## Transform Health Services

The health sector requires extensive use of information and communication to make decisions and deliver services. The absence of timely and reliable information contributes to inefficient uses of human, facilities, and financial resources, and ultimately to poor health outcomes. Making health systems more efficient and responsive requires seamless, sustainable, and secure data and information exchanges at all levels of the health system.

The potential for e-Health (including telemedicine and m-health) for service delivery and sector management is huge—for remote diagnosis for patients in India's rural areas, surveillance and alerts for HIV patients in South Africa and the elderly in Chile, tracking drug supply and demand at rural health clinics in Kenya and Malawi, modernizing rural hospital management information systems and electronic records in Sri Lanka, and improving measurement, accountability and collaboration across the whole health sector.[1] In Peru, a mobile application uses SMS messages to deliver information on health and nutrition during pregnancy. In Kenya, e-learning has been used for training to upgrade nurses, who otherwise have no access to advanced training.[2] ICT is also used for timely monitoring of the spread of disease and analysis of causes and sources for preventing strategies, as in the spread of Malaria in Kenya. In Uganda, maternal mortality dropped by 50% when rural care was provided under the Ultimate Emergency Relief During Pregnancy and Childbirth, using a mix of technologies.[3]

Using ICT to transform the health system can optimize the use of scarce resources and help bridge the urban-rural divide in health care, for example, by leveraging specialist doctors and expensive MRI machines using remote analysis and diagnosis. While m-health applications may have focused on tele-monitoring of patients at home in developed countries, they should address problems of access to scarce resources such as doctors and medicine in developing countries. ICT connectivity opens new options for redesigning health delivery systems that would be less facilities-intensive than traditional ones.

There is growing consensus that any systematic effort to address the challenges facing the health systems all over the world requires intensive use of information and communication (enabled by ICT) to support new and smarter service and management models. Alongside these models, a vision for a *learning health system* is emerging, one in which "progress in science, informatics, and care culture align to generate new knowledge as an ongoing, natural by-product of the care experience, and seamlessly refine and deliver best practices for continuous improvement in health and healthcare" (Grossman et al, 2011).

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[1] World Bank, IC4D 2012: Maximizing Mobile, 2012
[2] Accenture, African Medical and Research Foundation: E-Learning, 2005
[3] Eldis, ICTs for Poverty Alleviation, 2005

*The promise of mobile.* The explosion of mobile phone usage has the potential to improve health service delivery on a massive scale, support increasingly inclusive health systems, and provide real-time health information and diagnosis in rural areas. Mobile health, combined with an ICT enabling ecosystem, can transform health services and deliver more effective health care with relatively limited resources.

The range of m-Health applications in developing countries is fast expanding to include: education and awareness, remote data collection, remote monitoring, communication and training of care workers, disease and epidemic outbreak tracking, and diagnostic and treatment support. Here are some examples of m-Health applications from developing countries.

Short message service (SMS) now offers cost-effective, efficient and scalable method of providing outreach services in awareness and education applications. Pilots in India, South Africa and Uganda have shown that interactive message campaigns have greater ability to influence behavior than traditional means, offering information about testing and treatment methods, available health services, and disease management in areas such as AIDS, TB, maternal and reproductive health. SMS messages offer recipients confidentiality in environments where diseases such as AIDS is often taboo. And they have proven effective in targeting remote and rural populations (World Bank, 2012).

Gathering data where patients live, and keeping information updated and accessible on a real-time basis can be more effectively and reliably done via smart phones or mobiles. Various initiatives in multiple developing countries are closing the information gap for patient data and in turn enabling public officials to gauge the effectiveness of healthcare programs, allocate resources more efficiently, and adjust programs and policies accordingly.  Similarly, the use of mobiles for remote monitoring of patients may become a crucial capability in countries with limited hospital facilities. In Thailand, for example, TB patients were given mobiles so that healthcare workers can remind them daily of their medication; medicine compliance rate increased to 90% as a result (World Bank, 2012).

m-Health is used in disease and epidemic outbreak tracking in Peru, Rwanda, and India. Deployment of mobiles, with their ability to quickly capture and transmit data on disease incidence can be decisive in prevention and containment of outbreaks, as in Cholera, TB and SARS.  Real-time tracking of incidents of Encephalitis in Andhra Pradesh helped government prioritize vaccinations, based on evidence of clusters of outbreaks.

