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mHEALTH COMPENDIUM

VOLUME 5

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Cover photo taken in Zambia and supplied by Akros.

mHEALTH COMPENDIUM

VOLUME 5

The authors' views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

African Strategies for Health (**ASH**) is a five-year project funded by the United States Agency for International Development (USAID) and implemented by Management Sciences for Health (MSH). ASH works to improve the health status of populations across Africa through identifying and advocating for best practices, enhancing technical capacity, and engaging African regional institutions to address health issues in a sustainable manner. ASH provides information on trends and developments on the continent to USAID and other development partners to enhance decision-making regarding investments in health.

June 2015

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This compendium was produced in collaboration with the US Agency for International Development's Africa Bureau (USAID/AFR) by the African Strategies for Health (ASH) project implemented by Management Sciences for Health (MSH). Funded by USAID/AFR, the overall objective of ASH is to contribute to improving the health status of populations across Africa through identification of and advocacy for best practices, enhancing technical capacity, and engaging African regional institutions to address health issues in a sustainable manner. ASH provides information on trends and developments across the continent to USAID and other development partners to enhance decision-making regarding investments in health.

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Our thanks also go to the people and organizations whose mHealth applications are featured in this paper. They are pioneers in creative and useful mHealth applications that are designed to improve health systems and achieve health goals. We realize that there are many more people worldwide who are actively involved in mobile applications for health. While time and budgetary constraints did not permit a more extensive review, we would like to acknowledge them for their own contributions to the field.

Acronyms

API	application programming interface
ASH	African Strategies for Health
BCC	behavior change communication
CHW	community health worker
CHMI	Center for Health Market Innovation
HIP	high-impact practice
HIS	health information system
ICT4D	Information and Communication Technologies for Development
ITU	International Telecommunication Union
MCH	maternal and child health
MOH	Ministry of Health
MOHFW	Ministry of Health and Family Welfare
MSH	Management Sciences for Health
mTERG	Mobile Health Technical and Evidence Review Group
PDA	personal digital assistant
SMS	short message service
USAID	United States Agency for International Development
USAID/AFR	United States Agency for International Development's Africa Bureau
WHO	World Health Organization

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This fifth volume of the mHealth compendium offers project descriptions, publication references, and contact information for making further inquiries.

When using in a PDF format, resources and contacts can be accessed with a simple click on the email or website address appearing in both text and references.

Linda Suttenfield, Pathfinder, Haiti

Around the world, the mobile phone has become ubiquitous, making mHealth applications an important tool with which to impact the health of all.

EXECUTIVE SUMMARY

Mobile health (mHealth) is the provision of health services and information via mobile and wireless technologies. The mobile phone has become ubiquitous in Africa, making mHealth applications an important tool for impacting the health of Africans. When applied appropriately, mHealth can make real contributions to improved health outcomes. mHealth has the potential to address and overcome: (1) disparities in access to health services; (2) inadequacies of the health infrastructure within countries; (3) shortage of human resources for health; (4) high cost of accessing health; and (5) limitations in the availability of financial resources.

This fifth volume of the mHealth Compendium contains 41 case studies submitted by various implementing partners which document a range of mHealth applications being implemented mainly throughout Africa, but also in other regions of the world. In order to help USAID missions access relevant mHealth information, this compendium offers project descriptions, publication references, and contact information for making further inquiries. Each two-page case study developed by the implementing organization includes an introduction to the health area or problem; a description of the mHealth intervention highlighted; a description of any important results or evaluation findings; lessons learned; and conclusion. In addition, each case study includes a summary of the geographic coverage, implementation partners, donor name(s) and contact(s), as well as contact information for the implementing partner. The case studies in this compendium have been organized within five programmatic areas: Behavior Change Communication, Data Collection, Finance, Logistics, and Service Delivery.

The four previous volumes of the mHealth Compendium, which include a total of 116 case studies, can be downloaded at www.africanstrategies4health.org/resources.

Information on applications featured in the mHealth compendiums can also be accessed on ASH's online mHealth Database. The database facilitates a quick and targeted search for applications based on health area, application type, and location. Visit http://africanstrategies4health.org/mhealth-database.html to start your search.

INTRODUCTION

Mark Leong, WHO

Action Meningitis

What is mHealth?

mHealth is the use of mobile and wireless technologies to support the achievement of health objectives. mHealth can be utilized for a wide variety of purposes, including health promotion and disease prevention, health care delivery, training and supervision, electronic payments, and information systems. A 2009 global survey conducted by the World Health Organization (WHO) in 114 member states found that 83 percent of them were implementing mHealth services that fell into 14 distinct categories: health call centers, emergency toll-free telephone services, managing emergencies and disasters, mobile telemedicine, appointment reminders, community mobilization and health promotion, treatment compliance, mobile patient records, information access, patient monitoring, health surveys and data collection, surveillance, health awareness-raising, and decision-support systems. The five volumes of the mHealth Compendium feature mHealth case studies representing each of these 14 categories. For the purposes of this compendium mHealth includes mobile phones, personal digital assistants (PDAs), tablets, mobile applications, and wireless medical devices.

