



# mHealth Education: Harnessing the Mobile Revolution to Bridge the Health Education & Training Gap in Developing Countries



Report for mHealthEd 2011 at the Mobile Health Summit **June 2011**

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## Authorship and Acknowledgements

The iheed Institute and Dalberg Global Development Advisors have prepared this report to set the stage for mHealthEd 2011 at GSMA m-Health Alliance Mobile Health Summit, which is the first dedicated conference on the emerging phenomenon of mobile Health Education.

The report has been authored by Dr. Paul Callan, Robin Miller, Rumbidzai Sithole, Matt Daggett, and Dr. Daniel Altman from Dalberg Global Development Advisors, and David O'Byrne from the iheed Institute. We are grateful to colleagues at the iheed Institute, particularly Dr. Caroline Forkin and Dr. Tom O'Callaghan, for their guidance and feedback as we prepared this report.

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## Executive Summary

**Developing countries face an acute shortage of skilled health care workers, and consequently health education and training, especially for community health workers, needs to be a top priority.**

The High-Level Taskforce on Innovative Financing estimates that, to achieve the Millennium Development Goals for health, developing countries need an additional 2.6 million to 3.5 million health workers, who must be trained with limited budgets. Quality training and continuing education for community health workers is essential, as it is linked to improved health outcomes. For example, Save the Children estimates that training and support to midwives to provide a package of eight proven interventions could prevent 38% of newborn deaths, thus saving 1.3 million babies each year. A training programme for community health workers in Bangladesh reduced maternal mortality by two-thirds, which would correspond 120,000 fewer maternal deaths per year if replicated globally.

### **Mobile technology can help.**

The developing world now has more than 3.8 billion active mobile devices. They are transforming lives and accelerating development through a wide range of “mDevelopment” applications, including dissemination of agricultural prices, mobile banking, gathering data on disease epidemics, among many others.

**“mHealth Education” or “mHealthEd” is the name given to an emerging new set of applications of mobile devices to the training, testing, support and supervision of health care workers, as well as applications that provide health information to individuals.**

The first wave of mHealthEd applications for health workers – most introduced within the last 4 years and some of which are



presented in this report – include ones which enable workers to learn new treatment procedures, test their knowledge after training courses, take certification exams remotely, look up information in medical reference publications, and trade ideas on crucial diagnostic and treatment decisions. Current applications mainly target nurses and community health workers, rather than doctors. They do not attempt to replace classroom-based training, but rather to supplement it with mobile refresher quizzes, quick access to reference materials, real-time feedback, and updates about new or improved treatment procedures.

### **Early reports point to positive effects from mHealthEd applications.**

It is too early to test for impacts on health outcomes, but the first wave of projects suggest that mHealthEd applications are improving the provision of care and levels of knowledge. Improved training can also increase job satisfaction and reduce attrition rates for healthcare workers. The current wave of applications for healthcare workers mainly involve providing supplementary support; later ones should tap the potential for mobile applications to reduce costs by offering cheaper alternatives to traditional

approaches for training and for disseminating health information.

### **The full potential of mHealth Education will require adoption of mHealthEd applications by governments as tools to enable cost-effective implementation of their national health strategies and healthcare workforce development plans.**

The first wave of mHealthEd applications have come from pilot projects financed by donors, NGOs and academic institutions; and the next wave will benefit from interest from content producers, mobile operators and device manufacturers.

### **Actors and stakeholders should coordinate their efforts to develop, test and deploy new mHealthEd applications.**

The actors must include governments, healthcare institutions, academia, content creators, mobile operators, device manufacturers, NGOs, philanthropists and investors.



## Some of the priorities for coordination should be:

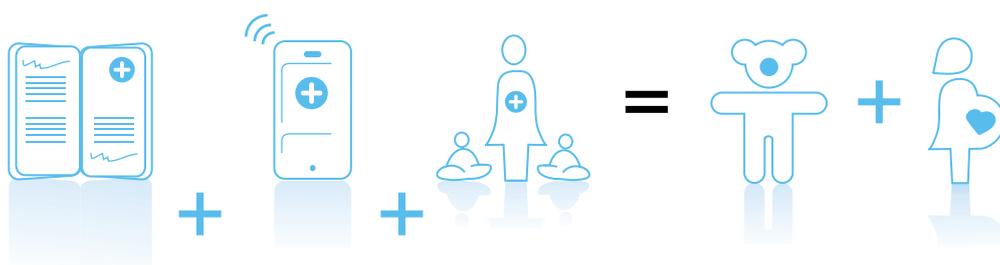
- Identifying training needs, especially for community health workers, as well as public health information needs, than can be met with mHealthEd applications, working from existing national health strategies and healthcare human resources plans;
- Developing content in a collaborative way, sharing best practices and perhaps including a meta-library of existing content;
- Continuing the development and testing of new applications, ideally based on agreed standards and formats to facilitate easy sharing of content between applications; and
- Keeping abreast of new device developments and trends in device pricing, and collaborating on joint specification and purchasing

Different members of the coalition will, of course, have different roles to play: governments must establish policies and decide on applications to roll-out at scale; NGOs, content developers and mobile industry companies must develop the applications; donors and investors must provide the financing for testing and rolling-out new ideas; mobile operators must provide capacity and pricing plans which facilitate scaling up of mHealthEd initiatives.

**The goals for mHealth Education must be ambitious, because the challenge is so great**, especially improving the training of over 2.1 million

current healthcare workers and supporting the training of perhaps 2.6 to 3.5 million new workers. All actors should prioritize quick deployment of promising innovations over building extensive portfolios of pilot projects.

**Only by thinking big, and acting urgently, can mHealthEd make a meaningful contribution to achieving the MDGs by the 2015 deadline.**



# Introduction to Mobile Health Education and Its Potential

## The challenge: closing the healthcare worker gap in developing countries

One of the primary barriers to improving health outcomes, and overall development, in developing nations, is the shortage of trained healthcare workers. The Task Force on Innovative International Financing for Health

It is generally acknowledged that community health workers (CHWs, defined in Box 2), must be an essential part of healthcare human resources strategies for developing countries. Such workers can take on some duties traditionally performed by doctors and nurses at much lower cost; they require less training than professional healthcare workers; and in many cases they also experience lower rates of attrition. A 2007 study by McKinsey estimated that, if sub-Saharan Africa continues to rely on professional doctors and nurses, then closing the gap in healthcare human resources would require a total of

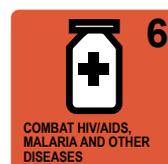
### Box 1. The Millennium Development Goals.

World leaders adopted the Millennium Development Goals (MDGs) in 2000 to align international efforts to reduce poverty and set ambitious targets to be achieved by 2015. The eight MDGs have 21 quantifiable targets that are measured by 60 indicators. All of the MDGs touch on issues of health, and three set specific goals for health outcomes, namely:

**Goal 4:** Reduce by two-thirds the mortality rate among children under five.

**Goal 5:** Reduce maternal mortality by three-quarters, and achieve universal access to reproductive health.

**Goal 6:** Halt and begin to reverse the spread of HIV/AIDS, malaria, tuberculosis and other major diseases, and achieve universal access to treatment for HIV/AIDS.



Systems estimated in 2009 that between 2.6 and 3.5 million health workers would be required to achieve the health-related Millennium Development Goals (MDGs, described in Box 1), which would more than double the 2.1 million workers who were in place in 2008<sup>1</sup>. According to the WHO, some of the most affected countries in sub-Saharan Africa would require an increase of as much as 140% to attain the health MDGs<sup>2</sup>. The shortage of health personnel in developing nations correlates with the overall burden of disease<sup>3</sup>.

\$33 billion in spending between 2007 and 2030, together with the addition of 300 new medical schools (from 90 today) and 300 new nursing schools (approximately doubling the number today)<sup>4</sup>. Using paraprofessionals – substitute medical doctors as well as community health workers – offers a more realistic path to strengthening rapidly the healthcare workforces in low-income countries.

<sup>1</sup>Taskforce on Innovative International Financing Systems, *More Money for Health and More Health for the Money*, March 2009, and Working Group 1 Technical Report: *Constraints to Scaling Up and Costs*, 5 June 2009.

<sup>2</sup>Kinfua, Yohannes et al. "The health worker shortage in Africa: are enough physicians and nurses being trained?" in *Bulletin of the World Health Organization* 2009, 87:225-230.

<sup>3</sup>World Health Organization. *Working Together for Health: World Health Report 2006*.

<sup>4</sup>McKinsey and Company. *Addressing Africa's Health Workforce Crisis*. 2007.

## Box 2. Definition of community health worker and other types of healthcare workers.

Community health workers (CHWs) help individuals and groups in communities to access basic healthcare, social services and health information. The term covers workers who may have titles such as community health-education worker, community health aide, family health worker, lady health visitor, health extension worker, and community midwife. Training periods for CHWs are less than for professionals, but are often not regulated and may range from just a few days up to 1-2 years.

### Professional healthcare workers include:

- **Doctors or physicians**, who are trained at medical school for 5 to 8 years, and licensed or registered after a further one or two years of supervised practice.
- **Nurses**, for whom registration usually requires a third-level degree or diploma; there are considerable variations between and within countries, there may be different certification levels each permitting a different degree autonomy in treating patients.
- **Midwives**, who are dedicated to the training and care of pregnant women, new mothers and newborn children, and whose requirements for training range greatly across countries, from unofficial trainings to bachelor's degrees.

Paraprofessional healthcare workers include community health workers, as well as substitute medical doctors or assistant medical officers, who have 2-3 years of training and may provide many of the same services as physicians.