Finally, the mobile phone is being equipped with specialized software applications for use for diagnostic and treatment support. The phone is used as a point-of-care device. The healthcare worker is led through a step-by-step diagnostic process. Once data are

entered (symptoms of patient captured on phone), remote medical professionals can diagnose and prescribe.

For middle-income countries, these applications will be also increasingly relevant for the prevention and early treatment of non-communicable diseases such as diabetes, and for health care needs of the aging population. Internet and mobile-based health applications can increase focus on prevention and support for healthy lifestyles (Vital Wave Consulting, 2009).

For advanced countries, the Internet and mobile are enabling a shift in locus of decision-making away from the state and health institutions to individual patients. The explosion of public access to health information on the Internet is changing the relationship patients and the organizations that care for them throughout their illness. It is empowering patients and facilitating preventive and cost-effective health care. With e-learning and specialized website, for example, people are able to adopt behaviors and lifestyles that keep them healthy and productive as well as improving their quality of life. Information management support for healthcare can bring immense value—from shorter hospital stays and waiting times for operations to radically lower costs for healthcare over a patient's life.

*Components of the e-Health System.*[4]   E-health covers the full range of potential uses of ICT, from health management systems to clinical decision support and patient information and tools, to support to all aspects of communication, measurement and accountability for results.  These can be summarized in terms of seven broad application areas:

First category is patient care management systems. These include electronic medical records (EMR), hospital information systems, telemedicine, and all other systems that aid clinicians in the diagnosis and treatment of health care for individuals, and which enables the sharing the clinical information across the continuum of care.

Second is the population management systems. These are concerned with the health of the population as a whole, including public health information systems, and consumer health information system—the latter helps patients manage their own health. They also include the emerging "Big Data" applications which allow us to detect patterns, to formulate hypotheses for clinical research, and fashion clinical guidelines and protocols.

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[4] This part draws on e-Health Technical Paper, June 2015. Paper submitted to MA4Health conference, on Measurement and Accountability for Results in Health, A Common Agenda for the Post-2015 Era.

Third is disease state management systems. These systems reflect the increasing need to manage chronic diseases, which are costly, and must be managed over long horizons and across levels of care and different venues.

Fourth is scarce resource management systems. These attempt to track, regulate, monitor, and optimize the supply chains of healthcare's scarce resources. This primarily involves healthcare workers, and managing their productivity, and continuing professional training and development. These systems also deal with optimizing the supply chain (logistics) for drugs—a major cost item and critical to availability and life saving.

Fifth is utilization management systems. These can measure the degree of productivity of each element of healthcare delivery, optimize the use of health services, and help deliver the right amount of services, at the right place and at the right time.

Sixth is financial management systems. These are critical to budgeting, accountability, and resource planning. They include enterprise resource planning systems, which must orchestrate resources with medical care needs. They also support sophisticated health financing schemes, health insurance, provider payments, claim processing, etc.
Seventh category is quality management systems. They measure quality of medical care overall, and the perceived quality by the patients. Increasing emphasis is on health outcomes. These must be drawn from accurate, timely and complete data flowing from the six systems categories described above.

Mobile phone feedback systems present a new opportunity to collect both clinical and population-based quality and timely feedback from end-users of these systems. They are increasingly used even in poor settings to learn about user satisfaction, and enable social monitoring of health programs.

Each of the above application areas plays important roles in measuring and accounting for health results. E-Health strategies must address them all so as to take a holistic view of the sector, its governance and performance, and of the interdependencies and information sharing across these systems.

*Challenges to e-Health.* The most relevant challenges to the greater uptake of e-Health include[5]:

- Common perception of e-Health as peripheral to health services delivery and management, or a "silver bullet" which requires a single large-scale investment rather than a planned, sequenced, integrated and continuous approach.

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[5] Draws, in part, from World Bank, 2012

- Fragmented, uncoordinated, short-term funding that is too often focused on standalone pilots and single application.
- Inadequate integration of e-Health financing (payment systems) with rest of healthcare infrastructure.
- Business models not adapted to match the scarcity of resources both on the demand and supply side in the developing world.
- Privacy and security concerns, with limitations on access to patient data that can complicate interaction with the rest of the ecosystem, or weak legal frameworks and practices that undermine trust and privacy.
- Governance to ensure that multiple stakeholders are contributing to e-Health development. E-Health governance covers the processes and standards that enable effective, secure, and timely collection, creation, storage, exchange, and ethical use and protection of health information. It also includes agreed upon shared enterprise architecture and standards to ensure interoperability.
- Collaboration among stakeholders, including private, public, and development agencies for e-Health. In particular, collaboration between the health and ICT sectors, both public and private, is central to e-Health strategic planning.
- Piecemeal implementation of e-Health products and services, which leads to poor interoperability between applications that run on different platforms.
- Limited understanding of the policy environment and technical ecosystem that will be necessary to foster and sustain scaled e-Health solutions at the national level.
- Shortages in human resources for e-Health, particularly in the public sector.
- The impact of e-Health services not regularly assessed.

