Innovative e-Health Solutions in Africa Award
Investing in smart human capital innovations: Spreading inclusive growth capacities in Africa
Spurred by technological innovations, a rapid information and communication revolution is taking place in Africa, especially in mobile technology, cloud computing, biotechnology and e-governance. From 2008 to 2010 most African countries doubled or tripled their international bandwidth capacity and some have witnessed a 10-fold increase. Today, one in every two Africans owns a mobile phone.

Investments in skills and technology are at the center of the Bank’s development agenda and stand for one of the five operational priorities of the Bank’s 2013–2022 Strategy. New technologies have a transformative power on governance and service delivery. The technological revolution in Africa can be harnessed to improve service delivery and accelerate inclusive growth and job creation.

The e-Health Award is part of the Bank’s Human Capital Strategy, which includes investments in technology for competitiveness and jobs as well as for better governance and service delivery. Africa’s impressive information revolution is enabling information and communications technology (ICT) innovations to deliver more services for the money—and to deliver them to populations that previously had little or no access.

The Bank’s leadership is needed to promote authentic African solutions. In the changing Africa a new agenda for health has emerged with a focus on promoting governance and value for money in health, developing and modernizing health systems (building on improved connectivity), mainstreaming gender, building human and material resources, and catalyzing private sector growth and job creation.

The e-Health innovations that are presented in this report pave the way for future intervention of the Bank in the health sector. They illustrate how technology can remove geographical and financial barriers to health services and succeed in providing better quality, timely and cheaper services to the populations, thus improving health status and productivity. In particular, the innovations show that e- and m-Health can improve access to health information by providing systematically reliable and accurate data at all levels to allow decision making. These innovations can also empower the health workforce and reduce the human resources for health shortage in Africa by providing training to health staff, thus increasing the number of trained personnel and improving the quality of training of existing staff, at a limited cost. They can also be used to convey health education to the public for improved public health. And finally, they can contribute to more accessible and better health services, as they can remove existing bottlenecks in the delivery of health services.

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Promising approaches to tackling the many challenges facing Africa’s health systems are e-Health, which applies ICT in the health sector, and the closely related m-Health, which includes medical and public health practices supported by mobile devices. But these twin approaches remain at a small scale in Africa, due to a lack of evidence-based knowledge on effectiveness, sustainability and best practices.

In 2012 the African Development Bank launched a competition for innovative and sustainable ICT initiatives for Africa’s health sectors. The objective was to identify the best authentically African ICT solutions for health and to help fill the knowledge gap in e- and m-Health through new pilots and programs. The competition was open to individuals, nongovernmental organizations and development partners based in Africa and engaged in designing or implementing e- and m-Health programs there; mobile phone and other companies that are based in Africa or that have local partners and are involved in the design or implementation of e- and m-Health programs in Africa; and African universities and research institutes.

Some 115 expressions of interest were received, and 39 projects were shortlisted. And they were submitted by a range of different participants (see figure). Of the projects, 48% were m-Health and 52% were e-Health. The projects spanned the various subregions, with 33% of projects submitted implemented in East Africa, 28% in West Africa, 11% in Southern Africa (11%) and 3% in North Africa; 25% of projects were implemented in more than one subregion.

The proposals were reviewed by a panel of international experts, which selected 10 projects for innovation, scalability and effectiveness in improving health service delivery. The projects address four health sector priorities: access to information, empowerment of the workforce, education and service delivery. This report summarizes the projects and focuses on the health challenges addressed, proposed e-Health solution, innovative aspects and lessons learned.

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Sub-Saharan Africa’s high burden of disease is a major economic and social development challenge. With just 12% of the world’s population, Sub-Saharan Africa accounts for 49% of maternal deaths, 50% of deaths of children under age 5 and 67% of HIV/AIDS cases. While there has been overall progress in the past two decades, under the impetus of the Millennium Development Goals, a closer look reveals a pattern of recurring gains and stagnation. Sub-Saharan Africa has generally lagged behind other regions. The immense challenges call for renewed efforts to sustain the gains and to scale up successful strategies to attain the goals still to be reached.

The Africa Health Strategy 2007–2015, prepared by the African Union Commission, identifies root causes for the high burden of disease in African countries: Health systems are too weak and services too under-resourced to support targeted reduction in disease burden and achieve universal access. Health interventions often do not match the scale of the problem. People are not sufficiently empowered to improve their health or adequately involved, while cultural factors play a role in health-seeking behavior. The benefits of health services do not equitably reach those with the greatest disease burden. There is widespread poverty, marginalization and displacement on the continent. Insufficient action on the intersectoral factors affects health. And environmental factors and degradation are not sufficiently addressed.

Technology can offer an interesting solution to resource limited countries in Africa. ICT can provide the opportunity for more transparency and accountability in service delivery as well as evidence-based practice and error reduction, diagnostic accuracy, and treatment. It can facilitate client empowerment, enabling better self-care and health decision-making. It can also be used to shift tasks down the skills ladder, thus helping address skills shortages. Finally, it can raise cost-efficiency by streamlining processes, reducing waiting times and improving accuracy of data.

Innovations presented in this report and challenges facing African health systems argue for the use of ICT in the health sector and the need for:

- **Strengthening the e-Health regulatory environment.** Increased use of e-Health services requires a regulatory environment covering legal and ethical issues that ensures data privacy, security and confidentiality. Some countries, such as Niger and Burkina Faso, have already undertaken initiatives to create digital laws.