The Rapidly Evolving mHealth Landscape

The mHealth landscape is consistently and increasingly evolving. This is driven by a powerful combination of factors, including rapid advances in mobile technologies and applications, increased opportunities for interoperability and integration across mHealth and eHealth interventions, and the continued growth in mobile cellular network coverage. According to International Telecommunication Union (ITU) 2014 estimates, there are nearly seven billion mobile subscriptions worldwide with more than five billion of those subscriptions in low- and middle-income countries. With mobile technologies accessible to 95.5 percent of the world population, many believe that mHealth has the potential to transform the face of health service delivery across the globe by offering new means of when, where, how, and by whom health services are provided and accessed.

Evidence for mHealth

Although still limited, the amount of evidence around the effectiveness or efficacy of mHealth interventions is rapidly increasing. In recent years, there has been a significant upsurge in mHealth-focused health outcomes research—including several studies published in the Lancet—and reviews that aimed to synthesize the evidence. Additionally, the mHealthevidence.org website which was developed in order to address the core challenge of a limited evidence base, currently contains more than 6,000 peer-reviewed or grey literature on mHealth evidence.

mHealth at Scale

While the vast majority of mHealth interventions are currently implemented in either pilot programs or at limited scale, a growing number of mHealth systems are reaching significant scale and/or being adopted by national governments, including ministries of health (MOH). If scale is defined as one million or more users if the application is patient/population facing and 1,000 or more users if the application is health system facing, the following mHealth programs would be considered implemented at scale:

- RapidSMS-MCH for improving maternal and child health in Rwanda (MOH managed and used by more than 45,000 community health workers)
- MomConnect in South Africa (adopted and led by the MOH)
- mCHTS in India (MOH adopted)
- Ananya in Bihar, India (currently serving a population more than 104 million and planned adoption by the Ministry of Health and Family Welfare, or MOHFW)
- mTRAC in Uganda (MOH adopted)
- MOTECH in Ghana (MOH adopted)
- C-Stock in Malawi (MOH adopted)
- MAMA in Bangladesh (MOHFW adopted)
- MAMA in South Africa
- TIBU in Kenya (linked with national health information system, or HIS)
- SMS for Life in Tanzania

Many of these mHealth programs have been featured in previous volumes of the mHealth Compendium or other mHealth publications and resources (see Other mHealth Tools and Resources).

Standards for mHealth

One of the most promising aspects of mHealth is its potential for enhancing the smart integration of health services and the continuity of care across provider, place, and time by making information available at the right place and the right time. Strengthening patient management and health systems in this fashion can only be achieved if the various mHealth and HIS platforms have sufficient common ground to reliably exchange messages in a way that minimizes errors and misunderstandings. Known as interoperability, this ability of diverse systems and organizations to communicate and work together (interoperate) requires the establishment of and adherence to standards. Much like speaking a common language enables communication, using common standards for how data is structured and exchanged enables mHealth platforms and HIS to share data.

mHealth interventions are significantly more powerful when health sector actors make their information systems interoperable. Through close cooperation, governments, donors, and private health care providers can achieve interoperability by applying the same standards. Donors can champion interoperability by requiring it as a condition of their funding for mHealth interventions. These actions will maximize the power of mHealth as a tool for coordinating individual, patient-level services and public health programs.[1,2]

Key Success Factors and Lessons Learned for mHealth Project Implementation

The following set of principles represents a concerted effort by donors to capture the most important lessons learned by the development community in the implementation of information and communications technology for development (ICT4D) projects. Having evolved from a previous set of implementer precepts endorsed by over 300 organizations, these principles seek to serve as a set of guidelines that are meant to inform, but not dictate, the design of technology-enabled development programs.

The current version of principles has been developed in consultation with the Bill & Melinda Gates Foundation, US Agency for International Development (USAID), UN Children's Fund, World Bank, Swedish Agency for International Development, Omidiyar Foundation, US State Department, UN High Commissioner for Refugees, World Food Programme, UN Population Fund, UN Development Program, Global Pulse, UNWomen, and the UN Office for the Coordination of Humanitarian Affairs.

Principles for Digital Development

1. Design with the User

- Develop context-appropriate solutions informed by user needs
- Include all user groups in planning, development, implementation, and assessment
- Develop projects in an incremental and iterative manner
- Design solutions that learn from and enhance existing workflows and plan for organizational adaptation
- Ensure solutions are sensitive to, and useful for, the most marginalized populations: women, children, those with disabilities, and those affected by conflict and disaster

2. Understand the Existing Ecosystem

- Participate in networks and communities of like-minded practitioners
- Align to existing technological, legal, and regulatory policies

3. Design for Scale

- Design for scale from the start, and assess and mitigate dependencies that might limit ability to scale
- Employ a "systems" approach to design, considering implications of design beyond an immediate project
- Be replicable and customizable in other countries and contexts
- Demonstrate impact before scaling a solution
- Analyze all technology choices through the lens of national and regional scale
- Factor in partnerships from the beginning and start early negotiations

4. Build for Sustainability

- Plan for sustainability from the start, including planning for long-term financial health, e.g. assessing total cost of ownership
- Utilize and invest in local communities and developers by default and help catalyze their growth
- Engage with local governments to ensure integration into national strategy and identify high-level government advocates

5. Be Data Driven

- Design projects so that impact can be measured at discrete milestones with a focus on outcomes rather than outputs
- Evaluate innovative solutions and areas where there are gaps in data and evidence
- Use real-time information to monitor and inform management decisions at all levels
- When possible, leverage data as a by-product of user actions and transactions for assessments