These challenges must be added to the governance and policy challenges in the health sector more broadly. Reforms in governance, policies, incentives and human resources within the health sector must be aligned with those specific to e-Health.

*National e-Health Strategies.* e-Health strategies should build on learning from pilots and experiments that target pressing problems and prevalent diseases in developing countries while demonstrating feasibility and measureable results. They should simultaneously aim for scalability and sustainability, and for strengthening health systems across programs. Such system-wide transformation requires major changes in institutions and individual behavior. It requires understanding and monitoring the behavior of patients and service providers, to devise appropriate incentives for change, and to learn from implementation. It requires frameworks, protocols, and standards to scale up successful pilots and integrate bottom-up initiatives. It also calls for partnerships between public agencies, private sector and civil society. Above all, it demands transformational leadership and change management.

E-Health strategies should consider the complex ecosystem of health, which they intend to transform and sustain. This means taking into account the incentives and human

factors that influence timely and accurate data collection, the culture of data sharing, and the utilization of data in health decision-making. E-Health systems are expected to be interoperable to allow broad integration across multiple and synergistic health information systems. All e-Health applications need to be integrated into the overall healthcare system and strategy.

An example of e-Health strategy of a developing country comes from South Africa (Box XX : e-Health Strategy South Africa, 2012).

**Box XX: e-Health Strategy South Africa, 2012**

South Africa's e-Health Strategy of 2012 covers a vast domain, including:

- Electronic Health Records (enabling sharing of patient data),
- Routine health management information (e.g. web-based surveillance systems, electronic disease registers, electronic district health information systems),
- Vital Registration (the use of computerized systems for registration of death or births),
- Consumer Health Informatics (access to information on health by healthy individuals or patients),
- Health Knowledge Management (e.g. best practice guidelines managed and accessed electronically),
- M-health (e.g. use of mobile devices such as cell-phones to share information or to collect aggregate or patient data),
- Telemedicine (e.g. use of ICTs to provide care at a distance),
- Virtual Healthcare (e.g. teams of professionals working together via ICTs), and
- Health Research (e.g. use of high performance computing to handle large volumes of data).

The m/e-health strategy addresses ten strategic priorities in order to leverage ICT to accelerate healthcare transformation:

1. National e-Health Care Strategy and Leadership
2. Stakeholder Engagement
3. Standards and Interoperability, and the Development of National Health MIS.
4. Governance, Institutions, Policies, and Regulation
5. Investment, Affordability and Sustainability
6. Benefits Realization
7. Capacity and Workforce
8. m/e-health Foundations
9. Applications and Tools to support Healthcare Delivery
10. Monitoring and Evaluation of the m/e-health Strategy

The stakeholder engagement perspective notes the importance of provincial (state-level) health information systems committees in promoting e-health co-operation with district health structures and local communities. More importantly, it proposes the establishment of professional registration for e-health practitioners, requiring a curriculum for e-health and registration with a professional body.

The governance and regulation perspective focuses on the role of government IT officers in implementing the e-health strategy, but does not explicitly require collaboration between IT practitioners and health practitioners. In all health and other services environments, cross-disciplinary collaboration should be considered the foundation of successful transformative ventures.

The investment, affordability and sustainability angle raises the necessity of long-term planning and budgeting (a 10-year budget is proposed), in contrast to the historical medium-term budgeting (3-year budgeting with the second and third years as indicative budgets). Long-term budgeting can be seen as an important measure for introducing programs that will mature over five years or more.

Capacity and workforce development assigns priority to health informatics professionals as a new practitioner group in the healthcare environment; it calls for collaborative partnerships for training such professionals.
*End of Box*

Recent policies of other emerging market countries like India have emphasized knowledge management and knowledge networks to support medical research and practice; advanced communication infrastructure; the use of open technologies and standards; drug surveillance; the networking among medical colleges, research institutions, and premier health service providers; partnerships with international organizations; development of Electronic Health Records (EHRs); integrating medical informatics into medical and paramedical curriculum; and developing analytics for healthcare financing, trends predicting, and performance monitoring.