- **Gathering intelligence about e-Health.** It is imperative to build the evidence base for e-Health by identifying what works, where and why, and sharing information on experiences and best practices. This will help improve the evidence base in countries in order to better guide policy and practice through collecting relevant indicators, analyzing key trends and reporting on best practices for integration of e-Health into national health systems.

- **Formulating and promoting norms and standards.** Countries that adopt and promote the use of e-Health standards are more likely to achieve e-Health success through interoperable, and even better, integrated systems. In this vein, development of an e-Government Interoperability Framework (Ghana) and promotion of Enterprise Architectures (Rwanda) are good practices worthy of emulation.

- **Developing public–private partnerships in e-Health.** Promoting partnership with key stakeholder groups—academia, government, industry and civil society—can stimulate research and development in information technology for public health and encourage sharing of resources.
• Using ICT in support of human resources for health. In all African countries there is a need for continuing professional development and measures to prevent brain drain. ICT can significantly improve the way health care professionals are trained through targeted e-Learning programs, and can improve the efficiency of health services, especially in areas with a small health workforce.

• Using ICT for health education and promotion. The spread of ICT, including the Internet and mobile telephones, provides an opportunity to reach the public at home, school and the workplace. These technologies can be used to provide health education and promotion, monitor chronic conditions and deliver information on demand.

• Promoting e-Health for health care services. E-Health can contribute to improving quality of, safety of, and access to health care.

The Bank is committed to assist its regional member countries (RMCs) in building on the ICT revolution to increase the supply of skilled workers and to improve service delivery and access to care. In particular, the Bank will:

• Promote the use of ICT in all its current and new health operations to improve access to information, strengthen health workforce and improve health education and service delivery.

• Promote a new model of ICT-based hospitals to improve management as well as service delivery.

• Support its RMCs in developing and implementing e-Health policies, strengthening regulatory mechanisms and focusing on returns on investments.

• Support capacity-building programs in RMCs for increased use of new technologies in service delivery, message transmission in local languages, and communication and awareness campaigns for service users.

• Encourage knowledge production on e-Health to the benefit of its RMCs. The e-Health Award Competition for Africa is a good example of the knowledge broker role of the Bank.

• Promote public–private partnerships between African governments and private sector ICT providers to pilot and scale up innovations in Africa as a way to ensure sustainability and ownership of e- and m-health services by government.
Accessing health information
1. Ghana
District Health Information Management System 2 (DHIMS2)

Health challenge addressed
Ghana Health Service (GHS) is Ghana’s largest autonomous national executive body. Responsible for implementing all national health policies, it operates a decentralized system of preventive/promotive, curative, and rehabilitative and occupational therapy services through delivery points across the country at national, regional, district, subdistrict and community levels.

Active in all 170 districts, GHS is authorized by the Ministry of Health to collect, collate and report on all routine health services provided through mission, private and quasi-government health facilities across the country. Although upstream activities are well-defined, obtaining routine service data from all the country’s health facilities has been an enormous challenge.

GHS relies on routine service data collected and passed on from district facilities to the regional and then to the national level. Reporting has been neither timely nor complete, and tracking both reporting and nonreporting facilities has been difficult. This has created an enormous challenge for monitoring and evaluation and has resulted in a slow response by GHS to potential health emergencies and epidemics. One goal of GHS is to build and strengthen health service capabilities below the district level through improved ICT.

Proposed e-Health solution
After many unsuccessful initiatives to address deficiencies in data and information flow, GHS partnered with the University of Oslo to develop the District Health Information Management System (DHIMS2), a comprehensive web-based health management information solution for reporting and analyzing the needs of health facilities at all levels.

DHIMS2’s user-friendly interface, accessible in all 170 districts, is being used by health facilities and district health directorates to collect, collate, transmit and analyze routine health service data. All staff in district health directorates and in health facilities with the required capacity for DHIMS2 management (trained staff, sufficient technology and Internet access) have been registered as secure users.

DHIMS2 offers national managers of health intervention projects the ability to use routine service data to monitor and compare performance across districts. All results and outputs are available to all health service managers in a timely manner for prompt action on potential emergencies and for improving services in poorly performing areas, activities and programs, particularly as they affect Ghana’s achievement of the health-related Millennium Development Goals. DHIMS2’s user-personalized dashboard facilitates real-time data capture for tracking service use and coverage and comparing performance. This helps users profile disease patterns and poor service use areas quickly—all the way down to the facility level. Use of DHIMS2 has made running out of data reporting forms and registers a thing of the past.
Lessons learned

An important lesson that has emerged from implementing DHIMS2 is that having routine health service data visible and easily accessible on a common platform for all managers stimulates constructive observations comparing typical trends for specific indicators with anomalies. This leads to regular discussion on how to improve reporting rates, completeness, accuracy and internal consistency of routine health service data. These data also reveal the real pattern of service use, which can be compared with information on inputs to the health care service delivery system across districts to uncover any discrepancies.
2. Cameroon
Using ICT to improve early detection and rapid response to epidemics

Health challenge addressed
Cameroon has suffered repeated epidemics of meningococcal meningitis, yellow fever, cholera, measles and other infectious diseases. Since 2010 there have been 33,911 cases of cholera and 4,574 cases of meningitis. Despite government efforts to control epidemics, the monitoring system had substantial gaps in early detection, notification and case confirmation. Mortality rates were high due to delays in treatment and inappropriate case management. Case reporting was weak. For example, during the 2010 cholera outbreak in the far north, flawed case reporting facilitated the rapid spread of the disease, and death rates reached 60%. Case confirmation was hampered by long delays in sample delivery and results reporting, as well as laboratory deficiencies. And the timeliness and completeness of reports on highly communicable diseases were substandard in many regions and health districts. Responses to epidemics were also substandard. Delays in detection, inadequate data reporting, and slow and inefficient information flows across the three levels of the health system (central, regional and local) led to poor case management and ultimately to high mortality rates.