According to the Taskforce on Innovative International Financing Systems, low-income countries have just over 2.1 million healthcare workers, including nearly 0.5 million doctors, nearly 1.2 million nurses and midwives, about 350,000 community health workers and about 135,000 lab, pharmacy and dental technicians.

Expanding and improving training programmes must be at the heart of human resources development strategies for health systems in developing countries. New approaches to training are needed to increase the number of people who can be trained, to decrease the time required for training, to decrease the cost per person trained and to improve the quality of training. For community health workers, whose training is limited, the quality and impact of the training they do receive should be a priority.

Evidence shows that improved training and ongoing learning, especially of community health workers, mean better diagnosis and treatment and improved health outcomes<sup>5</sup>. When healthcare workers are better trained, there are marked declines in maternal

mortality, infant mortality, and the overall burden of widespread disease. Save the Children estimates that training and support to midwives to provide a package of eight proven interventions could prevent 38% of newborn deaths, or 1.3 million babies per year<sup>6</sup>. A WHO study found that training community health workers in Bangladesh reduced maternal mortality by two-thirds and still births by 40%, as illustrated in Exhibit 17 – results which, if applied globally, could save the lives of 120,000 mothers and 96,000 babies per year.

Better training may also help to reduce attrition, especially among community health workers. Attrition depletes already limited health workforces in developing countries. It was estimated in 2004 that only

50 of the 600 doctors trained in Zambia since independence were still practicing in the country<sup>5</sup>. Attrition of community health workers has reached up to 70% per year in some community-supported programmes in Ethiopia<sup>6</sup>. Turnover is costly due to the high investment put into identifying, selecting, and training community health workers, and it disrupts continuity in relationships with the community. While low pay is the largest driver of attrition among healthcare workers, lack of career development opportunities and

lack of ongoing training also contribute<sup>10</sup>. This is especially true for nurses and community health workers in remote locations, who are often isolated from medical colleagues in their day-to-day jobs. TulaSalud, a health service programme for indigenous regions of Guatemala profiled later in this report, has retained 95% of its 500 community health workers, in part due to ongoing training and interaction with them<sup>11</sup>.



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<sup>5</sup>Global Health Workforce Alliance. *Scaling Up, Saving Lives: Task Force for Scaling Up Education and Training for Health Workers*. 2008.

<sup>6</sup>Rawe, Kathryn. *Missing Midwives*. Save the Children, 2011.

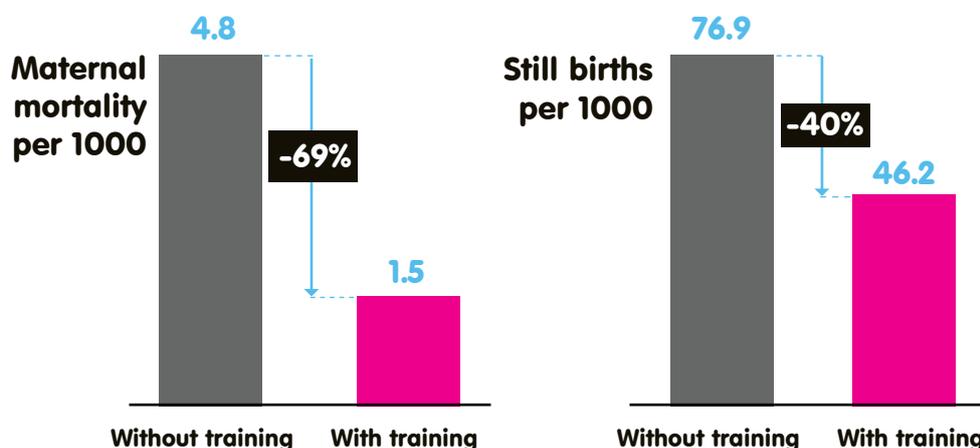
<sup>7</sup>Extracted from WHO: *Global Experience of Community Health Workers for Delivery of Health Related Millennium Development Goals: A Systematic Review*. Ronsmans C, Vanneste AM, Chakraborty J, Ginneken JV. "Decline in maternal mortality in Matlab, Bangladesh: a cautionary tale" in *Lancet* 1997;350:1810-1814. Begum SF. "Role of TBAs in improving maternal and neonatal health in Bangladesh: a long-term programme need" in *High risk mothers and newborns*, Ott Publishers, 1978. Fauveau V, Stewart K, Khan SA, Chakraborty J. "Effect on mortality of community-based maternity-care programme in rural Bangladesh" in *Lancet* 1991;338:1183-1186.

<sup>8</sup>Joint Learning Initiative. *Human Resources for Health: Overcoming the Crisis*. Harvard University Press, 2004.

<sup>9</sup>Wittcoff, Alison, and Lauren Crigler. "Measuring Engagement of Community Health Workers to Improve Productivity, Retention and Quality of Care", USAID HCI Project, 2010.

<sup>10</sup>Medecins Sans Frontieres UK. "Retaining Health Workers: the Basics - News - MSF UK." 24 May 2007. Web. <[http://www.msf.org.uk/Retaining\\_health\\_workers\\_the\\_basics.news](http://www.msf.org.uk/Retaining_health_workers_the_basics.news)>.

<sup>11</sup>TulaSalud. Organization website <<http://www.tulasalud.org>>.



Source: WHO Global Experience of Community Health Workers for Delivery of Health Related Millennium Development Goals: A Systematic Review, Country Case Studies, and Recommendations for Integration into National Health Systems , Begum 198733 Rural Districts (Bongra, Tongi & Dhaka) Bangladesh.pg61.

**Exhibit 1: Impact of a training programme for community health workers in Bangladesh on maternal mortality and still births.**

## The opportunity: mobile technologies for healthcare and learning

Mobile phones have achieved significant penetration in developing nations over the past decade. At the end of 2010, the ITU estimates that there were 5.3 billion mobile cellular subscriptions worldwide, including 3.8 billion in developing countries<sup>12</sup>. Access to a mobile network is now available to 90% of the world's population, including 80% of the population living in rural areas<sup>13</sup>. The growth rate in mobile penetration was fastest in Sub-Saharan Africa, where it grew from less than 2% to 32.6% between 2000 and 2008, according to ITU statistics<sup>14</sup>. The numbers of mobile phones and devices with internet connectivity is increasing rapidly. (See Box 3 for brief descriptions of different categories of mobile phones and devices.) There were 940 million subscriptions to 3G data services at the end of 2010<sup>15</sup>. Estimates from experts suggest that smartphone penetration across Africa is still well below 10% of total ownership, but the number of "feature phones" with internet connectivity is increasing and may

now account for perhaps a third to a half of all mobile handsets in Africa<sup>16</sup>.

Across the developing world, mobile devices are making a significant impact on users, especially those most vulnerable and geographically hard to reach<sup>17</sup>. The use of mobile devices is transforming the lives of many low-income people and communities, by giving people access to health information, correcting unbalanced access to markets, eliminating the cost of transportation to access services, and for many other reasons<sup>18</sup>.

The use of mobile devices to improve healthcare – dubbed "mHealth" – has been one of the most prominent areas within the larger field of "mDevelopment". As illustrated in Exhibit 2, mHealth includes a breadth of initiatives ranging from treatment adherence to data collection to supply chain management and health financing. The biggest areas of activity are the provision of tools and support to health workers, collection of public health data, and

<sup>12</sup>International Telecommunication Union. The World in 2010: ICT Facts and Figures. 2010.

<sup>13</sup>Ibid.

<sup>14</sup>International Telecommunication Union. Information Society Statistical Profiles 2009: Africa. 2009.

### Box 3. Categorization of mobile phones and devices.

**Low-end phones or basic phones** have only core functionalities including voice calling, SMS messaging and USSD (Unstructured Supplementary Service Data protocol which is used for adding airtime and can also be used for simple surveys, quizzes, and so on).

**Feature phones** or internet-enabled phones are mobile phones or devices that, in addition to voice, SMS and USSD, can access the internet for sending email, browsing the web and so on (but usually without the same ease-of-use as smartphones due to smaller screens, etc.).

**Smartphones** provide voice, SMS, USSD and internet access, and have an independent operating system (e.g., Symbian, Android, Apple) which can run built-in applications for a wide variety of purposes (e.g., Web browsing, calendars, document reading, among others).

**Tablet computers and e-Readers** are handheld devices with large screens designed for easily reading and working on long documents. They can be designed with functionalities similar to smartphones (e.g., Apple's iPad) or similar to traditional laptop computers, and can be designed to access the internet over mobile networks.

health information messaging and helpline services. There are many opportunities to integrate multiple applications within a single programme, using a single mobile device for each health worker, including diagnostic support services, training, epidemiological surveying, patient record updating and scheduling.

Mobile technologies have also been applied to support education, training and learning. Many mLearning applications have been developed for smartphones: for example, it is estimated that mLearning apps generated \$538 million in revenue in 2007 in the US, and accounted for 15-17% of the apps in the stores provided by China Mobile, China Telecom and China Unicom to their customers<sup>19</sup>. mLearning holds great potential for supporting education and learning in developing countries, and the GSMA's

recent report on mLearning: A Platform for Educational Opportunities at the Base of the Pyramid presented several case studies of successful applications including provision of materials for classroom use, the use of SMS for adult literacy and foreign language lessons delivered by voice and SMS. At the intersection of mHealth and mLearning is mHealth Education, which holds the promise of contributing to solving the challenge of educating and training healthcare workers.