6. Use Open Standards, Open Data, Open Source, and Open Innovation

- Adopt and expand existing open standards
- Open data and functionalities and expose them in documented application programming interfaces (APIs) where use by a larger community is possible
- Invest in software as a public good
- Develop software to be open source by default with the code made available in public repositories and supported through developer communities

7. Reuse and Improve

- Use, modify, and extend existing tools, platforms, and frameworks when possible
- Develop in modular ways, favoring approaches that are interoperable over those that are monolithic by design

8. Address Privacy and Security

- Assess and mitigate risks to the security of users and their data
- Consider the context and the needs for privacy of personally identifiable information when designing solutions and mitigate accordingly
- Ensure equity and fairness in co-creation, and protect the best interests of the end-users

9. Be Collaborative

- Engage diverse expertise across disciplines and industries at all stages
- Work across sector silos to create coordinated and more holistic approaches
- Document work, results, processes, and best practices and share them widely
- Publish materials under a Creative Commons license by default, with strong rationale if another licensing approach is taken

Neelu Singh

More information on the Principles for Digital Development can be found at http://ict4dprinciples.org

BBC Media Action

Other Key mHealth Tools and Resources

USAID and its implementing partners have developed a number of useful tools and resources for mHealth project implementers. The following list presents a short summary of selected tools and resources:

Databases

- The mHealth Evidence Database: This database includes searchable peer-reviewed and grey literature on mHealth effectiveness, cost-effectiveness, and program efficiency, enabling software developers, researchers, program managers, funders, and other key decision-makers to quickly get up to speed on the current state-of-the-art. (www.mhealthevidence.org)
- African Strategies for Health mHealth Database: A database of more than 100 mHealth projects and applications previously featured in the mHealth Compendiums. Information can be filtered by type of application, health area, and location. Use the database to learn about the interventions, how they address specific health areas or problems, important results or evaluation findings and contact information for both implementers and donors. (http://africanstrategies4health.org/mhealth-database.html)
- mRegistry.org: A global mHealth repository of the WHO's mTERG, which provides a way for projects to submit descriptions of their mHealth approaches and to be assigned a Unique ID for mHealth implementations related to reproductive, maternal, and child health. (www.mregistry.com)
- The GSMA mHealth Tracker: A customized tool which collates mobile health products and service around the globe. It tracks solutions in both the planning phase and those which have been commercially deployed. (www.mobileworldlive.com/mhealth-tracker)
- Center for Health Market Innovation (CHMI): With over 1,000 programs listed, the CHMI provides a downloadable database of health innovations, including mHealth. Programs can be filtered by program type, health focus, country, target population, legal status, reported results, funders, and technology used. (http://healthmarketinnovations.org/programs)

Training

- mHealth Basics: Introduction to Mobile Technology for Health: A new, free, self-paced eLearning course available on the USAID Global Health eLearning Center that provides an introduction to mHealth and an

overview of best practices for mHealth solution development. (http://www.globalhealthlearning.org/course/mhealth-basics-introduction-mobile-technology-health)

- TechChange's mHealth—Mobile Phones for Public Health: This four-week online certificate course focuses on building mHealth skills that revolutionize approaches to patient care and management, point-of-care support, health education, remote monitoring, diagnostics, supply chain management and logistics and more. This paid course is offered at least once a year. (https://www.techchange.org/online-courses/)

Guidelines and Toolkits

- National eHealth Strategy Toolkit: A WHO-ITU guide to help governments, ministries, and other stakeholders develop and implement a national eHealth vision, action plan, and monitoring framework. (www.itu.int/pub/D-STR-E_HEALTH.05-2012)
- The Integrating Mobiles into Development Projects Handbook: This handbook is intended as a practical and actionable guide to help USAID staff consider the challenges that can impede the realization of a more sustainable and equitable future powered by mobile technology and other digital solutions, and to think critically about when and how to deploy mobile solutions. (www.usaid.gov/sites/default/files/documents/1861/M4DHandbook_August_2014.pdf)
- Call to Action on Global eHealth Evaluation: A consensus statement of the WHO Global eHealth Evaluation Group Meeting held in Bellagio, September 2011. (www.ghdonline.org/uploads/The_Bellagio_eHealth_Evaluation_Call_to_Action-Release.docx)
- Forming Successful Partnerships with Mobile Network Operators: This GSMA insights paper analyzes qualitative research findings and outlines common norms and tactics for successful social sector/operator partnerships and informs a set of best practices to increase the social sector's understanding of how to successfully work with operator partners for mutual benefit. (http://www.gsma.com/mobilefordevelopment/partnerships-insights-paper)
- An mHealth Planning and Implementation Guide: How to Integrate Mobile Technology into Health Programming: An interactive online guide intended for global health practitioners working to implement mHealth solutions in family planning and reproductive health programs and beyond. (www.k4health.org/toolkits/mHealth-planning-implementation-guide)
- Making the Journey from Cash to Electronic Payments: A Toolkit for USAID Implementing Partners and Development Organizations: This toolkit was created for nongovernmental relief and development organizations to guide them in their journey of transitioning from using cash payments to electronic payments in all operational and program payment streams. It is intended to be practical, easy to follow, bite-size, sectional, with guidance on sequencing (ie. some sections are linear while others may be concurrent.) (http://solutionscenter.nethope.org/programs/c2e-toolkit)
- mHealth Field Guide for Newborn Health: Developed by the CORE Group, this guide that explains how mHealth serves newborn health through referral and tracking of mothers and infants, decision support for community health workers (CHWs), CHW supervision, scheduling and tracking postpartum and postnatal visits, and teaching and counseling for mothers and families. (www.coregroup.org/resources/420-mhealth-field-guide-for-newborn-health)
- mHealth: Mobile Technology to Strengthen Family Planning Programs: Commissioned by the USAID High Impact Practices (HIPs) in Family Planning series, this brief highlights evidence in mHealth and family planning programs to date and synthesizes lessons learned for implementation of mHealth programs. (www.fphighimpactpractices.org/resources/mhealth-mobile-technology-strengthen-family-planning-programs)
- Why Your ICT4D Work Plan Needs Design and Requirements Analysis: This NetHope blog post discusses the methods, roles, and skills needed for strategic design of information and communications technology for development (including mHealth) projects. (http://solutionscenter.nethope.org/blog/view/why-your-ict4d-work-plan-needs-design-and-requirements-analysis)
- GSMA mHealth Resources: A website to browse resources by topic (where applicable), region or type, such as case studies, presentations, research, and white papers. (www.gsma.com/mobilefordevelopment/programmes/mhealth/resources)
- mHELP: The mHealth Expert Learning Program (mHELP) is a non-profit organization that provides support and technical assistance to governments, the private sector, and non-governmental organizations in low- and middle-income countries that wish to implement electronic health (eHealth) and mobile health (mHealth) into their health programs. The website houses various resources including guides and toolkits. (http://mhelp.hingx.org/Project/Details/1396)