Proposed e-Health solution
In August 2010 the World Health Organization's Cameroon office rolled out a cost-effective strategy using ICT to strengthen epidemiological surveillance and speed the response to outbreaks.

The network built on existing ICT systems, the growing number of mobile phone users and expanding mobile network coverage. A mobile phone reporting network was created for health workers engaged in epidemiological surveillance at all levels, including those in referral laboratories. Computers and wireless Internet networks were installed to link the central and regional levels and were gradually expanded to all 10 regions of the country. Phone communications within the network are free around the clock. The high-speed Internet network connects five decision-making services at the central level and the 10 regional health services for electronic data transmission. The mobile phone network allows higher level health staff and community health workers to mentor surveillance officers in disease case definitions for better quality case detection and investigation.

Since July 2010 response time from case detection to pre-confirmation of outbreaks has been reduced from seven days to less than one. The timeliness and completeness of reporting of epidemiologic data have also improved. And better communication between laboratories and field teams on the results of sample testing has improved response time and accuracy.

Data transmission is 30 times less expensive through the phone network and Internet than through land transport, the common method before the initiative. Health personnel can now transmit data electronically, reducing the need to travel and thus freeing up time for direct health care issues. By enabling earlier notification of cases, the new system has supported rapid response to disease outbreaks at all levels of the health system. Data quality has been upgraded as well, as surveillance supervisors and referral laboratories are now using the phone network to confirm unusual data on diseases reported by some health districts.
Lessons learned

The phone network connects the central level with the intermediate and local levels of the health system, and the new opportunities for interaction have improved problem solving. Optimizing ICT for surveillance requires ownership by the stakeholders and assessment of monitoring needs at all levels. Personnel and other stakeholders need to be trained in advance to break down barriers to the use of ICT.

Innovative aspects

The phone network has greatly improved the flow of information among the district, regional and central health service. It helps the central, regional and district service managers provide guidance remotely on how to investigate outbreaks and manage cases in far-off localities with difficult physical access. The initiative was designed to better manage outbreaks. Now it is also used to transmit information on other diseases and health programs, by facilitating communications among district health managers or between them and regional and central managers.

Epidemiological surveillance has quickly become far more effective and efficient, as geographic coverage increased and more people were drawn into the network. Over time the data have become more reliable, informing more relevant and timely decisions for better response to outbreaks.
3. Uganda
Real-time monitoring and evaluation of disease surveillance, drug stocks and health service delivery through mTrac

Health challenge addressed
Malaria, an enormous threat to health, is a heavy drain on Uganda’s economy, accounting for 26% of the burden of disease, up to 40% of clinic outpatient attendance, 20% of health facility admissions and up to 14% of in-patient deaths. Artemesinin-based combination therapies (ACTs) for treating malaria are vital for effective case management, yet Uganda suffers from regular ACT stockouts of 40% at community-level health facilities. And some health centers are overstocked, resulting in waste as ACTs expire. Collection, analysis and use of vital health information at the local level have long been impeded by heavy workloads, inadequate infrastructure, lack of transparency, poor staff attitudes, weak community engagement and high transaction costs. Inadequate monitoring of ACT supplies has led to procurement and distribution lapses and inadequate access to ACTs because of both understocking and overstocking.

Proposed e-Health solution
UNICEF and Uganda’s Ministry of Health are rolling out the e-Health solution mTrac, which enables real-time monitoring of disease surveillance, drug stocks and health service delivery using text messaging (short message service, SMS) built on a web-based data aggregation and analysis platform using open source RapidSMS software. The mTrac solution takes advantage of the rapid growth in telecommunication infrastructure, network coverage and mobile phone penetration. Health facility and community health workers use their own mobile phones to submit weekly disease surveillance and ACT drug stock reports on a health management information system form at no cost. This weekly information is managed on a web-based dashboard by district health teams, the Ministry of Health and other national stakeholders who can generate reports to facilitate planning and monitoring. To strengthen community monitoring, mTrac has an anonymous, toll-free SMS-based hotline for reporting health service delivery problems. Data are fully integrated into mTrac to provide a cohesive report on disease surveillance and drug stocks.

With built-in intelligence features, mTrac enables health workers to receive summaries of their submitted reports and administrators to flag potential errors and communicate directly with health facility workers. Automatic reminders can be sent to the mobile phones of health workers who are late in submitting weekly reports. District dashboards automatically aggregate reports for district health teams and the Ministry of Health—so that they can more easily identify disease outbreaks, disease trends and drug consumption to make informed decisions and intervene at the district level. The dashboards are configured for data collection, cleaning, verification and analysis. And district health teams provide technical and field support to health facilities to improve the quality and timeliness of their reporting. At the community level, village health teams send weekly data on danger signs like fever, malnutrition and ACT availability, which can be used to keep ACTs sufficiently in stock. Combining health facility data and community-level data on disease and ACT consumption provides a more accurate picture of ACT requirements. At the national level, mTrac provides the Ministry of Health with an improved monitoring system for disease, drugs and health service delivery that enables better accountability.
**Innovative aspects**

The mTrac system works on any mobile phone, facilitating broad data collection of quantitative and qualitative indicators. SMS forms simplify reporting through a series of keyword codes and fields.