A study of three advanced countries (Denmark, Finland, and Sweden) was conducted for lessons to learn in anticipation for US adoption of an ambitious e-Health strategy (ITIF, 2009). According to the study, Nordic countries have nearly universal usage of EHRs among primary care providers, high rates of adoption of EHRs in hospitals, widespread use of health applications, including the ability to order tests and prescribe medicine electronically, and advanced tele-health programs and portals that provide online access to health information. All three countries have embraced ICT as the foundation for transforming their health care systems, and have implemented changes that reach every patient.

*The case for an ecosystem view of ICT in health sector.* These challenges point to the need to take an ecosystem view of integrating mobile (and other ICT tools) into the health sector (Figure 10). For example, m-Health may be positioned at the nexus of health, technology, and financial services, with government influencing all three of these spheres.

**Figure 10: m-Health ecosystem**
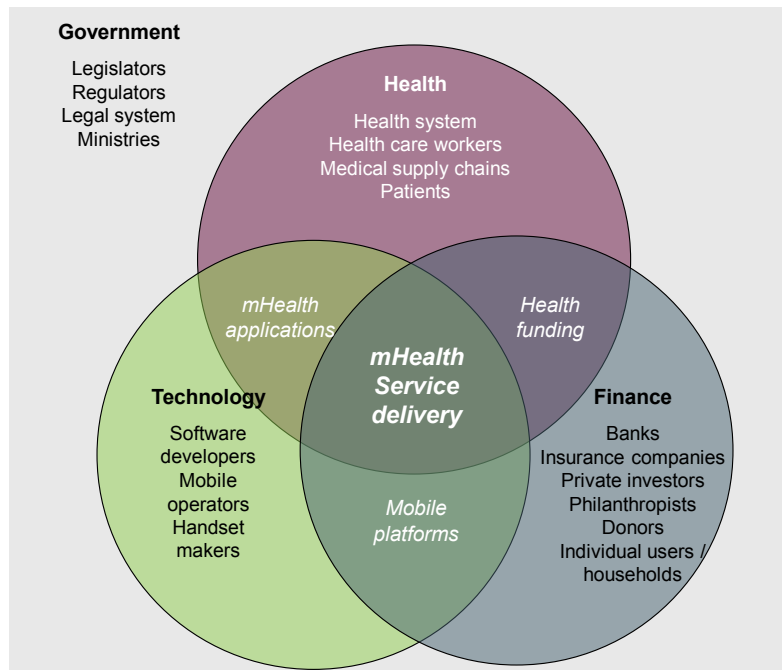
Source: World Bank, 2012

Increasingly, e-Health stakeholders are realizing the need to arrive at a more holistic understanding of the ecosystem not only to base implementation on best practices but also to factor in local circumstances. The large number of different stakeholder groups requires that their different roles and responsibilities be clarified. Because ICT in health always exists within and interacts with a country's larger health care system, it will be affected by public policy, private sector influence, diverse patient needs, and the interests of several other participants.

Taking an ecosystem view of the sector or context where e-Health is applied should help planners avoid a one-size-fits-all approach. Accordingly, e-Health applications should be designed to respond to people's needs and suited to their local context. A common pitfall is that, once an application is working well technically and is seen to have high potential, there is an immediate tendency to implement it everywhere regardless of context. Conducting readiness assessments with users can help avoid such overextension. Close involvement of health practitioners in the design and development of ICT applications and mobile content can ensure fitting the tool to the context.

A counter pitfall is reinventing the wheel. Pilots are spreading all over the world to leverage ICT and mobile platforms for improving health systems. But many of these pilots take on the task of developing software and solutions that may have been tried within the country and in other countries under similar conditions. The task of adaptation and scaling up promising e-Health applications to realize maximum impact and sustainability are often neglected.

Pilots have so far pursued specific health problems or targets of opportunities. But e-Health programs should be viewed and aligned within the broader contexts of national healthcare and e-government programs. Sustainability and scalability of m/eHealth programs ultimately depend on common building blocks. The targets of opportunity will vary among developed and developing countries, but an ecosystems view remains essential for sustainable progress and scalable impact.

