2013

Implementation lessons on the use of innovation in information technology in the developing world

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ABSTRACT: Information Technology (IT) innovation and its impact on health care is of particular relevance to the developing world, which spends a fraction of what health systems spend in OECD countries. Given the issues of accessibility, affordability and quality health services in the developing world, IT can play an important role by bringing marginalized communities closer to health care systems. Aga Khan University (AKU) and the eHealth Resource Center (eHRC), which are part of Aga Khan Development Network (AKDN), are active in the developing regions of East Africa, Central Asia and South East Asia and are currently initiating new changes in the use of IT and also the manner in which it is deployed. The eHealth programmes implemented and the lessons learned by AKU and eHRC in achieving its core values of impact, access, relevance, and quality through implementation of these innovations are described. These can be of value to health systems and academic medical centres in the developing world wanting to leverage scarce resources to create meaningful impact using IT.

AKU is an international university chartered as an autonomous private university and has teaching sites in eight countries including East Africa, Pakistan and Afghanistan. It has a clinical enterprise that operates on a private not-for-profit basis that provides university hospitals, general hospitals, outpatient and community-based health care services as part of a university system that has a tripartite mission of clinical delivery, education and research. eHRC is a grant-funded entity charged with supporting the development of innovative technological solutions to support health care delivery in the developing world. AKU and eHRC, in order to achieve their goal of eliminating disparities in access to health care, determined that two key strategies needed to be implemented. The first was to secure funding for the required infrastructure and the second was to develop affiliations with partners to reach out into communities. For funding support AKU (over many decades) and eHRC teams (more recently) worked with international donor agencies to build trust and establish competency. This attracted critical funding from various donor organizations such as the Canadian International Development Agency, the Aga Khan Foundation, KfW, USAID and the French Ministry of Foreign Affairs to strengthen the infrastructure at programme sites. A key lesson for us is that donors must see clear impact and relevance as these partnerships take a significant amount of time to establish. For building outreach into communities, we established affiliations with the Aga Khan Health Services (AKHS) hospitals and its primary medical centres, which are part of AKDN.

Defining the goals

We understood that a clear definition of goals was imperative. Since the use of technology would change, we also determined that we needed to be adaptable and use an iterative process of incorporating change into the use of IT in our health systems. Our key goals fit well to a current thesis (Piette et al 2012) and which we adopted as an operating framework of goals we would pursue – namely that the use of information communication technology (ICT) for health has the potential to increase accessibility; reduce cost for patients; improve patient care; support health education and clinical decision-making; promote behavioural change and improve health surveillance and disease management systems. Given the potential benefits of eHealth solutions, AKU has an overarching goal of adopting technology to provide access to low-cost and efficient health care services for the marginalized communities of the developing world.

Building a framework

We found it important to develop a framework to build on and adopted the World Health Organization's framework of eHealth as "the transfer of health resources and health care by electronic means" (E-Health 2013). Our key operating premise is that eHealth can be utilized to deliver health services (telehealth), to build human capacity and capability (eLearning) and to transfer relevant health information to support decision-making (health informatics) via ICT and mobile phones (mHealth). It became clear after initial implementation steps that a rigorous process was key. Therefore AKDN eHRC followed the Software Development Lifecycle (SDLC) with slight variations to develop all eHealth solutions as illustrated in Figure 1.

Building a successful approach

AKU and eHRC teams initiated multiple eHealth programmes in various communities within Pakistan, Afghanistan, Tajikistan and

Tanzania. The goal was to use technological innovations to deliver telemedicine, mHealth and eLearning services to improve access, efficiency and the quality of health care services to these under-served populations. A key implementation strategy that became clear is that to make health care more accessible and affordable for the population, we had to use simple, cost-effective and culturally appropriate technology. A particular case demonstrates the impact of this approach.

Sidra was born with a congenital brain malformation. When she was only a month old, her family consulted a local pediatrician in Faizabad, Afghanistan, who advised them to take her to Faizabad Provincial Hospital (FPH) where she was admitted as a critical case. While at the hospital, a live teleconsultation with a consultant general surgeon at the French Medical Institute for Children (FMIC) in Kabul diagnosed Sidra's condition as a complicated case of occipital meningoencephalocele, a protrusion of the brain through a birth defect in the skull bones. FMIC is a four-party joint venture, with AKU as the management partner. Realizing the severity of Sidra's condition from the teleconsultation, she was referred for surgery to FMIC where a team of surgeons operated successfully, excising the occipital mass and a shunt was inserted to relieve pressure from her brain caused by fluid accumulation. The teleconsultation, according to the consulting physician, enabled doctors to detect Sidra's condition in time as there was only a very slim chance of her survival.
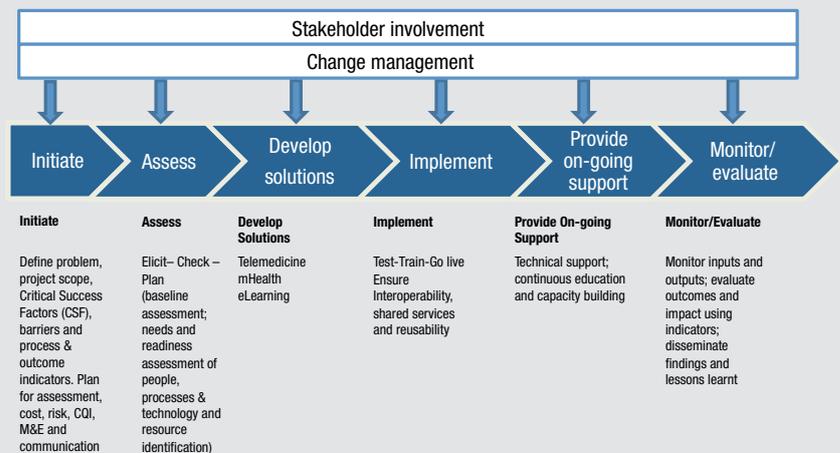
Teleconsultations