An open-source RapidSMS software platform captures and accelerates real-time transmission of key information at the national, facility and community levels, thus providing an optimized tool for management and programmatic response. The RapidSMS software can be expanded with new features to meet the needs of all users. By capturing real-time data across the continuum of care, mTrac can rapidly identify and resolve bottlenecks and strengthen accountability at all levels of the health care system.

The dashboard, managed by the district health teams, empowers districts to take the lead in improving health care services and intervening when necessary. It can handle mass data collection at a national scale and still function at optimal efficiency. District health teams can add or edit health facility and community health worker input, add or edit reports, approve reports, aggregate and analyze data and filter spreadsheet data to meet the differing needs of stakeholders.

**Lessons learned**

Engagement of national stakeholders has been critical for rolling out mTrac. Their involvement has improved training and supervision, increased use of data for program monitoring and clarified data sources for indicators. It has also refined procedures for data validation, quality and reporting compliance, technical and steering committee activities, discussion and consensus building on methodologies, data requirements and interpretation, and engagement of telecommunication service providers.

The use of media to target key audiences has resulted in a marked increase in both the quantity and quality of community reports. The Ministry of Health has partnered with community-based organizations and civil society organizations on mTrac campaigns for community engagement, including a dynamic SMS and print media question-and-answer series for district health teams, health officials and the public.
Empowering the health workforce
4. Kenya

Upgrading nurses through eLearning

Health challenge addressed

Kenya's health system is short of funding, staff and skills. Health workers are trained in an environment that lacks appropriate infrastructure, adequate teachers and budgets, and modern education models and that offers very little continuing professional development. The result is poorly trained health workers, severely limiting Kenya's ability to raise health care standards and deliver effective health care services.

Nurses are the frontline health workers in Kenya even though the vast majority of them were qualified at the lowest formal level (“enrolled”) status in 2000. For many people, nurses are the only point of contact with the health system. Enrolled nurses are unable to deliver many essential services and are not qualified to manage and treat diseases such as HIV/AIDS, malaria and tuberculosis. The Nursing Council of Kenya estimates a need for 22,000 diploma-level registered nurses to improve health service delivery. Meeting this need would require scaling up the existing classroom-based program. At the current intake of just 100 students a year, training that number of nurses would take more than 200 years.

Proposed e-Health solution

In 2005 a public–private e-Health distance education pilot program was launched to ease the training bottleneck—by training more nurses at lower costs. A partnership among AMREF (an Africa-based health development organization), the Nursing Council of Kenya, and Accenture, eLearning was selected as part of a blended distance learning and clinical practice approach for nursing students wishing to upgrade their skills from a certificate to a diploma. Because students could learn while working, the program did not create additional health worker shortages, and the training course was more affordable for nurses, who could continue to earn income as they learned.

A self-paced study method, eLearning addresses some of the key limitations of traditional classroom-based learning:

- **Flexibility**: eLearning can be accessed anywhere and anytime.
- **Continuity**: Learners can continue to work while training during off hours.
- **Scalability and speed**: The number of enrollees is not limited by facilities, infrastructure and instructors.
- **Cost**: Although an eLearning program requires investments in technology and operational infrastructure, it realizes considerable savings in overhead, staffing and course materials.

The course, which takes about two years, covers four modules—general nursing, reproductive health, community health nursing, and nursing psychiatry and management—delivered through a blend of electronic learning, face-to-face sessions and clinical practice. An ICT skills unit, completed at the beginning of the program, imparts the necessary computer skills.

To provide access to computers for eLearning’s online components, eCenters were set up in health facilities and training institutions across Kenya. At the end of the course, students sit for the same national exam as students who take the course by traditional means, but eLearning has enabled far more nurses to take the course than would otherwise have been possible.
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Innovative aspects

Classroom-based learning and paper-based distance learning did not allow for the scale and speed at which Kenya wanted to upgrade nursing skills. That required an innovative solution: eLearning. The innovation was in both the technology solutions employed to increase capacity, reusability and repurposing of the information resources, and in the unique synergies of the program’s public and private sector partners working together as program/content experts, local implementers, funders and scaling agents.

The eLearning program was the first for nurses in Africa to work at scale on a national level and incorporate stakeholders. To address the challenges and points of resistance identified in a preliminary study, the program ensured that course materials were available from different sources (CD-ROM and web-based) and provided better technology and an adequate support network. Using electronic media to enhance distance learning, the program upgraded nurses faster than traditional means could. The electronic content was also easier to deploy and revise when necessary.

Lessons learned

Several lessons have emerged from the eLearning program. It needs a strong communication plan and stakeholder engagement in its governance structure. Students need ready access to computers, materials and other resources. Tutors and mentors are vital for ensuring that students are fully supported and encouraged as they add studying to their daily workload. Instructors need training in using computers and the Internet to deliver training. And plans need to be in place for initial purchases and long-term maintenance of technical infrastructure, such as computers, printers and associated hardware and software.
5. Ghana

Mobile Technology for Community Health (MOTECH)

**Health challenge addressed**

Maternal health care in Ghana has improved over the past two decades, though slowly. Systemic challenges related to events during pregnancy, delivery and the early post-natal period are slowing the reductions in maternal and neonatal deaths. Most of these events occur in the home, where women receive no care from trained health workers. The main reasons are a lack of accurate health information to enable women to make informed decisions, harmful health practices endorsed by traditional beliefs and myths, low awareness of the importance of critical care services (and therefore low demand) and patchy delivery of early postnatal care.