<sup>15</sup>International Telecommunication Union. The World in 2010: ICT Facts and Figures. 2010.

<sup>16</sup>Estimates from experts made in interviews with Dalberg.

<sup>17</sup>Boakye, Kojo, Nigel Scott, and Claire Smyth. Mobiles for Development. UNICEF, 2010.

<sup>18</sup>World Bank ICT Division. The role of mobile phones in sustainable rural poverty reduction. 2008.

<sup>19</sup>GSMA Development Fund. MLearning: A Platform for Educational Opportunities at the Base of the Pyramid. 2010.

### Diagnostic Support and Data Collection

- Remote diagnostic tools to help with disease surveillance and treatment
- Collection of data for disease tracking
- Collection and storage of patient data
- Note: Many diagnostic support and data collection applications are combined



### Reminders on Treatment and Appointments

- Text and voice messages to patients regarding treatment (e.g., automated SMS reminders to patients about taking medications) or appointments



### Emergency Medical Response

- SMS or call-in service to request ambulance services



### Health / Medical Call Centres

- Medical call centers to triage services and treatment
- Helplines to provide access to medical information, advice, counseling and referral, often using a tele-triage model



### Healthcare Supply Chain Management

- Tracking of medical goods in supply chains using mobile recording
- Advocacy informed by supply chain information



### Healthcare Payments and Insurance

- Smart-cards, vouchers, insurance and lending for health services linked to mobile money platforms or otherwise supported with mobile phones



### Health Information and Promotion

- SMS and voice messages to distribute health information to subscribers (e.g., on HIV, maternal & child healthcare, etc.)



### Training and Support for Healthcare Workers

- Mobile device applications to train, test, support and supervise healthcare workers



Source: Dalberg research and analysis; World Bank Study on Mobile Applications for the Health Sector.

Exhibit 2: Overview of mHealth applications.

## mHealth Education: definition and potential

“mHealth Education” or “mHealthEd” is the name given to an emerging new set of applications of mobile devices to the training, testing, support and supervision of health care workers, as well as to the provision of health information to individuals. It forms a subset of mHealth (illustrated by the shaded sections in Exhibit 2) and of mLearning. mHealth Education tools can be used for both self-motivated learning and employee training for everyone from doctors to community-nominated volunteers. mHealthEd content can range from basic public health information to complex medical texts; it can be static or it can be dynamic as in, for example, testing applications. mHealthEd applications are delivered through a range of devices, from low-end phones to smartphones to tablets or e-readers. Exhibit 3 presents a framework for thinking about the range of possible needs, learners, content and delivery devices for mHealth Education.

This paper pays most attention to mHealth Education for healthcare workers, although it also provides an overview also of the many applications being developed to deliver basic health information to the general public or specific target groups such as pregnant women, mothers and youth. The paper does not cover applications such as on-the-job tools to help healthcare workers conduct diagnoses and decide on treatments, or medical helplines for individuals, which do have an educational aspect to them, but which are primarily aimed at directly improving healthcare service delivery.

The potential scale and impact of mHealth Education for healthcare workers can best be appreciated by thinking about it in multiple ways.

First, mHealth Education applications could bring benefits to all of the current healthcare workers in developing countries, who number over 2.1 million in all, including nearly half a million doctors, nearly 1.2 million nurses and midwives, and about 350,000 community health workers<sup>20</sup>. As noted earlier, there are clear linkages between improved training of health workers and health outcomes such as maternal and child mortality.



**What NEED for improvement in healthcare training is being addressed?**

**Availability of training:**

Classes are full or institutions lack capacity.

**Access to information:**

Limited access to up-to-date information and training, causing knowledge to become dated over time.

**Time efficiency:**

Lack time to take formal training courses or to travel from remote locations to learning institutions.

**Cost reduction:** Learning/training is too expensive, either for the individual or the provider.

**Quality improvement:**

Potential to enhance learning through additional learning modules and/or on the job learning.

**Who is the LEARNER?**

**Medical professionals**

- Doctors
- Nurses \*
- Midwives (trained)\*
- CHWs (trained)\*

**Health institution students**

- Students / Trainees

**Professionals (other)**

- Teachers
- HR employee

**Community**

- CHWs (untrained)\*
- Midwives (untrained)\*
- Traditional healers

**Individuals**

- Mothers / pregnant women
- Other adults
- Youth

**What type of CONTENT is being delivered?**

**Curriculum delivery**

- Traditional certification, testing or textbook type learning
- Upgrading training certification

**Learning support**

- Additional practice tests, vocabulary,

**Consultation/ support**

- Peer 2 peer sharing of information

**Treatment protocols**

- ART, TB, diabetes protocols

**Reference materials/ resources**

- Encyclopedia type access to a broad database of information

**Basic health information**

- Public health information/ learning
- Maternal health support

**Through what DEVICE is the information delivered?**

**Low end phone**

- Text and audio only
- Push, pull or interactive

**Feature phone (access to web)**

- Text, documents, audio, graphics or video
- Push, pull or interactive

**Smart phone**

- Applications, text, documents, audio, graphics or video
- Push, pull or interactive

**Mobile-enabled devices (including computers, e-readers)**

- Text, documents, audio, or video
- Push, pull or interactive

Source: Dalberg analysis; interviews with stakeholders

**Exhibit 3: Framework for the space of possible mHealth Education applications.**

Second, mHealth Education could accelerate the rate of training of new health workers. As an example, AMREF's distance learning programme for nurses in Kenya, in which mobile phones play a part, has more than quadrupled the number of registered nurses that Kenya can train each year. Thus, mobile technologies – most likely applied as part of larger reforms to training approaches – do have the potential to contribute to the more than doubling of the numbers of healthcare workers that is needed to meet the MDGs.

Third, mHealthEd applications could reduce health worker attrition rates, especially of community health workers. Even small reductions in the numbers leaving each year would contribute significantly over time to the total numbers of healthcare workers in service and would increase the returns on

investments in new training.

Fourth, mHealth Education can reduce the training costs for healthcare workers incurred by governments. WHO estimated in 2006 that the additional training costs to add required healthcare workers by 2015 would amount to an extra \$136 million per year on average for developing countries, or an increase of 11% over total health expenditures in 2004<sup>21</sup>. If one were to assume that even 2% of these costs would be replaced by mHealthEd applications, and that the financial benefits were shared equally between the government and the mHealthEd provider, then one could estimate savings of tens of millions of dollars per year for developing country governments and revenues of tens of millions of dollars per year for mHealthEd providers.

<sup>20</sup>Taskforce on Innovative International Financing Systems, More Money for Health and More Health for the Money, March 2009.

<sup>21</sup>World Health Organization. Working Together for Health. World Health Report, 2006.

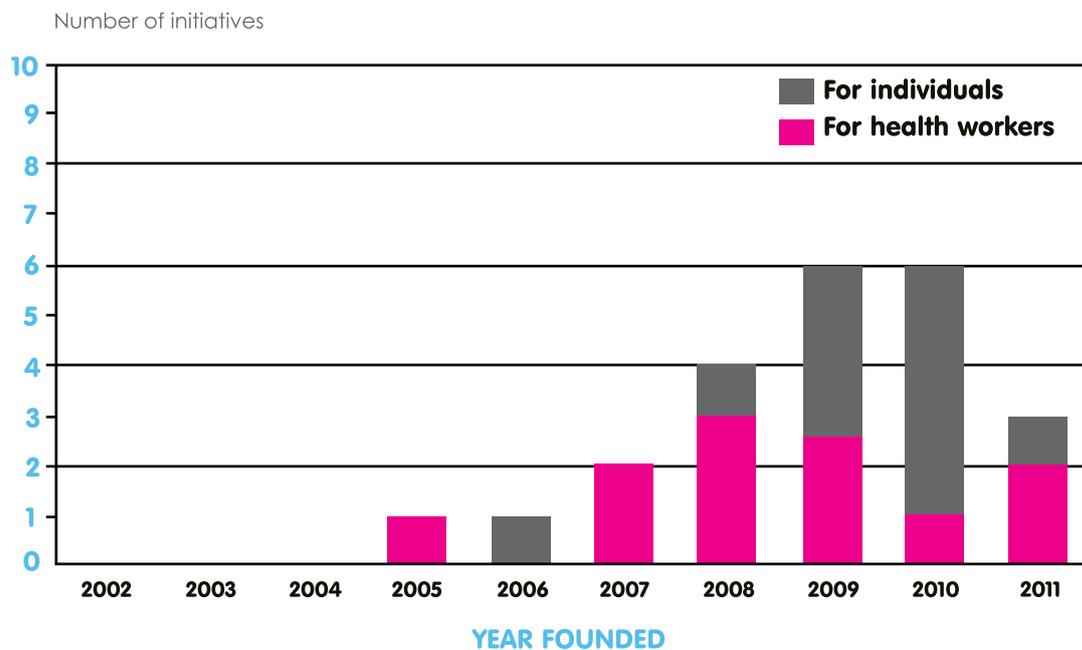
# The First Wave of mHealth Education Initiatives: Overview and Case Studies

## Overview of early mHealthEd initiatives

From a search which revealed more than 100 mHealth and mLearning initiatives, we were able to identify eleven mHealth Education applications targeted at healthcare workers and at least twelve applications targeted at providing information to members of the general public (although we expect that there are applications, especially ones targeted at individuals, that we did not

examples to discern clear patterns yet, and certainly it is too early to reach any definitive conclusions about where the “sweet spots” might be for mHealth Education, especially for healthcare workers. Nevertheless, it is instructive to consider how the examples to date fall within the framework shown in Exhibit 3.