In Central Asia, from 2007 to March 2013, AKU and eHRC teams have supported in excess of 10,000 teleconsultations from Bamyan Provincial Hospital (BPH, Afghanistan), Faizabad Provincial Hospital (FPH, Afghanistan), the French Medical Institute for Children (FMIC, Kabul), Khorog Oblast General Hospital (KOGH, Tajikistan), and the Aga Khan University Hospital Karachi (AKUH,K). These consultations were conducted in the fields of radiology, pathology, cardiology, pediatrics, internal medicine, obstetrics and gynecology, ENT, orthopedics, surgery, pain management, dental and dermatology. Recently, the teams have also connected two sites in Tanzania (Dodoma and Mwanza) with the Aga Khan Hospital Dar-es-Salaam, which has resulted in 22 teleconsultations in the last three months in the field of maternal and child health.

These teleconsultation services enabled the isolated communities in the regions to access quality health care services at a minimal cost and without having to travel long distances. This relatively new programme has the goal of assessing the use of innovations in health care service delivery through technology to improve access and quality of care while reducing disparities and cost. It has not been evaluated to determine its impact and outcome. This pilot project is an important one and is being watched by many professionals to determine if this approach works and can be expanded in scope.

mHealth

In Khyber Pakhtunkhwa (KPK, Pakistan), AKU and eHRC teams have piloted a safe motherhood programme and referral management system that uses mobile technology to streamline an antenatal referral system and to send behaviour change health messages to registered pregnant women. The programme also integrated mobile technology with telemedicine, via MDconsult software, to increase the accessibility of health care services. This initiative increased access to antenatal, natal, post-natal and newborn health services, and promoted preventive health and health seeking behaviour in the target population. Women getting four or more antenatal visits increased from 44% to 66% and women delivering at a health care facility increased from 35% to 55%.
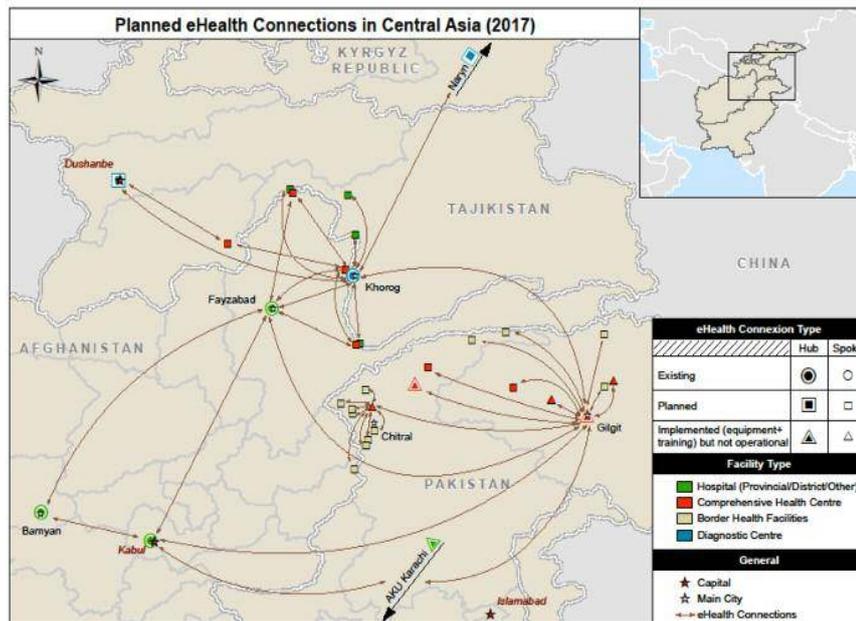
eLearning

Along with the telehealth and mHealth projects to enable access to health care, AKU and eHRC have supported 117 eLearning sessions, from 2008 to March 2013, to provide continuous education and training to 2,500 staff members of BPH, FPH, FMIC and KOGH. These eLearning sessions have decreased the professional isolation of staff working in these remote areas and have also built their capacity in using technology and providing effective access to health care for these communities. Our experience shows that eLearning is an effective tool to train and educate the health care workforce, particularly to extend the geographical reach of content experts in particular subject areas.