HELP Project

How to Use the mHealth Compendium

This mHealth Compendium contains 41 studies submitted by various implementing partners which document a range of mHealth applications being implemented mostly throughout Africa, with several implemented in other regions. While there are a number of existing databases with information on the many pilots being undertaken worldwide, these are often cumbersome and sometimes difficult to navigate. The authors envision that a compendium like this one is particularly needed with regard to mHealth where there is a plethora of activities being funded at the country level. In order to help USAID missions access relevant mHealth information, this compendium describes some of the major mHealth applications being utilized in Africa.

While each two-page case study does not offer an exhaustive description of all aspects of each application, it does offer enough information for those interested in learning further about innovative mHealth applications in the region.

The case studies in this compendium fall under five programmatic areas: Behavior Change Communication, Data Collection, Finance, Logistics, and Service Delivery. While it is acknowledged that some of these interventions can be classified into more than one area, the authors of the compendium have tried to highlight the range and versatility of mHealth as a tool in improving health and well-being. Each of these five programmatic areas is briefly described here.

Behavior Change Communication (BCC)

mHealth interventions are frequently utilized for community mobilization, awareness-raising, education, and demand-creation. It has been reported that mHealth BCC interventions are the most predominant of all mHealth interventions and also the most successful. This is because current interventions center on the use of low-cost SMS texts to reach various audiences. Important short-term behavior changes have been observed, though modest.[3]

Data Collection

Data collection and surveillance can be enhanced by utilizing mobile communication and personal data devices. Instead of sending paper forms, data can be sent more quickly and reliably through electronic methods. This has been shown to increase reliability, make data more readily available (especially data from remote areas), and enhance the quality of the data submitted. Throughout Africa, mHealth applications have been used for a variety of data collection activities, from routine reporting to large national surveys.

In order to help USAID missions access relevant mHealth information, this compendium describes some of the major mHealth applications being utilized in Africa.

Finance

Mobile money applications are increasingly used in Africa to facilitate payment for health services and other expenses associated with seeking care for both private patients and clients enrolled in various community health programs. These mobile money applications allow registered users to load money into their accounts, make transfers to other users (both registered or not), and withdraw money. While registration for these services is almost always free, transactions have a predetermined fee which is often covered by the specific health program or implementing partner supporting the intervention. Examples of how mHealth applications have been utilized include provision of vouchers for family planning clients to access counseling and services, as well as antenatal services, delivery, and postnatal services at participating hospitals.

Logistics

Availability of high-quality logistics data has been one of the greatest challenges facing the health care system. Without this data, decision-makers cannot adequately manage the supply chain, risking the possibility that patients won't receive the medicines they need. Increasingly, mHealth applications are being utilized to address this issue. Most of these applications allow a lower-level health facility to transmit information regarding their supply of essential medicines to the higher-level facility or warehouse which then provides the commodities. In some cases, these applications have even been utilized by CHWs to ensure they have the basic supplies needed.