For healthcare workers, the needs most commonly addressed by the current mHealthEd applications are those for access to information (e.g., AED-SATELLIFE’s mobile health information library), for availability of places in formal training institutions (e.g., AMREF’s distance learning programme to become a registered nurse in Kenya), and for enhancing quality of training and learning through the provision of supplementary



N = 23  
Source: Organizational websites; Dalberg interviews

**Exhibit 4: Profile of mHealthEd initiatives studied by year of foundation.**

identify). Five of the initiatives for healthcare workers are presented in the case studies which follow, and brief descriptions of all of the applications are provided in the annexes. As illustrated in Exhibit 4, most of the mHealthEd initiatives were started within the last 4 years; this is very much the first wave of pilot efforts in mHealthEd.

There are perhaps too few mHealthEd

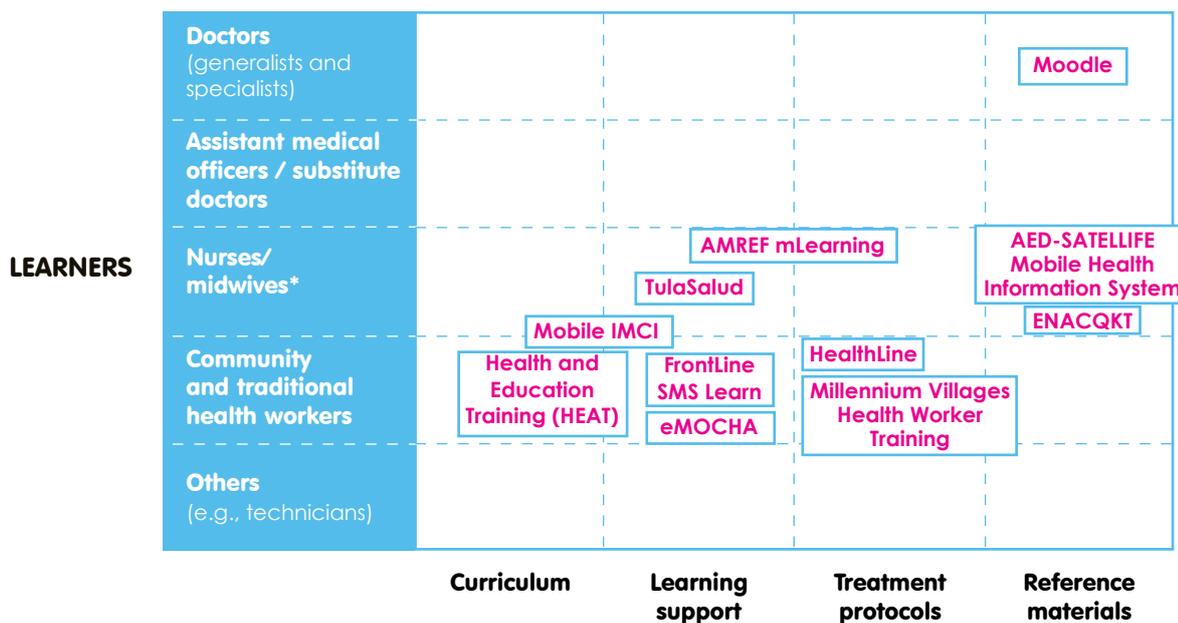
training (e.g., refresher training courses for community health workers in the Millennium Villages). Exhibit 5 presents the mHealth Education initiatives for healthcare workers on a chart which shows the target groups of learners and the types of content delivered for each of those initiatives. The learners who are most commonly targeted are frontline health care providers such as nurses, community health workers and community

volunteers, rather than doctors. The content of the mHealthEd applications typically does not aim to replace core curricula for classroom trainings, but rather the most popular content includes materials to support training courses, quick updates about new or improved treatment procedures, and access to medical reference materials.

For individuals, the need addressed is access to information. As shown in Exhibit 6, most applications provide information on sexual and reproductive health (including HIV/AIDS), on maternal and child health, and on general health issues.

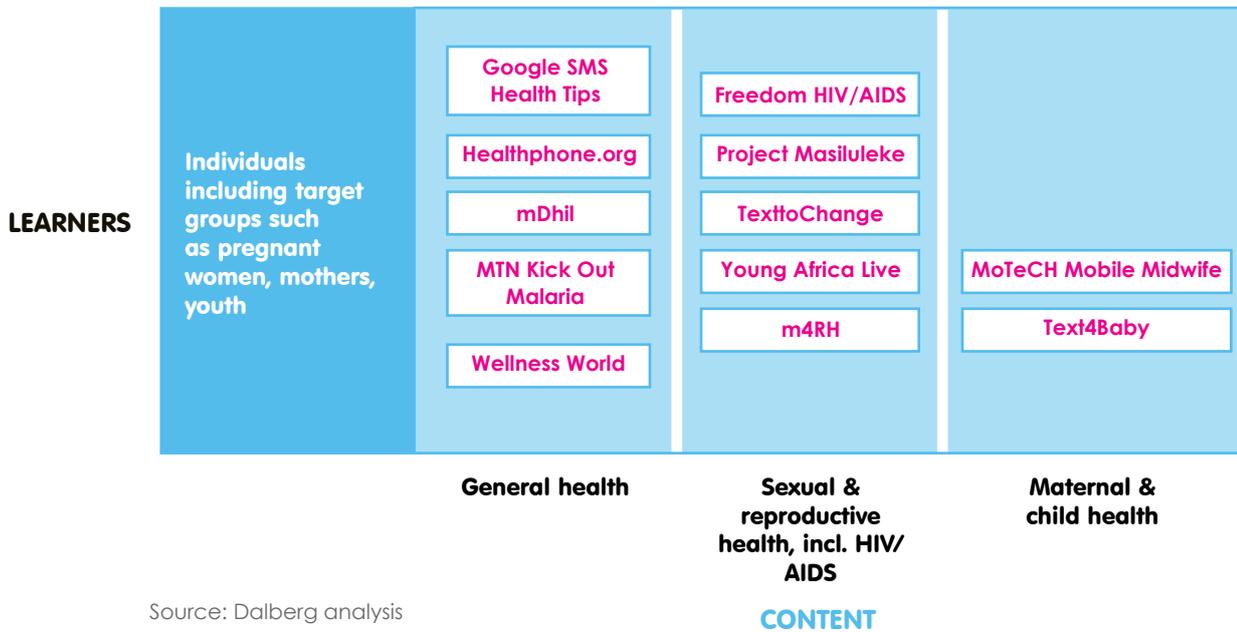
Most of the initiatives for healthcare workers

have delivered the content on smartphones, and usually provided the devices to the targeted workers. Some of the content – streaming or downloading of training videos, video conferencing, connecting to other medical professionals via social networking media, and so on – may be capable of delivery to feature phones as well as smartphones. Some of the mHealthEd applications for healthcare workers, and most of those for individuals, use relatively simpler content – such as audio messages, audio conferences, text messages and reminders, and simple surveys – and are, or could be, delivered on regular phones via voice calls, SMS or USSD.



Source: Dalberg analysis

Exhibit 5: Identified examples of mHealth Education services for health workers, plotted to show the types of learners and the types of content delivered.



Source: Dalberg analysis

Exhibit 6: Selected examples of mHealth Education services for individuals, grouped by the primary topic of the health information content.

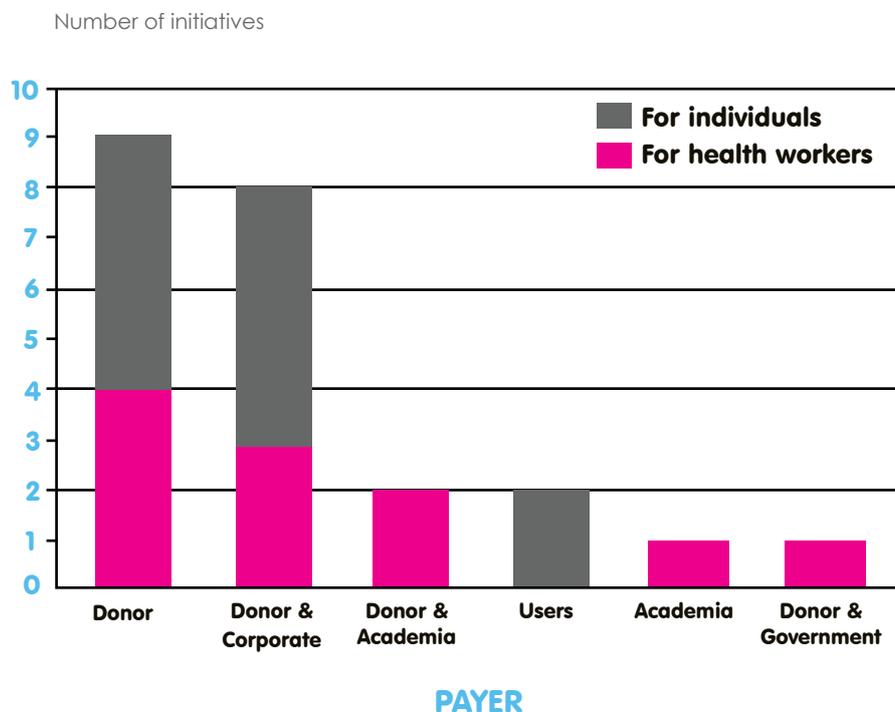


# Impact and financial models for mHealth Education initiatives

With many applications only recently launched, and many operating only at small scales, it is impossible at this stage to assess in any formal way the impact of the current applications on health outcomes. This will be resolved over the next few years through randomized control trials currently being planned by Johns Hopkins, Grameen Foundation and others. In the meantime, anecdotal evidence suggests that mHealthEd applications are having multiple benefits. They are improving training of healthcare workers, especially community-based workers – and there is ample evidence that improved training of health workers leads to improved care and better health outcomes. Applications for individuals are increasing levels of knowledge about health issues among the targeted populations. Mobile applications are clearly cheaper than alternative approaches to training

and disseminating information; however it is hard to identify cost savings from the current wave of applications because most involve providing additional support and information to healthcare workers or individuals rather than replacing existing services.

