process.”

Making the eHealth Connection: Overview

NATIONAL HEALTH INFORMATION SYSTEMS Week 1: July 13–18, 2008

Public Health Informatics and National Health Information Systems

- ▶ University of Washington's Center for Public Health Informatics
- ▶ Health Metrics Network

Public health informatics is an area of great growth and promise in the developing world.

This conference examined the use of ICT in public health, enterprise architecture issues, user needs, functional requirements, and the development of a Partners in Global Public Health Informatics Initiative.

The Path to Interoperability

- ▶ Health Level Seven (HL7)
- ▶ World Health Organization

A key obstacle to sharing information is the lack of interoperable health systems and consensus on data standards. This conference covered current standards development and implementation related to the interoperability needs of developing countries. And, it identified technologies, policies, skills, and government and industry leadership necessary to achieve interoperability.

KNOWLEDGE AND CAPACITY FOR eHEALTH Week 2: July 20–25, 2008

Access to Health Information

- ▶ Latin American and Caribbean Center on Health Sciences Information (BIREME)

Increasing access to health information can greatly improve health care. Participants discussed state of the art information access tools. They explored the role of social and virtual communities, seeding global alliances, and networks on e-information access and policies.

Health Informatics and eHealth Capacity Building

- ▶ American Medical Informatics Association
- ▶ International Medical Informatics Association

One of the biggest challenges to eHealth capacity building in developing countries is the shortage of qualified health care professionals and training resources. This conference prioritized capacity-building opportunities in developing countries and identified how eHealth technologies and tools can support them.

CORE eHEALTH TECHNOLOGIES

Week 3: July 27–Aug 1, 2008

Electronic Health and Medical Records

- ▶ Partners in Health
- ▶ Regenstrief Institute

Since fledgling efforts just five years ago, several successful medical information systems and electronic medical records (EMRs) systems have now been deployed in developing countries, and information technology (IT) is much

more widely available in resource-poor areas. The core objective of this conference was to explore a plan for the creation of a comprehensive hospital and ambulatory medical information system for developing countries.

mHealth and Mobile Telemedicine

- ▶ United Nations Foundation
- ▶ Vodafone Group Foundation
- ▶ Telemedicine Society of India

Mobile electronic health tools are rapidly transforming health care delivery. Mobile phone use in particular is exploding across the developing world, offering the opportunity to leapfrog forward. Participants assessed mHealth and telemedicine priorities, discussed market scaling, and seeded a multi-sectoral partnership dedicated to designing, funding, and advancing mobile health projects in the developing world.

POLICY AND MARKETS FOR eHEALTH

Week 4: Aug 3–8, 2008

Unlocking the market for eHealth

- ▶ Public Health Institute

eHealth is increasingly employed to address health system challenges and improve services, especially for poor and vulnerable populations. Yet a myriad of questions linger on the money and

Making the eHealth Connection: Partners

incentive side of the equation. These issues are particularly acute for developing countries. This conference generated new thinking about the finance and business of eHealth for the underserved and explore how to effect social and health care changes through eHealth investments in developing countries.

National eHealth Policies

► The World Health Organization Common policy challenges are emerging for countries around the globe embarking on eHealth implementations. Coordination between actors at the local, regional, national, and trans-national level and rational alignment on eHealth donor policy is increasingly important. This conference defined a new process for development of national eHealth strategies, described distinct models for regulation of national and global eHealth infrastructures, and began the process of drafting a five-year global eHealth policy roadmap.

AMERICAN MEDICAL INFORMATICS ASSOCIATION (AMIA)

www.amia.org

AMIA is a professional organization of leaders shaping the future of biomedical and health informatics in the United States and over 50 other nations. AMIA is dedicated to the development and application of informatics in support of patient care, public health, teaching, research, administration, and related policy.

HEALTH LEVEL SEVEN (HL7)

www.hl7.org

HL7 is a not-for-profit standards development organization dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information that supports clinical practice and the management, delivery and evaluation of health services.

HEALTH METRICS NETWORK (HMN)

www.who.int/healthmetrics/en

Health Metrics Network (HMN) is a global partnership that facilitates better health information at country, regional and global levels. Partners include developing countries, multilateral and bilateral agencies, foundations, other global health partnerships and technical experts.