Elana Fiekowsky, Angola

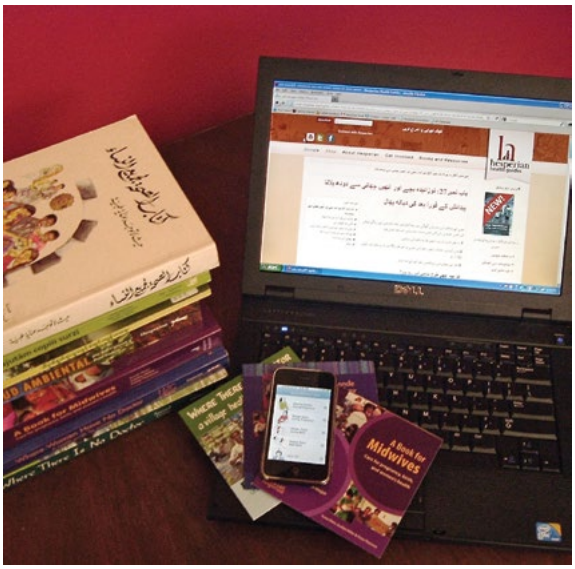
Service Delivery

Mobile phones have been used to improve the quality of and access to health care service delivery in myriad ways. Applications have been developed that assist health care workers in diagnosing and treating patients, such as the use of phone-based treatment algorithms and SMS reminders to follow up on clients' laboratory results and other services. mHealth has been successfully used to train and retrain health workers. Phone-based applications have also been developed to promote adherence to medications, provide notification of results, and remind patients to keep appointments.

Sala Lewis, Pathfinder, Tanzania

BEHAVIOR CHANGE COMMUNICATION

Meagan Demitz



Hesperian

HESPERIAN HEALTH**WIKI**

IMPLEMENTATION DATE: October 2011 to Present

Increasing access to mHealth and eHealth information in Africa

In most African nations, there is less than one physician per 1,000 people. Instead, community health workers (CHWs) are often the first line of defense against illness, and globally CHWs prevent a death once every three seconds.[1,2] To build up the skills and capacities of primary health care systems, CHWs, and lay people, Hesperian Health Guides created the HealthWiki, an online source of clear, actionable, and thorough health information.[3] With a lightweight, searchable format, the HealthWiki is accessible via computer or mobile device, and allows users to browse eight free volumes of health information on a range of topics, including family planning, early childhood development, first aid, noncommunicable diseases, environmental health, and disabilities. The HealthWiki has been online since October 2011 and has since been translated into 12 languages. By tracking the use patterns of users through Google Analytics, we may observe the health information-seeking behavior of end users to inform future content development and translation initiatives, and also compare the Pan-African health information-seeking behavior with global trends in HealthWiki use.

About HealthWiki

The HealthWiki was developed using MediaWiki software, an easy-to-use platform which allows local translation partners to perform content updates. Originally built using English-language content, content in other languages is being added using English pages as templates. Presently 1,186 English-language pages are available and 433 pages are available in widely-spoken languages in Africa (Arabic, Portuguese, French, and Swahili).

Since 2011, the HealthWiki has had 9 million page views by 4.8 million people. Demand increased from 128,914 views/month in January 2014 to 912,983 views/month in January 2015, when 60 percent of users visited via mobile device. These increases appear to be linked to wider availability of translated content in the HealthWiki, as well as website modifications which have made the HealthWiki mobile-friendly. A 2014 impact evaluation done in collaboration with New

York University reveals that the HealthWiki content has a 'multiplier effect'—the average HealthWiki user shares information accessed on the site with 21 people, with most using content for health worker training (29 percent), self-care (19 percent), community health (19 percent), and family health (13 percent).

In 2014, two pilot projects were launched in Africa to further the HealthWiki's reach. In South Africa, with support from the Bill and Melinda Gates Foundation, Hesperian partnered with two libraries (Msunduzi Municipal Library in Pietermaritzburg, Georgetown branch, and Bessie Main Library in KwaZulu-Natal) to encourage patrons to access eHealth information on library computers. Portal home pages tailored to local libraries were established to facilitate navigation and access. In Tanzania, with support from K4Health, Kiswahili health content was translated for the HealthWiki and an online hub was created as a forum for health educators to exchange health materials.

Evaluation and Results

Last year (March 15, 2014–March 14, 2015), 110,390 people in Africa visited the HealthWiki, with visitors in Africa comprising 5 percent of the 3.6 million users worldwide. The most popular content was related to reproductive health, maternal and child health, and digestive issues, consistent with global trends in information-seeking behavior of HealthWiki users. Although African visitors make up a relatively low percent of HealthWiki users as yet, compared to other regions the number of African users accessing the HealthWiki increased dramatically during 2014, with a 748 percent increase in visitors from 2013. Sixty-six percent of these were mobile visits.

This increase appears to be correlated with the increase in number of translations available, as well as the library partnerships in South Africa. Materials in Kiswahili, French, and Portuguese were launched within the last year—and other global trends in HealthWiki use have demonstrated that the dramatic increase in HealthWiki users in the past year has been tied to increased amounts of translated content.

In South Africa, 22,085 individuals accessed information on the HealthWiki during the past year, compared to only 2,168 visitors from South Africa in the previous year. The page most visited by South African users is the Georgetown Branch Library landing page for the HealthWiki, making it clear that this increase is directly linked to the library. Of the total visitors to the HealthWiki in South Africa, 15,829 visited via mobile device, which suggests that once users have accessed content in the library, they go on to access the HealthWiki again, independently, via mobile device.