Demographic and Health Surveys and Multi-Indicator Cluster Surveys indicate that antenatal coverage has always been far higher than supervised delivery coverage. In 2011 antenatal coverage was 96.7%, while skilled attendance at delivery was just 68.4%. Despite the high antenatal coverage, treatment is incomplete. Most women do not make the minimum four recommended antenatal visits. Reducing maternal and neonatal mortality requires reaching women with the information needed for a safe pregnancy and delivery—dispelling the traditional beliefs that encourage women to deliver at home and to withhold skilled care from their newborn babies during the critical 48 hours after birth.

**Proposed e-Health solution**

To narrow the gap in service use to reduce maternal and neonatal deaths, pregnant and postpartum women must have the right information. The Internet is one source of such information, but access is limited. An alternative source is the mobile phone. In Ghana, as in other African countries, mobile phone use is spreading rapidly, reaching even people in remote rural communities. Mobile Technology for Community Health (MOTECH) is using mobile phone technology to provide a creative, evidence-based approach to improving maternal and infant health.

MOTECH has two interrelated mobile phone applications that focus on improving the health of pregnant women and infants in poor rural areas. Mobile Midwife sends targeted, time-specific, evidence-based voice messages containing important health information to pregnant women and new parents in their local language. Nurse Application helps community health nurses electronically record the care given to patients and identify clients—both mothers and infants—due for critical care.
Innovative aspects

A key innovation of MOTECH is sending voice messages to women in their local language. A voice message sidesteps low literacy and affords the messages more credibility. Another key innovation: MOTECH’s two applications function together to enable appointment reminders for patients and nurses. Mapping patient data stored in MOTECH’s electronic medical records against GHS care protocols allows for easy identification of clients who have missed health care appointments (such as vaccinations and postnatal visits).

MOTECH detects when a woman or infant is due or overdue for care and sends a reminder through Mobile Midwife. Each week, nurses receive on their mobile phone lists of clients whose care is overdue, enabling them to plan their outreach and home visit schedules to maximize coverage. These alerts are delivered to both client and nurse the moment a woman or infant is due for an appointment. If a client delivers at home, Mobile Midwife messages encourage her to notify the toll-free call center. Community health volunteers are also incentivized to inform the call center of deliveries in their communities.

When the call center is notified of a birth, the event is added to the client’s MOTECH medical record, triggering a schedule of postnatal reminders for the client and her nearest health facility and prompting the nurse to follow up with postnatal care at a home visit. The flexibility of the core technology and its open-source license ensure that GHS will be able to extend MOTECH into new health areas, such as inventory tracking.

Lessons learned

The MOTECH team published a detailed report highlighting the following lessons learned (www.grameenfoundation.org/sites/default/files/MOTECH-Early-Lessons-Learned-March-2011-FINAL.pdf). Community health workers should be issued mobile phones to standardize implementation and enable data transmission over general packet radio service rather than SMS. GHS, not the project, should establish employee responsibilities. The content of mobile phone messages needs to address local practices and beliefs to be relevant and credible, and the voice and tone of messages strongly influence their credibility. System technical support, important to both community health workers and clients, can be effectively provided through a call center staffed by experts. Establishing the technical infrastructure (server configuration, connection to telecommunications providers) can take a long time. As clients become more educated, demand for clinic services rises; clinics must be ready to accommodate the additional demand.
6. Multinational
An Africa-wide telemedicine and distance learning network, RAFT

**Health challenge addressed**

Most Sub-Saharan countries face formidable challenges in developing and strengthening their health system. A key challenge is developing the health care workforce and deploying it in remote regions to provide quality primary and secondary care to underserved populations. "Medical deserts" arise in part because most health care professionals prefer to live and work in large cities. Telemedicine and e-Health have the potential to improve the situation substantially by supporting care professionals remotely, helping them make better diagnostic and therapeutic decisions, giving them access to distance continuing education, and improving coordination of public health activities by providing decision-makers with more complete and timely information. Recently, a new need has been identified for training physicians during their specialization. A challenge is to be able to deliver certificates and diplomas, which implies that there is a way to control the acquisition of competencies.

**Proposed e-Health solution**

To address these needs, Geneva University Hospitals and their African partners developed RAFT, a telemedicine network in Africa. Initiated in 2001 in Mali, RAFT has since expanded to a dozen African countries. Its main purpose is to move expertise, not people, to reduce the isolation of health care professionals in isolated areas. Reducing their isolation has entailed keeping them motivated and well-trained, using remote advice for diagnosis, remote help for choosing and monitoring treatment, remote supervision of specialized diagnostic devices (such as ultrasonography and electrocardiography) and remote continuing education.

RAFT’s core activity is webcasting interactive courses for physicians and other health care professionals. The topics are proposed by network partners. Courses are webcast every week, freely available and followed by hundreds of professionals who can interact directly with the teacher. Some 80% of the courses are now produced and webcast by African experts. A bandwidth of just 20 kilobits per second, the speed of an analog modem, is enough to webcast to participants in remote hospitals or cybercafés. Other activities of the RAFT network include teleconsultations, tele-echography and collaborative development of educational online material.

The network is run by more than 40 national co-ordinators and a small coordination team in Geneva. In each partner country, RAFT activities are supervised by a medical authority (usually a university professor) that links the project to national government bodies (ministries of health and education). A local medical coordinator (a junior physician) and a technical coordinator take care of day-to-day operations, including communication with health care professionals, identification of training needs, technical training and support to sites across the country.