Philanthropic capital is financing the field of mHealth Education today and models for financial sustainability have yet to emerge. As illustrated in Exhibit 7, the majority of mHealth Education applications studied were financed by donors, often along with subsidies or CSR support from mobile operators, handset manufacturers or other companies. Looking forward, it seems likely that the main source of revenue for mHealthEd applications for healthcare workers would come from sales to governments and relevant educational institutions who want to offer the applications to the workers they employ or train. Some applications may be able to partly or fully finance themselves through fees (possibly packaged with tuition and training fees), or even through advertising.



N = 23  
Source: Organizational websites; Dalberg interviews

Exhibit 7: Sources of funding for mHealth Education initiatives studied.



## Case Studies

## Case Study – Millennium Villages Project: continuous education and refresher learning for community health workers

The Millennium Villages Project (MVP) is a community-led effort that aims to achieve the Millennium Development Goals in the poorest, most remote places in Sub-Saharan Africa, and beyond, through an innovative model. As part of the overall economic and social development plan, community health workers, most of whom are members of the local community, are responsible for 100-250 households each, conducting house visits, using paper forms to report information, and providing routine and preventative health

services. Despite the integral role they play in MVP, they often receive little medical training, and their knowledge is rarely reinforced after training.

Telecommunications corporation Ericsson, together with mobile carriers Airtel Bharti (formerly Zain) and MTN, is working with MVP to bring mobile communications and Internet access to the fourteen MVP sites in ten African countries, in total reaching close to half a million people. Ericsson is providing the broadband communications infrastructure to MVP, enabling communities to remotely connect with medical services, education, and social networks which otherwise might not be accessible.

Ericsson, in conjunction with MVP, is also developing locally relevant applications such as health worker training. One



such programme is aimed at supporting continuous education and refresher learning for community health workers currently in Dertu, Kenya; Mwandama, Malawi; Mbola, Tanzania; Ruhiira, Uganda; and Bonsaaso, Ghana. Content is adapted from the community health worker training manual and converted into a file format that is readable on a Java-enabled mobile phone. The modules help to reinforce community health worker learning in family planning, reproductive health, care for newborns, malnutrition, diarrhea, and infectious diseases. Community health workers can select their module of interest from a menu. At the end of each module, the community health workers can test their knowledge by answering multiple choice questions and getting immediate feedback on the answers. There are also optional case studies that can be used to test knowledge.

While promoting a sustainable business model and building the capacity of local community communication, Ericsson also aims to contribute to economic growth by stimulating higher levels of education, improved health services, and reduced poverty. Ericsson has also included environmental protection measures, using renewable energy to run its network, which reduces reliance on dirtier energy sources, as well as reducing operating costs. The Mobile Innovation Centre works closely with local people to find out what is needed and at what scale, increasing the centre's understanding of market dynamics among the poor and across remote areas of Africa around the specific technologies proven to have positive social impact.

Initial indications show that community health workers find the modules easy to access. Community health workers report that having a mobile reference point eliminates the need to carry a heavy manual or constantly call a nurse for support. Initial feedback also shows that community health workers wanted more quiz questions in their module-end evaluation. One problem is the small storage capacity of the phones, limiting the length and number of

modules that can be stored, particularly for non-English versions. As content evolves, it will need to be updated but this cannot be done remotely, a challenge that will need to be addressed. The fact that not all phones have the Java technology required to download the modules could also limit the project's reach.



## Case Study – TulaSalud: distance learning teleconferences for nurses in remote regions of Guatemala

More than 75% of indigenous people in Guatemala live in poverty – a number which has not decreased despite significant increases in average incomes. Health outcomes mirror the poverty indicators; the highest maternal mortality rates are found among the rural, poor, indigenous populations who often live in remote areas with very limited access to healthcare.

In 2003, the Guatemalan Ministry of Health and the National School of Nursing of Cobán with the support of CIDA, and the Tula Foundation began training culturally-appropriate healthcare workers to live, study, and work with indigenous populations.

Nurses are now trained in rural health centres using low-cost high-efficiency information and communication technologies. The majority of these nursing students are themselves indigenous peoples from remote rural communities, and they return to provide services near their homes. They speak the local languages and understand the complexities of interaction between traditional and Western medicine. Over time, the centres began to provide education, training, and curative care to rural communities on the margins of Guatemala's health care system.

Since 2004, ENEC and TulaSalud have been offering a community auxiliary training programme via distance education to indigenous students from seven departments of Guatemala. The students are linked for distance training classes with their teacher at the nursing school through the internet provided by TulaSalud.



Many of the nurses returned to their communities and found they were asked to perform procedures far beyond their knowledge and skill levels. Those with cell phones called their health centres or their teachers. This sparked a new programme to use TulaSalud's community health workers, known as tele-facilitadores, to use mobile phones to: (i) get help from doctors in diagnosing and making decisions; (ii) receive calls from people in their communities seeking care; (iii) organize logistics and transportation for emergencies; and (iv) refer patients to hospitals and follow up to ensure they received care.

TulaSalud is then also able to: (i) monitor disease outbreaks in real time based on the data aggregated from patient consultations through EpiSurveyor, (ii) send text message alerts and reminders to tele-facilitadores using FrontlineSMS, (iii) evaluate the productivity of tele-facilitadores working in the field, and (iv) deliver remote health training via mobile-based audio conferencing. Christy Gombay from TulaSalud said, "Now everyone is talking about technology. Get the right people into the right place and it will grow organically -- we picked students who wanted to have an impact on their community."

TulaSalud was initially funded by a grant from the Tula Foundation in Canada and from CIDA. Seeing the programme's positive results, the government started to fully subsidize the fees of all teachers for these auxiliary nurse students, and other local

donors continue to fund the operational costs of some of the training centres. To date, 500 new community auxiliary nurses have graduated from the programme, and more than 95% are working close to their home communities. ENEC is currently training a new cohort of 450 students. The success of this programme spawned a distance education programme for certifying auxiliary nurses to become technical nurses; there are currently 200 students enrolled in this 3-year programme. Christy Gombay from TulaSalud said, "Some health centres have said that they are the best trained nurses they have ever had because they are from those areas and training by distance gives them the practical and theoretical grounding."

The project is showing excellent results: community health workers have been instrumental in epidemiological surveying (for example providing training for H1N1 early detection in 2009), community training in health issues like nutrition and HIV/AIDS, and community-based health planning for emergencies. Initial results have been impressive in 2010: over 31,000 consultations and more than 590 patients transferred to health centres, approximately 450 of which were high-risk pregnancies. In the Department of Alta Verapaz, maternal mortality fell from 260 per 100,000 births in 2006, the highest in the country, to 203 in 2010 with no maternal deaths where the tele-facilitadores are working.

## Case Study – AED-SATELLIFE: mobile health information system library for healthcare workers in South Africa

Rochelle Gelandt is a registered nurse at the Livingstone Hospital Wellness Clinic in Port Elizabeth, South Africa. Due to a shortage of doctors, the duty of providing health care to the poorest populations often falls to nurses like Gelandt. When complex cases come up, nurses need advice and information to decide on the appropriate response. But only 11% of South Africa's population has Internet access and only 1% has broadband, so healthcare workers, particularly in rural settings, often have no way to get online. Leela McCullough from AED- SATELLIFE said, "In a 2006 pilot project in South Africa that tested the usefulness of HIV/AIDS information on mobile devices, we found that doctors had enough information but nurses were hungry for it. Targeting clinical nurses in our 2009 project, it was clear that they did not have access to most of the health information on the Eastern Cape Department of Health's website." They were thus unable to look up references in real time for patient evaluation, share information on complex cases, and keep abreast of epidemics.

AED-SATELLIFE designed and implemented the Mobile Health Information System (MHIS) project to provide nurses at three urban hospitals in Port Elizabeth with clinical information on smartphones at the point of care. They created an electronic library of over 4,500 pages, including continuing provider materials such as digitized South African medical treatment guidelines, protocols, diagnostic tools, drug formulas, and content from health journals. The MHIS Library was created using a software tool called GUIDE which converts large documents to an optimized format for viewing on smartphones, and then loads into the main memory of the phones and the micro-SD card for backup purposes.

Through the MHIS, nurses can simply launch the mobile library interface from an icon on the main screen of the smartphone. (The nurses were also trained to use email, SMS, and search the Internet.) McCullough said,

"The nurses were initially apprehensive at the training, so we started with playing an electronic game on the phone. Only two weeks later they were already asking for specific and specialty guidelines that they needed."

The pilot programme was funded by the John M. Lloyd Foundation, Henry E. Niles Foundation, and Qualcomm's Wireless Reach Initiative. Collaborating partners included the Eastern Cape Department of Health, MTN, Nelson Mandela Metropolitan University, and South Africa Partners. Once the project has been fully tested, AED-SATELLIFE says it would like to see the tool used in every hospital. "We want the hospitals to institutionalize this and streamline the tool in the same way they would support the purchase and maintenance of a microscope. There is a lot of political will and support," Berhane Gebru said. "The programme needs smartphones because of data storage needs, but with the negotiating power of the Department of Health, they can obtain them at a lower cost."