Lessons Learned

- Libraries may be a good vehicle for targeting and popularizing mHealth and eHealth initiatives, and can also be used to support local health campaigns. Data from the South African library project also indicates that these initiatives may encourage individual usage outside of these institutions and drive significant increase in access.
- Expanding the amount of accessible content and making it available in local languages is likely to increase use of eHealth- and mHealth-delivered information in the region.
- Usage statistics are very much an indicator of the digital divide. The top three performing African counties (Egypt, Kenya, and South Africa) in the HealthWiki were among the top five most digitally connected countries in Africa, which each have 46 million, 21 million, and 25 million Internet users respectively.[4]
- Trends in web traffic highlight health topics of Pan-African interest, as well as local concerns.

Conclusion

While the number of HealthWiki users in Africa remains significantly lower than other regions, the recent increase in HealthWiki users points to an opportunity to increase access to easy-to-understand health information, especially when translated into local languages. Hesperian plans to expand content in French, Portuguese, and Kiswahili, and launch content in Chichewa and other languages. Moreover, usage information collected about user interests can be used to determine priorities for new mHealth and eHealth applications.

Partnerships with libraries, schools, and other public institutions with digital infrastructure offer great potential for rapidly increasing the reach in Africa of both eHealth and mHealth resources. The fact that digital health information is shared with 21 people by the average HealthWiki user suggests that this is an effective strategy for disseminating health information to reach beyond those who have access to mobile devices. ■

Geographic Coverage: Global

Implementation Partners: Hesperian Health Guides; COBEHISA; Msunduzi Municipal Library in Pietermaritzburg, Georgetown Branch and Bessie Main Library in KwaZulu-Natal (South Africa); TALC; UnaMesa Association

Donors: Bill & Melinda Gates Foundation, Rockefeller Foundation, K4Health

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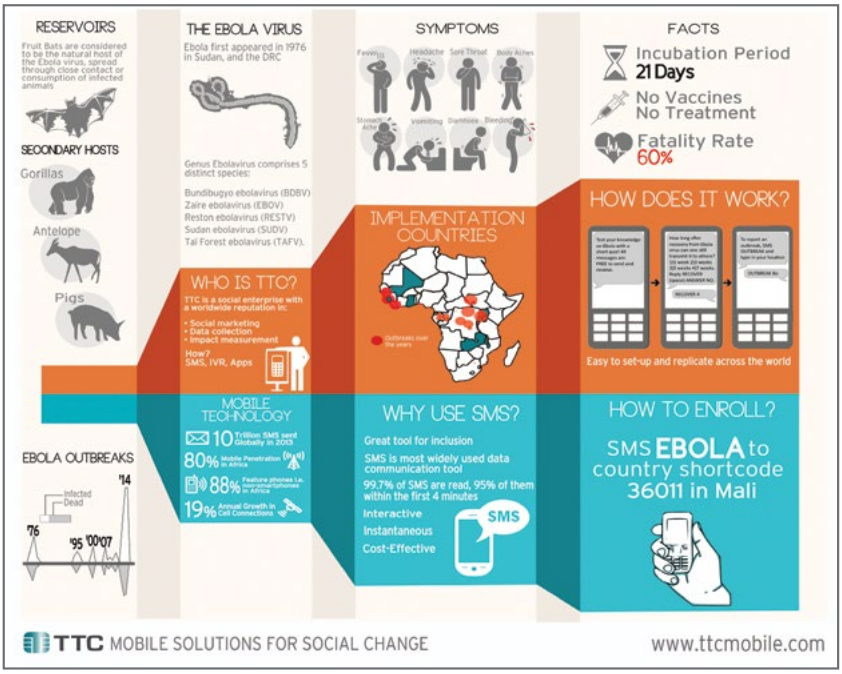

Citizens can report suspected cases using their mobile phones, and can access resources to locate and ascertain available capacities of health clinics.

EBOLATXT

IMPLEMENTATION DATE: September 2014 to March 2015 (ongoing in Sierra Leone)

Using SMS for social mobilization and reporting on the Ebola outbreak

The recent Ebola outbreak resulted in thousands of deaths due to a lack of knowledge and misinformation about containing the virus. EbolaTxt was conceived from Text to Change (TTC)'s experience in other health-related campaigns. EbolaTxT provides contextualized, personal, accurate, and reliable information about Ebola in times of crisis through the use of short message service (SMS), an instantaneous, interactive, and cost-effective tool to reach people quickly. The aim of EbolaTxT is to prevent the spread of the Ebola virus. Due to the interactivity of EbolaTxT with other platforms in mobile phones, it can be used for improving awareness or education. Citizens can report suspected cases using their mobile phones, and can access resources to locate and ascertain available capacities of health clinics. The scalability of EbolaTxt enables it to be deployed across five countries within four months. TTC's in-house SMS platform Vusion can reach a number of people, primarily also through TTC's connection with different mobile providers in multiple countries.

About EbolaTxt

In the fight against Ebola, mobile phones can save lives. Access to mobile phones enables community members to gain life-saving information, even in some of the poorest regions. Leveraging on high mobile penetration, TTC has launched several large-scale, interactive SMS campaigns since September 2014 in Sierra Leone, Mali, Ghana, Uganda, and Malawi to enable awareness-raising, social mobilization, and reporting on the Ebola outbreak. The interactivity of EbolaTxT ensures that community members are truly involved and the contextualized content makes sure that they understand important information about Ebola.

In Mali, EbolaTxt was promoted through flyers that were distributed in strategic locations across markets, bus stations, schools, health centers, and other busy areas. In other countries, TTC has launched a radio and marketing campaign using different radio stations to mobilize people to participate. The right communication mix is necessary to tell people about EbolaTxT and let them know that participation is free of charge.