Key partners include Université Numérique Francophone Mondiale, the World Health Organization (WHO), and the International Telecommunication Union. RAFT is recognized as an official WHO collaborating center for e-Health and telemedicine.
Innovative aspects

Governance is based on a multilateral network of experts (focal points) active in university hospitals in Africa, who define education priorities (as members of the Educational Program Committee), oversee national coordination teams and link with national authorities to anchor RAFT activities in national e-Health and health strategies. As a result, most of the activities (education and remote expertise) are now provided by African experts to African health care professionals, thus increasing the relevance and applicability of expert advice.

Technologies have been developed to cope with infrastructure challenges (such as network bandwidth and irregular electricity availability). The two main technologies are Dudal and Bogou. Dudal is a distance education environment developed and tuned to enable remote users with low-bandwidth connections (25 kilobits per second) to participate, even from a cybercafé in a small town. Bogou is a secure tele-expertise environment that organizes virtual communities of experts willing to give advice to health care professionals facing difficult clinical situations.

Because the project’s long-term success depends on its scalability and sustainability, telemedicine units have been standardized to facilitate deployment and provide quality support, even to remote facilities.

Lessons learned

RAFT’s development depends on expanding Internet access and increasing bandwidth. Telemedicine will have the greatest impact on health systems in the most remote areas, where it can relieve the isolation of health care professionals and lower the likelihood that they will move away. These connections should improve the flow of information back and forth between the capital and the periphery, so that health authorities can optimally allocate scarce resources.

The high expectations for satellite technology remain unmet, however, as connectivity is still too expensive for rural communities. Meanwhile, high-bandwidth ground-based connectivity is developing, and several mobile phone operators are deploying WiMAX and GSM technology. These new technologies could quickly become alternatives for connectivity in rural areas.

Sustainability remains the key challenge, from securing long-term funding of resources to integrating them into government planning and nurturing the involvement of health care professionals as users and providers of quality content.
Conveying health education to the public
7. The Gambia
Using ICT to promote health in schools—the Health Academy Project

Health challenge addressed
The Gambia, like many developing countries, has a high burden of communicable diseases. More worrying is the growing burden of noncommunicable diseases and their risk factors. For example, 16% of urban women are obese; 24% of children ages 13–15 and 31% of adults ages 24–34 smoke tobacco; 22% of adults are physically inactive; and adults do not eat enough fruits and vegetables.

Interventions to promote positive behavior change, especially in the school-age population, fall short. For example, most health interventions delivered in schools are top-down, expert-driven events, with limited student involvement.

Proposed e-Health solution
The Health Academy Project offers a pioneering approach to promoting healthful practices among young people in The Gambia. Using schools as the entry point, the project seeks to reduce the incidence of noncommunicable diseases by packaging its health messages on CD-ROMs—to enhance the acquisition and use of health information and its transformation into positive behavior change. The health information covers key national health concern priorities, such as proper nutrition, physical activity, tobacco use, and prevention and control of such communicable and noncommunicable diseases as malaria, HIV/AIDS, tuberculosis, diabetes, hypertension and vehicle accidents.

This initiative seeks to tackle common health problems among students, by teaching them, entertaining them and building their skills. Health Academy courses to promote healthy behaviors have been used in six countries in three regions and are expanding. The project was launched by the World Health Organization in 2003 with a pilot in Egypt and Jordan; it was then introduced in Ghana, Lebanon and The Gambia in 2007–08 and in the Philippines in 2008–09.

The project both disseminates information and facilitates its understanding. By engaging the learner as an active participant, this initiative promotes skill development and behavior change. For example, physical activity modules not only provide information on the benefits of physical activity but also demonstrate different types of physical activity and how to keep fit. Animation and other audio-visual features also enhance understanding and motivate behavior change. The Safer Food for Better Health module, for example, shows how to handle and prepare foods for better health, enhancing both understanding and skills development and thereby influencing positive behavior change.
Innovative aspects

This tool is simple and practical. It engages people to learn how to reduce their health risks and helps them become more aware of contemporary health issues. Because it employs CD-ROMs, it can be used where Internet access is limited or nonexistent. It is particularly appropriate for The Gambia, where use of ICT is a key component of its National Education Policy. Learners need little or no external support to run the courses, which are self-paced and easy to navigate. The CDs contain glossaries, games, animation and documentaries—a multifaceted approach that enhances learning, skills development and behavior change. Quizzes help learners evaluate their progress. In addition to CDs, the modules can be shown to large audiences using overhead projection.

Lessons learned

The project has strengthened ties among the Ministry of Health and Social Welfare, the Ministry of Basic and Secondary Education, and the World Health Organization. The project has also served as a point of entry for health education in schools, strengthened science teaching and enhanced schools’ information and communication infrastructure and capacity.
Delivering health services
8. Sierra Leone

Strengthening maternal, neonatal and child health services using mobile phones to extend the reach of community health workers

Health challenge addressed

The skills crisis among health workers in Sierra Leone is impeding the ability to reduce child and maternal mortality. The skill scarcity has been dealt with by incorporating alternative health workers, such as community health workers, into formal health systems. These care providers are a critical link between rural communities and the health system, and they have been shown to greatly improve maternal and neonatal care.

The potential of community health workers to reduce illness and death among women and children is diminished, however, by inadequate training, loose supervision and poor connectivity to health facilities. These deficiencies are compounded by limited resources, rough terrain and insufficient feedback, which weaken motivation, undermine supervision and erode effectiveness. If community health workers are to continue offering essential maternal and child health care services, human resource management needs to be improved to provide a supportive and enabling work environment.