Challenges in eHealth

In almost every region, the biggest challenge we face is the lack of skilled human resources with eHealth capability and a robust public

FIGURE 1: AKDN-eHRC PRODUCT DEVELOPMENT FRAMEWORK

Stakeholder involvement

Change management

Initiate → Assess → Develop solutions → Implement → Provide on-going support → Monitor/evaluate

Initiate
Define problem, project scope, Critical Success Factors (CSF), barriers and process & outcome indicators. Plan for assessment, cost, risk, CQI, M&E and communication

Assess
Elicit– Check – Plan (baseline assessment; needs and readiness assessment of people, processes & technology and resource identification)

Develop Solutions
Telemedicine
mHealth
eLearning

Implement
Test-Train-Go live
Ensure Interoperability, shared services and reusability

Provide On-going Support
Technical support; continuous education and capacity building

Monitor/Evaluate
Monitor inputs and outputs; evaluate outcomes and impact using indicators; disseminate findings and lessons learnt

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> In the near future, AKU and eHRC will be focusing on expanding eHealth services in East Africa using the knowledge they have gained

ICT infrastructure. There is a high staff turnover rate due to skills that are in high demand. AKU and eHRC teams provide training and ongoing technical support to build the capacity of staff members using the technology. The teams have learned strategies to provide hybrid solutions to adapt to specific challenges including connectivity and electricity shortages. These solutions that may be taken for granted in developed economies form a key innovation in the implementation of simple and effective solutions in regions that are remote and where supply chain logistics are cumbersome and complex.

Future direction of eHealth in our network
In the near future, AKU and eHRC will be focusing on expanding eHealth services in East Africa using the knowledge they have gained. We have learnt that by working in low-middle income countries (LMICs) that we must first address the cultural barriers to get service acceptance in the community we serve. Creating eHealth awareness in the physician community is also very critical to the programme's success. In these countries we also have learned to adapt to low bandwidth eHealth solutions as in some countries there is bare minimum public ICT infrastructure. eHealth expansion in Central Asia is planned over next four years (as illustrated in Figure 2) based on key clusters of health care. A cluster in our strategy is a major health care facility that supports remote clinic, hospital and outreach facilities in our network.

> Part of our strategy is the development of population-based health care and the implementation of an EHR (Electronic Health Record) across all our hospitals and outreach clinics

Cluster to cluster interaction is also being promoted where facilities within a cluster interact to provide telehealth support after they have the necessary capability of specialist care and an infrastructure.

A key issue we are grappling with is development of a mechanism to make telehealth self-sustainable in the developing countries we work in. In this regard, AKU and eHRC teams will be initiating dialogue and collaborating with the government sector to promote the understanding and appreciation of technology, to increase eHealth readiness and adoption and to integrate eHealth with regular service delivery. The goal is to develop mechanisms to generate revenue streams for eHealth programmes and make them self-sustainable. The teams will also be focusing on developing eHealth technologies and bringing innovation to the field.

Future direction of hospital-based eHealth
AKU has a two-pronged strategy for innovation in the use of hospital-based IT to support access to health care in remote communities. The first is the development of university hospitals that provide services of the highest international standards and which form anchor institutions for an integrated delivery system. Both Aga Khan University Hospital Nairobi (AKUH,N) and Aga Khan University Hospital Karachi (AKUH,K) have received Joint Commission International accreditation. These hospitals demonstrate that international standards can then form the anchor for a platform around which delivery of eHealth and technology support can be provided to other network facilities.

The second strategy is to develop meaningful and relevant technology solutions that show demonstrable value in improving health standards and care for the populations they serve, and that only university hospitals can provide. Therefore we are working on constructing an eHealth innovation centre in AKUH,K which will include Da Vinci minimally invasive surgery robots; medical imaging and video processing laboratories; and a simulation laboratory where doctors and biomedical engineers can work together to bring innovations to the medical field.

Part of our strategy is the development of population-based health care and the implementation of an EHR (Electronic Health Record) across all our hospitals and outreach clinics. In time we have the goal of integrating remote locations into a delivery system platform of an EHR and eHealth to significantly impact assess to health care. Our most significant challenge is the cost of the implementation of such systems, which do improve safety, quality

and outcomes for beneficiaries. However, the cost of such systems is not currently recovered as part of the reimbursement systems in the markets we serve. We therefore have to work on mechanisms for funding these systems so that we keep our services affordable, accessible and also of high quality.

Conclusion

The development and implementation of IT innovations and eHealth by health systems in the developing world can have significant impact on access and the quality of health care. These innovations that use scarce resources to create meaningful impacts need effective partnerships among the different stakeholders, and also relevant infrastructure and capabilities in the remote regions that need access to health care. The leverage of these eHealth capabilities can be enhanced if they are tied to a hub institution that is either an academic medical centre, a general hospital or a tertiary facility.

Challenges remain in funding the wide-spread use of electronic health records which can have an impact on safety and quality and finding funding mechanisms for recovery of their costs. ❏

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