According to an evaluation conducted by the Nelson Mandela Metropolitan University, 82% of nurses said they were more confident answering questions at the point of care, and 89% indicated that their nursing practice was enhanced. Of the initial group of nurses, 68% had little or no computer training, but 81% said they found it easy to find and read content on the mobile device. The nurses also reported that the project generated a pattern of knowledge-seeking behavior and learning, with nurses increasing communication with medical colleagues both within South Africa and internationally via email. All of the surveyed nurses said they will continue to use the Mobile Library and tools after the pilot programme ends, and 92% said they would be willing to buy their own mobile device to access the information.

"Since I was introduced to the device in January 2009, I have been using it on a daily basis – the device as well as the mobile library loaded on it," said Gelandt. "I love that I can access health information at the point of care, as I do not always have the time to go to the library. The device is loaded with so much relevant and interesting content that it is hard not to want to read more."

## Case Study – Health Education and Training in Africa (HEAT) programme pilot in Ethiopia

The HEAT in Africa programme aims to transform the way in which healthcare education is delivered and in which health workers are supported in communities across Africa, and is currently considering ways to use mobile phones to accelerate the training of these health workers. The pilot programme is a partnership between the Ethiopian Federal Ministry of Health (FMOH), the Regional Bureaus, the UK's Open University (OU), UNICEF, WHO and AMREF. As part of a national programme formed at the request of the Minister of Health, the programme is supporting the FMOH's aim to upgrade the skills of its 31,000 Health Extension Workers (HEWs) through "blended learning" in order to ensure that the programme can be delivered with consistent quality nationwide with minimum disruption to the delivery of village health services. "There is no disconnect between theory and practice. It's all integrated because they do training and work at the same time. HEWs used to be trained at residential colleges, away from their communities. There was significant variation in the content delivered by each of these colleges. Now the national curriculum has been standardized and most HEWs will be studying in their communities, using the same high quality learning resources" said Lesley-Anne Long, director of HEAT.

HEAT is modeled on the successful Teacher Education in Sub-Saharan Africa (TESSA) initiative, a web portal with extensive audio and text materials covering the core areas of primary education, and which is now being accessed and used by nearly 400,000 primary school teachers in 12 African countries. Distance-learning resources to meet enhanced occupational standards have been developed by Ethiopian educators, supported by the Open University's HEAT Programme team. The materials are designed as open educational resources and are freely available for anyone to access, adapt and use.

"The uniqueness of HEAT and TESSA is that they were developed in African countries with the help of reviewers and the OU, versus being modeled on a Western curriculum," said Long. The modules are freestanding materials that can be integrated into existing training programmes or used to create new ones, as in Ethiopia. As open source material, they can be taken and adapted to local needs and circumstances in other countries and regions. The access portal is easily downloaded so the information can be printed in cases where Internet connectivity is unreliable or unavailable. Since mobile coverage is poor in Ethiopia, the possibility of using discrete components of the training will be explored in other countries.

The HEAT programme in Ethiopia is being funded through a UK£250,000 grant from the Ferguson Trust and a US\$4 million grant from UNICEF, which cover the costs of the pilot, curriculum development costs, student costs, tutor fees, and clinical equipment and supplies. Once the Open University has secured additional grant funding, it intends to expand the programme to six more countries: Zambia, Tanzania, Rwanda, Ghana, Kenya and Nigeria. Funding will go towards recruiting staff to engage with governments, to adapt, update and translate material, and to support programme planning, implementation and monitoring and evaluation.

The HEAT pilot was launched in the first quarter of 2011 with 1,000 students, 100 distance learning tutors, and 100 practical skills tutors from six regions of Ethiopia. There are plans to add 3,000 students to the programme in the second quarter of 2011, and thereafter to register larger numbers of students until all of the current 31,000 healthcare workers have been upgraded. Based on the success of TESSA, the HEAT programme is expected to increase the knowledge and skills of health extension workers, help health supervisors to support distance education programmes, and increase the number of experts able to develop distance education learning resources. Governments and other partners have already begun to show interest in adopting the programme as well as expanding it to other health professionals.

## Case Study – African Medical and Research Foundation (AMREF): distance learning for nursing registration in Kenya

Getting a place at one of the few nurse training schools in Kenya is very difficult. Too many applicants vie for too few places. Consequently, most of Kenya's 20,000 nurses (more than 85% in 2005) are trained only at certificate level and do not have a Registered Nurse's diploma. Classroom-based training for the nursing diploma was limited; only 100 of the 20,000 nurses could qualify each year, leaving Kenya with 1 registered nurse per 27,000 people.

Anne Kamene, who was an enrolled nurse at the Kangundo District Hospital in Kenya's Eastern Province, said: "I tried twice but both times I was not selected. Then in 2006, I saw an advertisement in the newspaper for a diploma nursing course by eLearning."

AMREF, the Nursing Council of Kenya, Kenyan Ministry of Health, Accenture, and the Kenya Medical Training Colleges teamed up to develop a training programme that shifts the emphasis from traditional classroom-based teaching to "paper-based" distance learning and eLearning. The partnership developed four computer-based training modules that are being delivered through more than 100 eLearning centres by 400 tutors and mentors – reaching nurses in the most remote areas of Kenya. Unlike traditional training, the eLearning programme is flexible, enabling students to learn anytime and anywhere, without the need to stop working while they acquire new skills.

The programme uses mobile phones to provide students with academic reminders via text messaging, and for accessing telephone tutorials. AMREF is now testing whether mobile phones can be used to distribute selected eLearning materials to students via mobile phone using a Java application.

The various components of learning were funded by Accenture (eLearning Nurse Upgrading Programme) and the Flying Doctors Society of Africa and the Fresenius Foundation (AMREF Virtual Nursing School). Students are required to pay the fees to the nursing institutions they are studying with, and these amounts vary slightly per institution. Public institutions charge up to \$486 per module, while private and faith-based organizations can charge up to \$846 and \$692 per module, respectively. Some employers such as Kenyatta National Hospital are now funding their employees.

Between 2005 and March 2011, over 7000 students have enrolled in the eLearning programme. In Kangundo Hospital, programme-trained nurses were reported to be more motivated, knowledgeable, and proactive. As the training programme built nurses' general professional capacities (for example, by training them on computer use), they took on duties previously performed by doctors, which in turn helped doctors focus on their own core responsibilities. The work of administration was also lessened since the nurses need less supervision. Time savings are realized through fewer meetings needed to explain procedures. The end result is an improvement in overall patient care. Whereas patients used to stay for up to a month in the wards, the maximum stay is now 14 days. The wards are less congested and doctors can concentrate on other patients.

Kamene said: "I [now] interact a lot with the patients and give them more attention than I used to. Even the doctors respect us. Before, we were just there to follow instructions, but after seeing what we're able to do, they listen to us and even consult us."

The Registrar of the Nursing Council of Kenya states, "We are proud of the programme, as nurse managers are reporting an improvement in the quality of nursing care. With improved nursing care, we are confident of our contribution in steering our country towards meeting the health-related MDGs." The programme's success in Kenya has also led to interest in replicating it in other African

countries. According to Dr. Peter Ngatia, Director of Capacity Building for AMREF, "This programme is not only going to drastically improve the health care of Kenya, it is

already being replicated by the Ministries of Health in Uganda and Tanzania with support from AMREF— and the impact on Africa's health system will be enormous."