Proposed e-Health solution

The Centre for Global Health at Trinity College, Dublin, is partnering with Sierra Leone’s Ministry of Health and Sanitation and World Vision International to improve access to maternal and child health services for the 22,000 households in five rural chiefdoms in Bonthe District. The partnership builds on a joint initiative for training more than 330 community health workers in the delivering “7-11,” a timed and targeted counseling strategy for pregnant women and their newborn children. This evidence-based framework focuses on 7 core health interventions for pregnant women and 11 for children under age 2, promoted through a minimum of 10 visits by community health workers.

A mobile phone application enables community health workers to receive reminders about household visits, register pregnant women for the program, make emergency referrals to their affiliated peripheral health unit, track their progress and collect household data to transmit to the health facility to support clinical and managerial decision-making.

The phone application expedites three major processes: registration, visits and services, and referrals and counter-referrals. Registration involves informing the affiliated health center of a probable or confirmed pregnancy and of any live births. The visits and services process refers to the scheduling of the 7-11 counseling services once a pregnant woman or newborn has been registered. Referral and counter-referral processes come into play when a health worker opens a referral (pregnancy, home birth, missed services). If the health center fails to confirm a client visit, the health worker is prompted to visit the household to see what happened.
Innovative e-Health Solutions in Africa Award

Innovative aspects

The program is an innovative approach to addressing health education and behavior change within households. Working at the household level enables health messages to be communicated in a secure environment and encourages open discussion by all decision-makers with a skilled and knowledgeable provider. The mobile phone application combines the best features of two field-tested open-source applications, placing it at the forefront of mobile technology. On the front end, the updated, CommCare-based mobile application does not just allow community health workers to receive reminders about household visits, register pregnant women for core health interventions and refer clients to the affiliated health center. It also allows them to track progress and collect household data. On the back end, the MoTech solution gives the Bonthe District Health Management Team access to key performance monitoring indicators in time-stamped, exportable, aggregated reports. The project also collects data that can be used to examine both the effects of the mobile phones as vehicles for health programs and the program’s impact on health worker motivation and health care service delivery structures.

Lessons learned

Before this mobile phone application is scaled up to other countries implementing the 7-11 timed and targeted counseling strategy, the added value of the mobile component in advancing the strategy needs to be considered. Therefore, the project has an embedded research component to address two objectives: assessing changes in health worker motivation triggered by the introduction of a mobile job-aid and the impact on health worker performance and maternal and child health over time, and exploring how the mobile component affects health care delivery practices and identifying potential challenges to scaling up.

The design is a quasi-experimental longitudinal cohort study that randomly assigns all 26 public health units in the program and their associated community health workers to one of three intervention groups. One group of health workers is receiving only 7-11 timed and targeted counseling training from the Ministry of Health and Sanitation in collaboration with World Vision Sierra Leone. A second group is receiving training plus a mobile phone without the mobile counseling application. And a third group is receiving training and a mobile phone set up on the closed-user group and equipped with the application.

Changes in health worker motivation, supervision, organizational commitment and job satisfaction will be monitored through a series of follow-up questionnaires administered at 5- to 6-month intervals over 18 months. The results will inform a model for using mobile phones as a human resource management tool in a health training program to boost health worker motivation—by improving supportive supervision, job satisfaction and organizational commitment.
9. Kenya

Improving the reliability of family planning supplies through the Mobile Inventory Management System (MIMS)

Health challenge addressed

Access to good health services, especially for the poor, remains a challenge across Africa. In Kenya women cite problems with getting contraceptive care as one of the reasons for the high unmet need for family planning. Kenya’s contraceptive prevalence rate has stagnated, with only 39% of women using modern family planning. The distribution bottleneck is greatest at the final stage of delivering pharmaceutical commodities to health facilities and ultimately to clients. Family planning commodities are often available at the regional level, but lack of accurate information keeps them from being efficiently distributed to lower level health facilities.

Increasing access to family planning also improves child health outcomes. Serving all women in developing countries whose need for modern methods is unmet would prevent an additional 54 million unintended pregnancies, 1.1 million infant deaths and 79,000 maternal deaths.

Family planning is the most cost-effective means of reducing maternal mortality.

The Kenya Medical Supplies Agency (KEMSA) is responsible for procuring and distributing family planning commodities. An assessment of KEMSA’s operations indicated that distribution is impeded by poor information flows from health facilities to the central level, making it difficult to forecast demand and replenish stocks at the right time and in the right amount. There are also reports of losses of medical supplies along the supply chain.

Proposed e-Health solution

To improve the family planning commodity supply chain, the German Society for International Cooperation facilitated a collaboration between Virtual City and stakeholders to customize a supply chain management solution that had worked in the fast-moving consumer goods supply chain. The Mobile Inventory Management System (MIMS) automates distribution—from ordering through sales to inventory management and from district stores to dispensaries in the field—and reporting for all levels of management in the distribution process. The application runs on various mobile phone platforms at the lower ends of the supply chain; higher ends of the supply chain are web based, with use of cloud technology ensuring access from anywhere. The system was piloted in two rural districts in Kenya.

By automating the supply chain, MIMS provides real-time access to accurate information on transactions all along the supply chain. The system is a three-level solution with mobile phone, district store and headquarters applications. Health facilities use the mobile phone application to record stock on hand, stock issued to clients and stock returned to the district level.