INTERNATIONAL MEDICAL INFORMATICS ASSOCIATION (IMIA)

www.imia.org

IMIA provides leadership and expertise to the multidisciplinary health focused community and policy makers to enable the transformation of healthcare in accord with the world-wide vision to improve the health of the world population. It plays a major global role in the application of information science and technology in the fields of healthcare and research in medical, health and bio informatics.

LATIN AMERICAN AND CARIBBEAN CENTER ON HEALTH SCIENCES INFORMATION (BIREME)

www.bireme.br

BIREME's mission is to contribute to the development of the health in the countries of the Latin America and the Caribbean by the promotion of the use of the scientific and technical health information.

PARTNERS IN HEALTH (PIH)

www.pih.org

Partners In Health is a non-profit corporation based in Boston, Massachusetts, and active in the Caribbean, Latin America, Africa, Russia, and the United States. Through service, training, advocacy, and research, and by establishing long-term relationships

Making the eHealth Connection: Partners

with sister organizations, PIH strives to bring the benefits of modern medical science to those most in need.

PUBLIC HEALTH INSTITUTE www.phi.org

The Public Health Institute (PHI) is an independent, non-profit organization dedicated to promoting health, well-being and quality of life for people throughout California, across the nation and around the world. As one of the largest and most comprehensive public health organizations in the nation, it is at the forefront of research and innovations to improve the efficacy of public health statewide, nationally and internationally.

REGENSTRIEF INSTITUTE www.regenstrief.org

The Regenstrief Institute is an internationally recognized informatics and healthcare research organization, dedicated to the improvement of health through research that enhances the quality and cost-effectiveness of healthcare.

TELEMEDICINE SOCIETY OF INDIA

www.tsi.org.in

The Telemedicine Society of India was created in 2006 with the objectives to promote and encourage development, advancement and research in the science of telemedicine and the application of telemedicine technology in clinical care, education and research in the health sector of India.

UNITED NATIONS FOUNDATION (UN FOUNDATION)

www.unfoundation.org

The UN Foundation acts to meet the most pressing health, humanitarian, socioeconomic, and environmental challenges of the 21st century through the support of the United Nations, new and innovative public-private partnerships, advocacy and grantmaking.

UNIVERSITY OF WASHINGTON'S CENTER FOR PUBLIC HEALTH INFORMATICS (CPHI) www.cphi.washington.edu

The mission of CPHI is to link practitioners, faculty, staff, and students from a wide variety of disciplines to enhance public health informatics research, training and practice. It is an interdisciplinary environment that supports innovative research into information strategies and technologies to improve the health of the public.

VODAFONE GROUP FOUNDATION

www.vodafone.com/start/foundation.html

The Vodafone Group Foundation makes social investments that help the people of the world to lead fuller lives by: sharing the benefits of developments in mobile communications technology as widely as possible, supporting the local communities in which Vodafone operates, helping to alleviate suffering in disaster areas, supporting sport and music projects to benefit young people and their communities, promoting the health and well-being of young people; and protecting the natural environment.

WORLD HEALTH ORGANIZATION (WHO) www.who.int/en

WHO is the directing and coordinating authority for health within the United Nations system. It is responsible for providing leadership on global health matters, shaping the health research agenda, setting norms and standards, articulating evidence-based policy options, providing technical support to countries and monitoring and assessing health trends.

Making the eHealth Connection: Participants

Patricia A. Abbot

Johns Hopkins University,
School of Nursing

Savas Alpay

Centre for Islamic Countries

Najeeb Mohamed Al-Shorbaji

WHO, Regional Office for
the Eastern Mediterranean

Barbara Aronson

WHO

Diana Arsenian**Chris Bailey**

WHO

Ayelet Baron

Cisco Systems Inc./NetHope

Peter Benjamin

Cell Life

Paul Biondich

Regenstrief Institute

Joaquin Blaya

Partners In Health

Meryl Bloomrosen

American Medical Informatics
Association

Gaetano Borriello

University of Washington and
Google/Seattle

Jorn Braa

Information Systems Program,
University of Oslo

Bill Braithwaite

Anakam Inc.