Participants can opt into an interactive quiz using the keyword EBOLA and are then prompted through a set of

educational questions on the disease. Participants receive further informative messages on prevention, control, and treatment. As there is currently no known treatment or vaccine, prevention and control of Ebola is focused on raising awareness regarding risk factors of Ebola infection. An example is shown below as it relates to the use of improving hygiene, one of the best ways to fight the virus.

Evaluation and Results

In EbolaTxt campaigns in Malawi, Ghana, and Mali, TTC has reached and interacted with 30,000 individual participants. Since the first case of Ebola was detected in Mali, there was an increase of over 65 percent of participants requesting information about Ebola from their own mobile handsets in just a few days. The campaign in Sierra Leone aims to reach over 50,000 unique respondents and is ongoing as of March 2015. Follow-up text messages were sent and TTC's call centers were to be used for phone interviews in Mali to measure the impact of the campaign among the participants by testing their knowledge levels.

The incoming responses from TTC's interactive campaign are useful for monitoring and reporting so that respondents can be contacted for additional information. This way, the results for EbolaTxT are useful for policymaking by local authorities and human-interest organizations working in the affected areas. TTC is currently liaising with governments so as to establish a rapid monitoring and reporting system to facilitate the health networks in rapidly identifying outbreaks and responding to them swiftly and effectively.

Lessons Learned

- Importance of local context in disseminating messaging: During the outbreak, unfounded fears and rumors spread quickly and widely. Due to the sensitivity of the messages, their script and format need to be well-designed and discussed with all partners, taking into consideration cultural beliefs and traditions of certain villages and tribes. Together with local experts, colleagues, and partners, TTC ensured that citizens received the appropriate information in the appropriate language to protect themselves and prevent dangerous misunderstandings.
- Interactivity is a win-win situation. Due the interactivity of TTC's campaigns, data gathered was used for comparative analyses, to measure effectiveness of campaigns, current knowledge levels, prevalence of health-related myths, etc. For example, questions on Ebola enabled TTC's partners to find out the current knowledge level of Ebola awareness among community members. This created opportunity for partners to improve their understanding of the target groups and resulted in increased effectiveness of their work.

Conclusion

The most innovative aspect of EbolaTxT is the way it maintained simplicity and the use of technology best fit for the target population. Communication success is greatly influenced by context, therefore it is important to know the target audience to make sure that the right message reaches the right people at the right time.

However, certain challenges in implementation remain: initial hesitation from the Ministry of Health in Mali was a result of ensuring that messaging does not create panic among citizens. It took some time to assuage concerns that messages with the right context can dismiss fears instead. In Mali, EbolaTxT was also part of a larger distance-learning program to inform health professionals nationwide on major aspects of the disease as another measure of the national contingency plan.

Next steps include dissemination of information regarding reconstruction in actively hit areas in Sierra Leone. In countries where it was only a threat, the campaign will end as there is no longer a need. EbolaTxT showed that it is possible to attain scale during times of emergency if mobile technology is combined with the appropriate partners, the contextualized communication mix, and personalized content. ■

Geographic Coverage: Mali (Bamako and two health districts bordering Guinea), Sierra Leone, Ghana, Uganda, and Malawi (nationwide)

Implementation Partners: This awareness campaign is a collaboration of several partners within the Dutch Connect4Change consortium, including TTC, MUSO Ladamunen, CERTES, and International Institute for Communication and Development (IICD); Mali Ministry of Health; UNICEF/Sierra Leone; the Association of Church-Based Development NGOs (ACDEP) in Ghana

Donor: Dutch Ministry of Foreign Affairs

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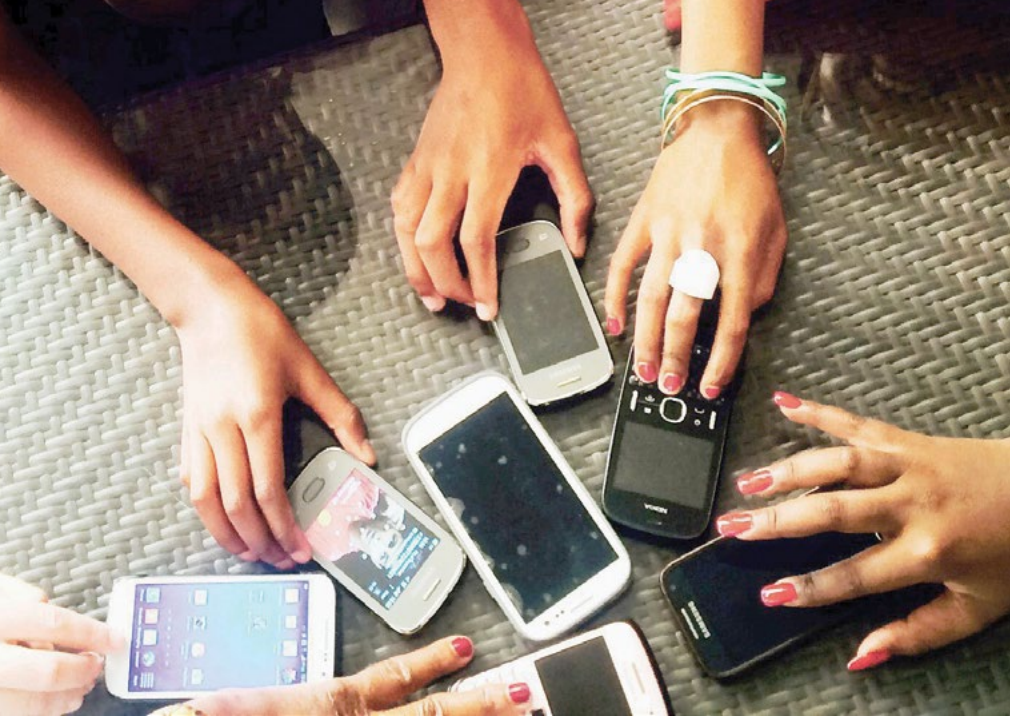