MIMS handles the main components of the supply chain through its ordering mechanism, which covers dispatch, inventory management, minimum reorder level and proof of delivery. The system also facilitates inventory tracking at each link in the supply chain. The system enables knowledge-based decision-making, from accurate quantification to forecasting demand for contraceptives. This solution is scalable and can be integrated into KEMSA’s inventory management system.
Lessons learned

MIMS has been piloted successfully for family planning commodities in 29 health facilities in two rural districts in Kenya. Several lessons emerged from this experience, at both the technical and policy levels. At the technical level, user engagement is required from the inception of a project to ensure smooth implementation. The methodology needs to encompass incremental components of the system, and proper testing of module inputs and outputs is required by all involved. A continuous feedback loop is necessary for users to comment on shortcomings in the technology and to request assistance. At the policy level, the project has revealed the importance of stakeholder engagement for acceptance of new technologies, the need to support continued buy-in, the importance of government leadership during implementation and the need to consider sustainability and phase-out at the project design stage and to prepare stakeholders to take over the execution.

Innovative aspects

MIMS brings together several “firsts” in pharmaceutical supply chain management in Kenya. Because MIMS can be accessed by mobile phone at lower levels of the supply chain, users across the supply chain can track their data. MIMS is integrated with KEMSA’s Enterprise Resource Planning system, thus allowing seamless information exchange. A proposed future module for mobile payments would allow private facilities to pay KEMSA for stock ordered through MIMS.

Other advantages of MIMS are its scalability, ease of use, linking capabilities, automatic reconciliation of inventory across the supply chain, and data integrity and compatibility with the existing infrastructure and security frameworks.
10. Multinational
Mobile for Reproductive Health (m4RH)

**Health challenge addressed**

Where the unmet need for family planning is high, improving access to family planning can reduce maternal mortality 40%, infant mortality 10%, and child mortality 21%. Contraceptive prevalence rates are low in many countries in Sub-Saharan Africa, at just 28% in Kenya and 23% in Tanzania, for example. And nearly a quarter of women in Kenya and Tanzania have an unmet need for family planning, which is 7 percentage points higher in rural areas than in urban areas.

Both women and men report concerns about side effects and widespread misinformation and rumors as the top reasons for not using modern contraception. Of women who begin using family planning, more than a third stop within the first year, putting them at renewed risk for unwanted pregnancy. Accurate information on the benefits of family planning and on managing any side effects is critical for family planning uptake and continued use.

**Proposed e-Health solution**

The Mobile for Reproductive Health (m4RH) program is an opt-in, text message–based health communication program that provides information on nine family planning methods as well as a clinic locator database. The program has reached underserved populations, including people in rural areas with more limited access to information and services, as well as men and youth, who family planning programs are increasingly targeting. The rapid spread of mobile phones in the developing world makes m4RH a simple, yet powerful means of putting contraceptive information and decision-making in the hands of the men and women who want it.

The m4RH system provides information on long- and short-acting family planning methods, including implants, intra-uterine devices, permanent methods, injectables, oral contraceptives, emergency contraception, condoms and natural methods. Each text message contains information on side effects, effectiveness, duration of use and ability to return to fertility. In Rwanda, m4RH also includes messages on HIV/AIDS, other sexually transmitted diseases, pregnancy and sex, and puberty.

All messages adapt evidence-based global guidelines to the 160-character limit of text messages and have been tested with a pilot group of users.

FHI 360, an organization that seeks integrated, locally driven solutions for human development, conceptualized, developed and deployed m4RH as part of a feasibility study on providing family planning information through text messages, the reach of this communication channel and the impact on family planning use. It was piloted and evaluated in Kenya and Tanzania over 2010–11 in collaboration with several partners, including the ministries of health in both countries, Text to Change (the technological partner) and other health entities. Results from the pilot indicate that women, men, young people and couples use m4RH to learn about family planning methods. Users find m4RH easy to use and understand and report increased family planning knowledge, as well as some behavior change. To build on these successes, m4RH is being implemented in Rwanda to encourage healthy behavior among young people.
Innovative aspects

To reach as many people as possible, particularly those underserved by traditional methods of family planning promotion, m4RH provides information through text message, available on all mobile phones. Providing family planning information in this novel format helps overcome many of the barriers to access, including cost and logistic challenges associated with traveling to health facilities and the stigma attached to inquiring about family planning, particularly for younger people.

The program is based on best practices in health communication design, health behavior change theory and family planning research. FHI 360 developed the text messages by engaging the target audience, identifying their perceptions on and specific needs for contraception and creating messages to meet those needs, based on World Health Organization and national family planning guidance. Results from the formative research led to important modifications to system content and architecture. The final messages were reviewed by national and international family planning experts, clinic partners and ministry of health representatives.

The program has tested and scaled up innovative data collection and evaluation methods. To monitor and evaluate the effectiveness of m4RH, four questions were sent via text message to m4RH users in two rounds of data collection in Kenya and Tanzania. Response rates reached 35% in round 1 (n = 2,439) and 69% in round 2 (n = 27,364). This method’s success has prompted Text to Change to incorporate it into a new open-source platform.

Lessons learned

The m4RH project has highlighted the need to identify and work with a range of partners that bring value to the service and that see value in it. It has also shown the importance of offering m4RH across all mobile phone providers to maximize reach. Other lessons include the benefits of continuously monitoring the mobile phone service for outages, developing text messages methodically, working collaboratively while identifying a project leader to manage implementation and follow-up, linking into the larger mHealth ecosystem, encouraging local “ownership” of the system and considering long-term costs.