Karl Brown

Rockefeller Foundation

Julie Carandang

Rockefeller Foundation

Henry Chasia

Nepad eAfrica Commission

Molly Cheah

Primary Care Doctors'
Organization, Malaysia/Open
Source Health Care Alliance

Konstantin Chebotaev

Medical Center for Information
and Analysis of the Russian
Academy of Medical Sciences

Jie Chen

Fudan University School
of Public Health

Ngai Tseung Cheung

Hospital Authority

Chris Chute

Mayo Clinic

Michael Clarke

International Development
Research Centre

Jon James Conibear

Hearst Corporation

Thomas M. Cook

The University of Iowa, College
of Public Health, Occupational
and Environmental Health

Nicholas Cop

Nicholas Cop Consulting

Jillian Copeland

Boston Consulting Group

Kevin Crean

Microfranchise/Social
Entrepreneur/TomKat
Foundation

Patrice Cristofini

Orange/France Telcom

Walter Curioso

Universidad Peruana Cayetano
Heredia

Merceline Dahl-Regis

Commonwealth of
the Bahamas

Tao Dai

Institute of Medical
Information and Library,
Chinese Academy of Medical
Sciences & Peking Union
Medical College

Beatriz de Faria Leao

Zilics Information Systems

Patrice Degoulet

Paris Descartes University

Susan Dentzer

Health Affairs

Don Detmer

American Medical
Informatics Association

Brian Devore

Intel

Matt Diver

Boston Consulting Group

Robert Dolin

Semantically Yours

Peter Drury

Healthcare Practice,
Emerging Markets,
Cisco Internet Business
Solutions Group

Hammad Durrani

Aga Khan Foundation

Making the eHealth Connection: Participants

Chris Elias
PATH

Tim Elwell
Mysis

Andre Erthal
Nokia Technology Institute

Amado Espinosa
Aportia Inc.

Tim Evans
WHO

Alex Ezeh
African Population and Health
Research Center

Bokai Fofana
allAfrica.com

Hamish Fraser
Partners In Health

Sherrilynn Fuller
University of Washington,
Biomedical and Health
Informatics

Richard Gakuba
King Faisal Hospital, Rwanda

Hector Gallardo
Carso Health Institute

Krishnan Ganapathy
Apollo Telemedicine
Foundation

Patricia Garcia
National Inst. Of Health of Peru
and School of Public Health,
Universidad Peruana Cayetano
Heredia

David Garets
HIMSS Analytics

Nolwazi Gasa
Development Bank of
Southern Africa

Pape Gaye
Intrahealth International

Berhane Gebru
AED

Antoine Geissbuhler
Geneva University

Ticia Gerber
Manatt Health Solutions

Yvette Gerrans
PATH

Dennis Giokas
Canada Health Infoway

Roger Glass
National Institute of Health

Mzamose P. Gondwe
TropIKA Reviews

Phil Gormley
Boston Consulting Group

Robert Greenes
Arizona State University

Pat Guerra
Santa Clara University

Ravi Gupta
eIndia/Centre for Science,
Development and
Media Studies

Ana Estela Haddad
Ministry of Health, Brazil

Ed Hammond
Duke University

Lyn Hanmer
Health informatics R&D
Coordination Division and
South African Medical
Research Council

Verle Harrop
Atlantic Health Sciences
Corporation

Carleen Hawn
Found READ

William Hersh
Oregon Health and Science
University

Allen Hightower
CDC Kenya

Carola Hullin
University of New South Wales

Omer Imtiazuddin
Acumen Fund

Gautam Ivatury
CGAP

Charles Jaffe
HL7

Joseph Jasinski
IBM Research

Darius Jazayeri
Partners In Health/OpenMRS

Macollvie Jean-Francois
South Florida Sun-Sentinel

Pamela Johnson
Voxiva, Inc.