# Beyond the First Wave: How to Maximize the Potential for mHealth Education

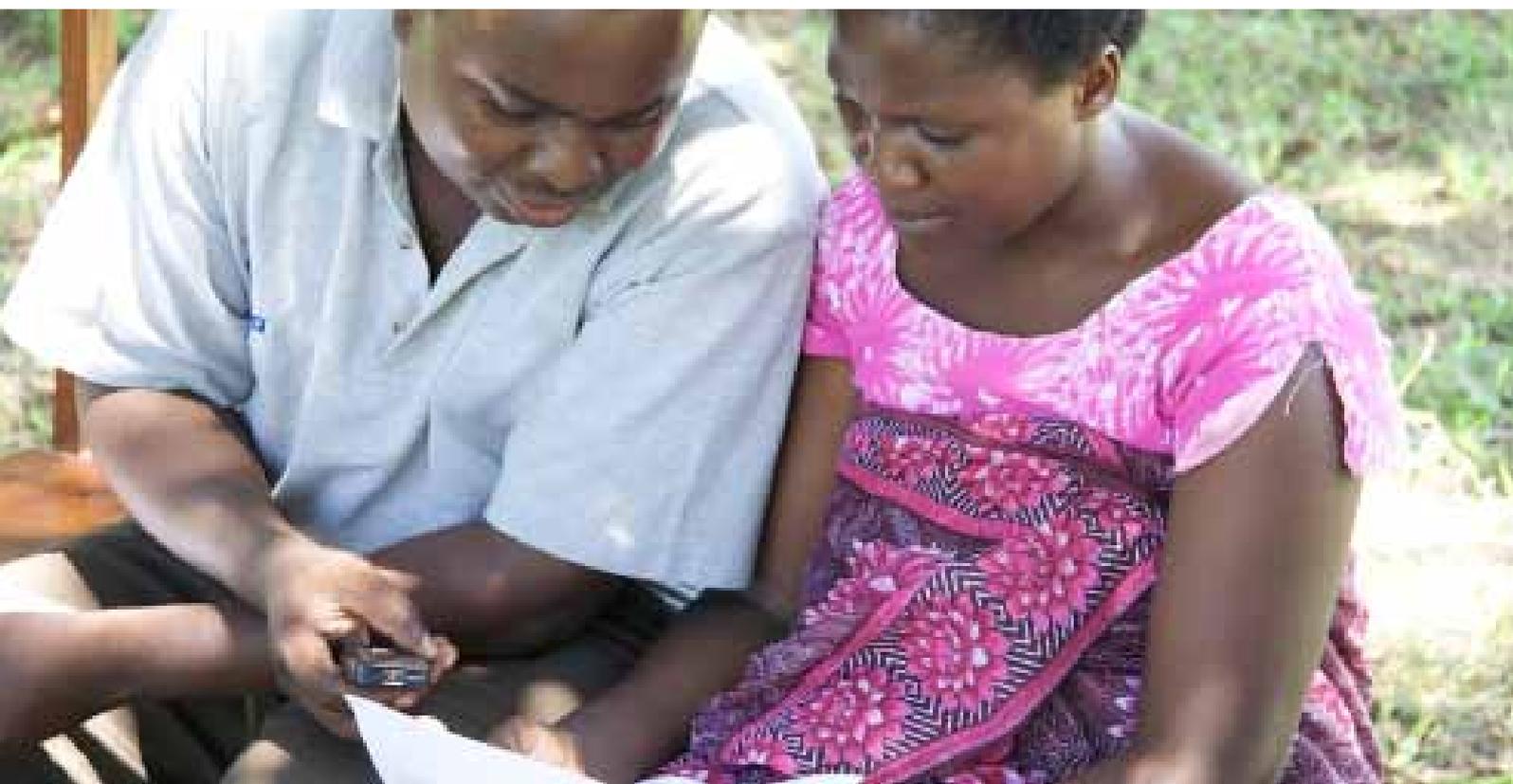
## Adopt a systematic approach

mHealth Education is only getting started, but there is enough promise to merit a more systematic approach to exploring opportunities and developing solutions. This systematic approach should include work on needs identification, on content development, on standards and formats for platforms, and on business models. Most importantly, it needs to tie mHealthEd work to national health strategies, and especially to plans for strengthening health systems and for developing healthcare human resources.

Initiatives to date have sought to address specific opportunities identified by particular organizations in particular contexts. It could be useful to review existing national healthcare human resource plans, and conduct further research on key training and learning needs for different categories of healthcare workers in different countries, to

identify gaps between needs and the current training and learning provided, and to pick out the areas where there is both a gap and a high likelihood that a mobile application could help. Likewise, new applications for individuals should be targeted towards identified critical knowledge gaps among affected populations.

There is a wealth of content for health worker training and learning, but much work needs to be done to make it suitable for mobile applications. Both the Millennium Villages Project and FrontlineSMS noted the challenge of designing, managing, and delivering content despite working from preexisting community health manuals. Given the similarities in topics about which most healthcare workers need to learn, there would be real value in a coordinated approach to reviewing existing content, validating its educational value, and converting the most useful sets of materials into a shared meta-library with appropriate formats and multiple languages, so that new efforts don't have to create new content. Of course, this baseline of pre-existing content would need to be refined for each country, to reflect the health priorities and country context as directed by the government's health experts.



As with most technologies, there could be real benefits to all from agreeing on common standards and formats for applications, content storage, and so on. Such standards and formats would facilitate the involvement of telecoms and education industry players, who could engage with governments, NGOs and funders to define and develop platforms.

Grants have financed the majority of mHealth Education applications to date, so there are not yet many proven models of financial sustainability. A variety of paths to sustainability may be possible. For mHealthEd applications for healthcare workers, the most likely is that government ministries or health worker training institutions will be willing to pay for mHealthEd applications that demonstrate the ability to enhance quality significantly and/or reduce the time or cost to train a healthcare worker. Some applications may be directed at students interested in supporting their own learning and certification. Mobile operators or device manufacturers may be willing to offer to provide mHealth Education-related services or devices for free to healthcare workers, or to facilitate health information campaigns with free or low-cost rates, either as part of larger contracts with government or private healthcare institutions or as part of their corporate social responsibility programmes.

### **Promote collaboration between actors and stakeholders**

Real benefits could come from increasing collaboration among the relevant actors in mHealth Education, to implement a systematic agenda along the lines of that presented above, to design, develop, test and deploy new mHealthEd applications, and to share best practices and learnings with each other as the field develops. The actors should include governments, healthcare institutions, academia, content creators, mobile operators, device manufacturers, NGOs, philanthropists and investors. Different members of the coalition

would, of course, have different roles to play. Governments have the responsibility in their countries to set national health strategies and healthcare workforce development plans, establish relevant policies to govern and support mHealthEd (including, for example, facilitating the use of content developed in other countries), and decide on which mobile applications to roll-out at scale. NGOs, content developers and mobile industry companies need to collaborate to develop applications, and also to evaluate pilot efforts so that the most effective models can be identified. Donors and investors are needed to provide financing for testing and rolling-out new ideas. Mobile operators provide the capacity for voice, text messaging and data, and can promote mHealth Education through subsidies or pricing plans which facilitate scaling up of mHealthEd initiatives.

### **Aim for scale**

The goals for mHealth Education must be ambitious. The challenges which mHealth Education seeks to meet are great, in particular improving the training of 2.1 million current healthcare workers and supporting the training of perhaps 2.6 to 3.5 million new workers. And the 2015 deadline for achieving the Millennium Development Goals is only a few years away. The mantra cited by Gustav Praekelt, whose foundation developed the Young Africa Live portal, is apt: "Don't do it unless you can reach at least one million people". Therefore, the focus should be on quick deployment of the most promising innovations as part of national health strategies and healthcare workforce development plans, on carefully selecting any pilots based on their likelihood to be scaled quickly, and not so much on building extensive portfolios of pilot programmes.

# List of mHealth Education Initiatives Studied

## Applications for healthcare workers

Initiative	Location	Primary Partners	Description
African Medical and Research Foundation (AMREF): distance learning for nurses	Kenya, Uganda	Nursing Council of Kenya, AMREF, Accenture, the Kenya Medical Training Colleges, several private and faith-based nursing schools, Kenya Ministry of Health	AMREF is exploring the integration of mLearning into its existing eLearning curriculum which aims to accelerate the training of nurses from certificate to diploma level. As a complement to the Virtual University training, AMREF has also developed a mobile website for nurses to access information about ART treatment protocols and is currently piloting the use of mobile based peer-to-peer learning for nursing students.
eMOCHA: electronic mobile open-source comprehensive health application	Afghanistan, Uganda, United States	Johns Hopkins Center for Clinical Global Health Education	In addition to data collection and communication tools for health workers, the eMOCHA application provides multimedia courses and lectures (recorded in MP4 format), followed by quizzes to test users' knowledge of the information. Results are submitted to a central server for further analysis on the impact of the courses.
ENACQKT: Enhancing Nurses Access for Care Quality and Knowledge through Technology	Barbados, Dominica, Dominican Republic, St. Lucia, St. Kitts and Nevis	University of Saskatchewan, IDRC	ENACQKT nurses use PDAs in publicly funded hospitals to improve care for patients with hypertension, diabetes, HIV and AIDS. Nurses use the PDA to access preloaded material including policy and procedure manuals, a medication handbook, laboratory diagnostics, a symptom-interpretation program, critical-thinking tools, and a medical calculator; and they feed back data to a central computer.
FrontlineSMS: Learn	Uganda	Johns Hopkins Program for International Education in Gynecology and Obstetrics (JHPIEGO), USAID-funded SHOPS program, Abt Associates, Marie Stopes International	JHPIEGO, in partnership with Marie Stopes International and Abt Associates, uses FrontlineSMS, a free open source software, to support knowledge retention for trained health workers. JHPIEGO is currently piloting the platform to prompt SMS based responses and quizzes on family planning modules after a training in Uganda.

HealthLine	Pakistan	Carnegie Mellon University, Aga Khan University Pakistan, Health and Nutrition Development Society (HANDS), Microsoft Research through the Digital Inclusion Initiative, Siebel Scholars Foundation, Pakistan-US Science and Technology Cooperative Program	The HealthLine project is an information access system for health workers, to help them fill gaps in their knowledge. Piloted in 2008, health workers can call a toll-free number and learn about a variety of topics through audio transmission in their native language.
Health Education and Training in Africa (HEAT) Programme	Ethiopia	Ethiopian Federal Ministry of Health, OU HEAT team, AMREF, Allan and Nesta Ferguson Charitable Trust, UNICEF, WHO	HEAT is a comprehensive online knowledge bank of learning resources that can be freely accessed by anyone – individuals, organizations training community health workers and global health institutions – and is currently exploring the use of mLearning for distribution. The materials are designed to be easily downloaded for printing and distribution particularly in regions where connectivity is unreliable or not yet available. In Ethiopia, HEAT delivers training for CHWs across the country.
Millennium Villages Project (MVP): continuous education for health workers	Ghana, Kenya, Uganda, Tanzania, Malawi	The Earth Institute at Columbia University, Ericsson, Millennium Villages Project, Sony Ericsson	The Millennium Villages Project is building on their existing mHealth initiatives (Child-Count+) to introduce applications that create access to health manuals and reinforce training on topics ranging from family planning, reproductive health, care for newborns, malnutrition, diarrhea and infectious diseases. Questions are linked to a central database where information can also be used for monitoring and supervisory support.
AED-SATELLIFE: Mobile Health Information System (MHIS)	South Africa	AED-SATELLIFE, Eastern Cape Health Department, MTN, Nelson Mandela University, Qualcomm Wireless Reach, Universal Service and Access Agency of South Africa (USAASA)	AED-SATELLIFE designed a management health information system (MHIS) which provides health workers with locally relevant, reliable and accurate clinical information at the point of care through smartphones pre-loaded with a library of pertinent resources. The library of information includes digitized medical guidelines, protocols, diagnostic tools, drug formularies and other actionable, evidence-based clinical content drawn from publicly available information sources.