*Emerging lessons.* Country experiences suggest the following critical success factors to drive e-Health adoption:

- *National leadership to promote e-Health adoption.* Global leaders pursue national-level strategies to drive and coordinate e-Health adoption.
- *Health care system organization and financing.* Costs and benefits of investing in IT systems for healthcare are better aligned in countries with single-payer health care systems. They can also afford to take a longer-term view and make investments that may not pay off in the short term (this presents a challenge for larger countries with diverse populations and decentralized supply structure)
- *Financial incentives* should be used to overcome the high initial cost of HER systems.
- *Common health IT infrastructure.* Creating a shared platform for health care organizations to use can lower costs, increase information sharing and interoperability, and accelerate implementation. Sweden has developed a national broadband network for the secure exchange of health information connecting all hospitals, primary care centers, among others; it also used this infrastructure for video conferencing, tele-radiology, and e-learning in medical schools.
- *Use of unique patient identifiers.* UID help facilitate data sharing between healthcare organizations. Benefits include reduced risk of medical error, improved efficiency, and better privacy protection for patients.
- *Government policies* and mandates are essential to spur e-Health, such as making e-prescribing mandatory for primary care providers, addressing privacy issues, facilitating standard setting processes.

National government policies can play an important role in shaping and facilitating a country's adoption of e-Health and its effective use to transform the whole system. Investing in e-Health must be guided by such national policies to lead to scalable and sustainable change.

*A Vision of Future Health System: personalized, information-driven, learning system.* The journey towards a future health learning system will be fueled by the transformative power of digitization and connectivity. For OECD countries, the emerging vision is of a learning health system, based on real-time and personalized information. Realizing this vision will require enhanced capacity to share, process, and analyze large streams of

data from heterogeneous sources and a major change from traditional practices. A transformed health care system will need to be proactive, preventive, and focused on quality of life. The new system would shift from hospital/doctor-centered to community/patient-centered. Data would be generated and aggregated from digital clinical and administrative records, advances in genomics, new diagnostics and medical imaging, sensor and mobile technologies, and geospatial location tools. These data must be captured, harmonized and converted into meaningful information at all levels, and particularly at the point of care. This should generate system-wide efficiencies, including for health care diagnostics, delivery, research, and innovation.

With the fast declining cost of having a personal human genome map, it is possible to envision a future in which treatments are tailored to individuals' genetic structures, prescriptions are analyzed in advance for likely effectiveness, and researchers study clinical data in real time to learn what works. With this personalized medicine, treatments are better targeted, therapies not likely to be effective for particular people are avoided, and researchers and health administrators have a better understanding of comparative effectiveness.

Progress towards this vision will require better understanding of the health ecosystem and barriers to change—political, institutional, policies, incentives, skills, and technological capabilities. This understanding of the ecosystem and enabling conditions should help inform a research agenda and policy action to ensure that the emerging smart health care models are accepted and timely used with maximum benefits for all stakeholders. It should address the challenges of personalized medicine, the new privacy and security risks, incentives for radical and social innovation, and incentives to various actors with different organizational cultures and roles. It is also necessary to understand the regulatory structures that provide incentives at different levels of the health ecosystem to encourage investments in new models of healthcare.

Progress also requires moving from silos of technology towards an integrated ecosystem of smart solutions. New smart models of care are increasingly being shaped by convergent technologies.   Barriers to such convergence should be addressed to secure integration and interoperability. There will be also a huge need for training health providers and community health workers in the use of the new technology platforms, and for improving patient understanding and use of these new tools.

Health system transformation demands research. Research should address challenges to data integrity and develop robust procedures for aggregation and analysis. New risks should be anticipated, including unintended outcomes. Attention should be given to quality assurance, monitoring of use, identification of potential adverse outcomes or intentional abuses, timely analysis of incidents, and creation of appropriate regulation.

For developing countries, this vision remains relevant but requires local experimentation and adaptation in search of frugal and inclusive innovations. This may mean, among others, more emphasis on telemedicine, access to medical information and diagnosis via kiosks and clinics in schools and markets, and making hospitals more of a network, less of a big box with all specialists co-located. Mobile technology confers eyes, ears, voice, reach and knowledge. It will educate patients about aliments and symptoms via websites, and mothers about nutrition and baby care. Small test centers can spread across areas currently devoid of modern medicine. Developing countries will have to build the system from the ground up, with local adaptation and experimentation to overcome last mile problem of health service delivery, and empower local health providers with information and patients with choice. Such a health system will also need to give attention to mapping and monitoring the devastating and endemic diseases like Malaria and Tuberculosis. It should capture a lot more real time information from the field to spin the learning cycle faster.