Claudia Juech
Rockefeller Foundation

President Paul Kagame
Rwanda

Making the eHealth Connection: Participants

James Kahn
University of California,
San Francisco

Clifford Kamara
Ministry of Health and
Sanitation, Freetown,
Sierra Leone

Andy Kanter
Millenium Villages Project,
Earth Institute at Columbia
University

Simon Kennedy
Boston Consulting Group

Aamir Khan
Interactive Research
and Development

Shariq Khoja
Aga Khan University

Ann Marie Kimball
University of Washington,
Epidemiology and Health
Services

Liza Kimbo
CDC

Michio Kimura
Hamamatsu University

Jean-Baptiste Koama
Voxiva, Inc.

Sergio König
IT & GS Consultores, Center for
Information, Technology, and
Management for Healthcare

Ramesh Krishnamurthy
CDC

Rebecca Kush
CDISC

Yun Sik Kwak
Kyungpook University

S. Yunkap Kwankam
WHO

Holly Ladd
AED-SATELLIFE Center
for Health Information and
Technology

Mark Landry
PEPFAR, Office of the U.S.
Global AIDS Coordinator
(OGAC)

Larry Leisure
iMetrikus

Les Lenert
National Center for Public
Health informatics, CDC

Neal Lesh
D-tree International;
Dimagi, Inc.

Bill Lober
University of Washington

Nancy Lorenzi
Vanderbilt University,
School of Medicine

David Lubinski
WHO

Hoat Ngoc Luu
Hanoi Medical University

Becky Lyon
National Library of Medicine

César Macias Chapula
National Institute of Public
Health, Mexico

Michael Madnick
Bill & Melinda Gates
Foundation

Rachel Maguire
IFTF

Michael Maltese
Massachusetts Institute of
Technology

Burke Mamlin
Regenstrief Institute

Melissa Mann
Latin-American and Caribbean
Center on Health Sciences
Information

Alvaro Margolis
International Medical
Informatics Association (IMIA)

Heimar Marin
Federal University of
Sao Paulo

Maurice Mars
Nelson R. Mandela School
of Medicine, South Africa

Bob Martin
Coordinating Office for
Global Health, CDC

Strive Masiyiwa
Econet Wireless International

Claire McCarthy
Kaiser Permanente

Clint McClellan
Qualcomm, Inc

Patricia Mechael
Earth Institute at Columbia
University

Making the eHealth Connection: Participants

Lauri Medeiros
University of California,
San Francisco

Michelle Meigs
Association of Public
Health Laboratories

Randy Miller
JAMIA

Katherine Miller
United Nations Foundation

Satyan Mishra
Drishtee

Moretlo Molefi
Telemed Africa

Barend Mons
University of Rotterdam,
Erasmus Medical Centre,
Department of Medical
Informatics

Jesse Moore
GSM Association

Fidelis Nde'eh Morfaw
WHO

Lincoln Moura
Zilics Health Information
Systems

Edward Mukooyo
Uganda Ministry of Health

Fadwa Murad
Informatics and Decisions
Support Directorate,
Ministry of Health

Maria Goretti Musoke
Makerere University

Henry Mwanyika
Ifakara Health Institute

Brian Nairn
Elsevier Health Sciences

Anand Narasimhan
Voxiva, Inc.

Vung Nguyen Dang
Health Policy Unit, Ministry
of Health of Vietnam

Boris Nikolic
Bill & Melinda Gates
Foundation

Ivo Njosa
World Bank

Patrick O'Carroll
USPHS

Esther Ogara
Ministry of Health, Kenya

Catherine Omaswa
Ministry of Health, Uganda

Egongdu Onyejekwe
Earthmap Foundation for
African HIV/AIDS; Lead
Visiting Professor, Futo,
Owerri, Nigeria