Mobile IMCI	Peru	DataDyne.org, Ministry of Health in Peru, Pan American Health Organization (PAHO/OPS), Adventist Development and Relief Organization (ADRA), Zoltnner Consulting Group	The Mobile IMCI programme sends text messages to nurses and community health workers to reinforce key elements of the IMCI curriculum. Using a series of quizzes and follow-up tests, trainers can determine if the reinforcement texts help health professionals retain the information, with the expectation that better informed care-givers will lead to better health outcomes for children.
Moodle	Peru	Institute of Tropical Medicine Alexander von Humboldt (IMTAvH) in Lima, Institute of Tropical Medicine (ITM) in Antwerp, Ministry of Health Peru, REACH Initiative-Tibotec	In a pilot study, smartphones were distributed to twenty physicians loaded with a set of 3D learning scenarios simulating interactive clinical for a continuing medical education program lasting three months. A mobile educational platform supporting learning events (Moodle) tracked learning progress of participants, who were assessed through multiple choice mobile quizzes at the end of each module.
TulaSalud	Guatemala	Ministry of Health, National School of Nursing Coban, Tula Foundation, and the Centre for Nursing Studies Canada	TulaSalud is a Guatemalan NGO using mLearning solutions to provide distance education and auxiliary nurse training in Guatemala. TulaSalud's goal is to support to Ministry of Health and the National School of Nursing to improve health services to the rural population, using e-health and m-health. TulaSalud's programs allow students and teachers to download videos onto mobile phones and play back on various devices including televisions. Post-graduation, students can continue to use the phones to receive remote diagnostic and decision support from urban physicians as well as to conduct community learning sessions with external experts.

## Applications for individuals

Initiative	Location	Primary Partners	Description
<b>General Health</b>			
Google SMS – Health Tips	Uganda	Grameen Foundation, AppLab Uganda, Google, MTN Uganda, Marie Stopes Uganda, Straight Talk Foundation	SMS based service that allows users to access information on healthcare.
Healthphone.org	India	Mother and Child Health and Education Trust	Audio service to help communities and health workers access information on issues such as timing births, safe motherhood and HIV. Information is in English and 15 Indian languages.
mDhil	India	mDhil	Uses SMS and web to deliver interactive healthcare information and daily health tips on sex, fitness, diet, etc. through web and mobile.
MTN Kick Out Malaria	South Africa	MTN, Medical Research Council of South Africa, FIFA, Praekelt Foundation	'Please Call Me' SMS based quiz use to educate the general public about malaria.
Wellness World	India	Handygo Technologies, Uninor, Indian Hospitals including VidyaSagar Institute of Mental Health & Neurosciences (VIMHANS), GM Modi Hospital, Jaipur Golden Hospital	Interactive Voice Response (IVR) and Short Messaging Service (SMS) platforms to deliver daily information to Uninor subscribers on health-related issues.
<b>Sexual &amp; reproductive health (incl. HIV/AIDS)</b>			
Freedom HIV/AIDS	India, Kenya	ZMQ Systems, House of Learning, Delhi State AIDS Control Society, Hivos, Manufacturers Association for Information Technology, Mobile4Good, Reliance, Times Foundation	Cricket, soccer and other mobile games designed to create HIV/AIDS awareness.
Project Masiluleke	South Africa	iTeach, Praekelt Foundation, Frog design, MTN South Africa, Pop!Tech, Nokia Siemens Networks, National Geographic Society	Uses 'Please Call Me' messages to provide referral to the National AIDS Helpline.
Text to Change	Kenya, Uganda	Text to Change, Zain, AIDS Information Center in Uganda	General HIV/AIDS quiz and workplace policy programme using SMS to create HIV/AIDS and health awareness.
Young Africa Live	South Africa	Praekelt Foundation, Vodafone Live/Vodacom, Traffik, Matchboxology, iTeach, Cell-Life, Mindset	Mobile entertainment portal designed to engage youth on topics of general and sexual health.

m4RH	Kenya, Tanzania	Text to Change, Family Health International, Marie Stopes	Automated SMS based system that provides access to family planning information.
<b>Maternal &amp; child health</b>			
MoTeCH MobileMidwife	Ghana	Grameen Foundation, Grameen AppLab, Bill & Melinda Gates Foundation, Columbia University's Mailman School of Public Health and the Ghana Health Service	Java-based information service that delivers time-specific voice or text messages to pregnant mothers and their partners and families before and after childbirth. MoTeCH also helps community health workers to identify women and newborns in their area in need of health-care services and automate the process of tracking patients who have received care.
Text4Baby	United States	National Healthy Mothers, Healthy Babies Coalition (HMHB), Voxiva, CTIA - The Wireless Foundation and WPP, Johnson & Johnson, WellPoint, Pfizer, CareFirst, BlueCross BlueShield, White House Office of Science and Technology Policy, US Department of Health & Human Services, US Department of Defense Military Health System, BabyCenter, Danya International, Syniverse Technologies, Keynote Systems, George Washington University, MTV	SMS based mobile information service designed to promote maternal and child health.

## List of Interviews Conducted

Name	Title/Responsibility	Organization
Aker, Jenny	Assistant Professor of Development Economics & non-resident Fellow Centre for Global Development Fellow	Fletcher School, Tufts University Centre for Global Development, Project ABC, Niger
Banks, Ken	Founder	Kiwanja.net & FrontlineSMS
BonTempo, James	Learning Technology Advisor	Johns Hopkins Program for International Education in Gynaecology and Obstetrics (JHPIEGO),
D'Elia, Nicola	mApps and Innovation Manager	GSMA Development Fund
Das Gupta, Trina	mWomen Programme Director	GSMA Development Fund
Gebru, Berhane	Director of Programmes	AED-SATELLIFE
Gombay, Christy	Director	TulaSalud
Hellström, Johan	PhD student; Author of SIDA mLearning Report	University of Stockholm
Jacobs, Rachel	Consultant (former Director of Strategy and Planning )	Lead Growth and Innovation (Mc Graw Hill)
Kaonga, Nadi	mHealth Programme Associate	Millennium Villages, Earth Institute, Columbia University
Keisling, Kelly	Coordinator	mHealth Working Group (formerly Johns Hopkins)
Kelly, Tim	Lead ICT Policy Specialist	InfoDev
Ladd, Holly	Vice President and Centre Director	AED-SATELLIFE
Long, Lesley-Anne	Director of Health Education and Training (HEAT) Programme	Open University
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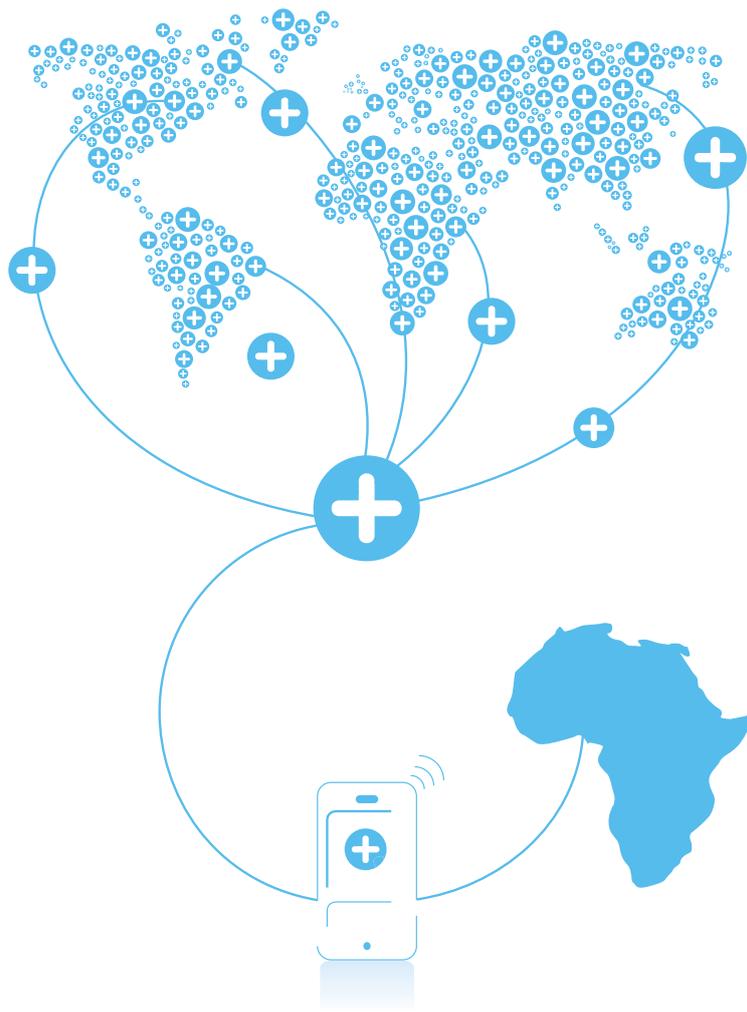
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