Aida Opuku-Mensah
UNECA

Zulma Ortiz
CONAPRIS/Academy
of Medicine

Paula Otero
Hospital Italiano de
Buenos Aires

Judy Ozbolt
Nursing Informatics,
University of Maryland

Ariel Pablos-Mendez
Rockefeller Foundation

Abel L. Packer
WHO, BIREME

Neil Pakenham-Walsh
Global Healthcare
Information Network

Naina Pandita
National Informatics Centre,
Department of Information
Technology

Brooke Partridge
Vital Wave Consulting

Surj Patel

Alberto Pellegrini
National Commission of
Social Health Determinants
on Health

Ian Pett
UNICEF

Gustav Praekelt
Praekelt Foundation

Ruben Puentes
Rockefeller Foundation

Octavian Purcareea
Microsoft

John Quinn
HL7

Miriam Rabkin
Columbia University Mailman
School of Public Health

Sumanth Raman
Tata Consulting Services

Jody Ranck
PHI

Eric Rasmussen
INSTEDD

Making the eHealth Connection: Participants

Richard James Richardson
Health Systems Group LTD

Giselle Ricur
Instituto Zaldívar, Argentina

Dave Ross
Public Health Informatics
Institute

Thais Russomano
PUCRS University, Brazil

Sundeep Sahay
University of Oslo, Norway

Shahida Saleem
SehatFirst

Reijo Salmela
WHO Regional Office for the
Western Pacific

David Sasaki
Global Voices on-Line

Rodrigo Saucedo
Carso Health Institute

Andrea Saveri
Institute for the Future

Sophia Schlette
Bertelsmann Stiftung

Tim Charles Schwarz
Linklaters LLP

Nina Schwenk
Mayo Clinic

Richard Scott
University of Calgary, Canada

Chris Seebregts
Medical Research Council

Tarun Seem
Ministry of Health and Family
Welfare, India

Joel Selanikio
DataDyne.org

Jeong-Wook Seo
Seoul National University,
College of Medicine

Dave Sessions
Microsoft

Stephen Settimi
USAID Bureau of Global Health

Mitul Shah
United Nations Foundation

Bern Shen
High Tech Consultant

Augusto Paulo José Silva
Ministry of Public Health,
Guinea-Bissau

Pratap Singhasivanon
Faculty of Tropical Medicine,
Mahidol University

Clive Smith

Mark Spohr
WHO

Sally Stansfield
WHO

Andy Stergachis
Center for Public Health
Informatics, UW

Jeff Stringer
The CIDRZ Foundation

Abu Bakar Bin Suleiman
International Medical
University, Malaysia

Dianne Sullivan
Vodafone Group Services Ltd

Adalberto Tardelli
WHO, BIREME

Mary Taylor
Bill & Melinda Gates
Foundation

Sheila Teasdale
American Medical Association

Claire Thwaites
United Nations Foundation

Jonathan Tien
Boston Consulting Group

William Tierney
Indiana University,
School of Medicine and
Regenstrief Institute

Simbini Tungamirai
University of Zimbabwe

Lo Veasnakiry
Cambodia Dir Planning

Neil Versel
Independent Journalist

Ndiba Wairioko
Meridian Medical Centre

Kier Wallis
Manatt Health Solutions

Norma Wilson
Routine Health Information
Network (RHINO)

Wendy Woods
Boston Consulting Group

Mohamed Youssouf
African Development Bank

Nihat Yurt
Ministry of Health, Turkey

From Silos to Systems: Contributors

We want to thank the following individuals for their contributions to “From Silos to Systems: An Overview of eHealth’s Transformative Power.”

Editor

Ticia Gerber, MHS/HP

Contributors

Patricia Abbott, PhD
Najeeb Al Shorbaji, MD
Christopher Bailey, MLS
Meryl Bloomrosen, MBA
Karl Brown, MIA
Rachel Christmas Derrick
Don Detmer, MD
Hamish Frasier, MD
Sherrilynne Fuller, PhD
Ticia Gerber, MHS/HP
Mzamose Gondwe, BSc
W. Ed Hammond, PhD
Holly Ladd, JD
David Lubinski, MBA
Claire Mack
Alvaro Margolis, MD, MS
Robert Martin, MPH, PhD
Barend Mons, PhD
Saroj Mishra, MD
Veronica Olazabal, MCRS
Ariel Pablos-Méndez, MD, MPH
Abel L. Packer, MLS
Naina Pandita, MSc, MPhil
Alberto Pellegrini, MD, PhD
Jody Ranck, MD, PhD
Richard Scott, PhD
Mitul Shah, MBA
Chetan Sharma, MSEE
Indra Pratap Singh, MSc
Sally Stansfield, MD
Andy Stergachis, PhD, RPh



420 Fifth Avenue

New York, NY 10018

212.869.8500

www.rockefellerfoundation.org/THS/eHealth