SHM Foundation

"I learned that I should not be afraid to talk about my feelings. Before I started in the group, I felt like I was different to other people."
—*Khuluma participant*

PROJECT **KHULUMA**

IMPLEMENTATION DATE: December 2013 to February 2015

Creating mobile phone support groups for HIV-infected adolescents in South Africa

There is growing awareness that HIV/AIDS-affected and -infected adolescents may be at increased risk of mental health problems and distress.[1] Depression and anxiety are associated with noncompliance of medical treatment which, in turn, can further impact health. In South Africa, challenging home environments and stigma in the community weaken support structures at a crucial time when young people are navigating their developing sexuality and HIV status, as well as many other issues associated with adolescence.[2] Despite the need for more support structures for HIV-infected adolescents, such as support groups, in countries like South Africa it can often be challenging to provide them.[3] Challenges include stigma, discrimination, finding a space to run the support groups in often overcrowded hospitals and having adequately trained staff and the capacity to provide regular sessions. Furthermore, in many under-resourced contexts, individuals have to travel long distances to access health care facilities with limited access to transport. These opportunity costs may mean choosing not to attend support groups, which are often seen as "nice-to-have" rather than essential in facilitating compliance of treatment and providing support through the various related challenges of HIV/AIDS.

About Project Khuluma

Through the use of mobile phones, Project Khuluma facilitates peer-led support groups for HIV-infected adolescents aged 13 to 18 years old. Khuluma provides facilitated and interactive support to groups of 10 to 15 participants. Participants are able to communicate amongst themselves and with a facilitator via mobile phone—currently using short message service (SMS)—about a broad range of topics. The adolescents have the opportunity to provide direct input into the support they receive and can come up with topics that they want to discuss. Guest speakers are also invited into the groups to run facilitated discussions on specific topics such as sexual health, nutrition, or career advice. Each support group runs for three months. At the completion of each support group cycle, interested partici-

pants are invited to continue involvement in the project as peer mentors who will help with future groups. The project team provides these peer mentors with ongoing training, support, and supervision. A training tool, available as a mobile application, has been developed to assist the mentors.

Evaluation and Results

Project Khuluma is ongoing, and as of March 2015 was entering a phase of in-depth evaluation. Pre- and post-interviews have been conducted with each participant. The assessment is underpinned by the information-motivation-behavioral skills (IMB) model to assess changes in the areas of adherence motivation, knowledge of HIV, perceptions of internalized stigma, social support, adherence behaviors, and life skills.[4] As of March 2015, the project has worked with more than 100 adolescents, and has supported adolescents in Gauteng, Mpumalanga, and the Western Cape provinces in South Africa. Over 30,000 SMS messages have been sent among the participants, demonstrating the need of participants to discuss issues they share with others. Abandonment, discrimination, and fears of disclosure are among major themes discussed. Conversations about adherence are common, centering on why sometimes it is difficult to take medication. Other discussion topics have focused on encouraging and reminding each other to take their medications. Much of the communication so far has been related to information support primarily on HIV and sexual reproductive health.

Initial evaluation findings have been encouraging, with a significant increase in perceived social support and significant decrease in levels of internalized stigma and attributed stigma among the participants. There also appears to be a trend towards an increase in adherence self-efficacy. Khuluma participants have expressed how the project has given them the chance to connect with others who are in a similar situation to them on an emotional level.

Lessons Learned

- The Khuluma groups are currently run in English. Most participants have felt comfortable communicating in English, but some clearly would have found it easier to speak in their own language. Having facilitators who understand the other languages used, in addition to being competent in English, is valuable.
- To date, the project has provided participants with basic mobile phones. In the recruitment process and in the way that Khuluma promotes the project there has been some confusion with some participants thinking that they will receive a smart phone. This has led to some participants not actively participating in their group because they had different motivations. It is clear that more needs to be done to emphasize the true purposes of the group to potential participants, and to ensure that participants understand.

Conclusion

Khuluma offers support to adolescents that is accessible from any location, and simultaneously provides an opportunity to further explore the issues facing HIV-infected adolescents and how best to address them.

Going forward the SHM Foundation team implementing the project is working on models of sustainably financing the operating costs and expansion of the support groups, with a view to scaling up across South Africa and further development of the mentorship program. ■

Geographic Coverage: South Africa

Implementation Partners: The SHM Foundation; Kalafong Hospital; Steve Biko Academic Hospital; University of Pretoria; Kidzpositive; Groote Schuur Hospital; University of Cape Town

Donor: The SHM Foundation

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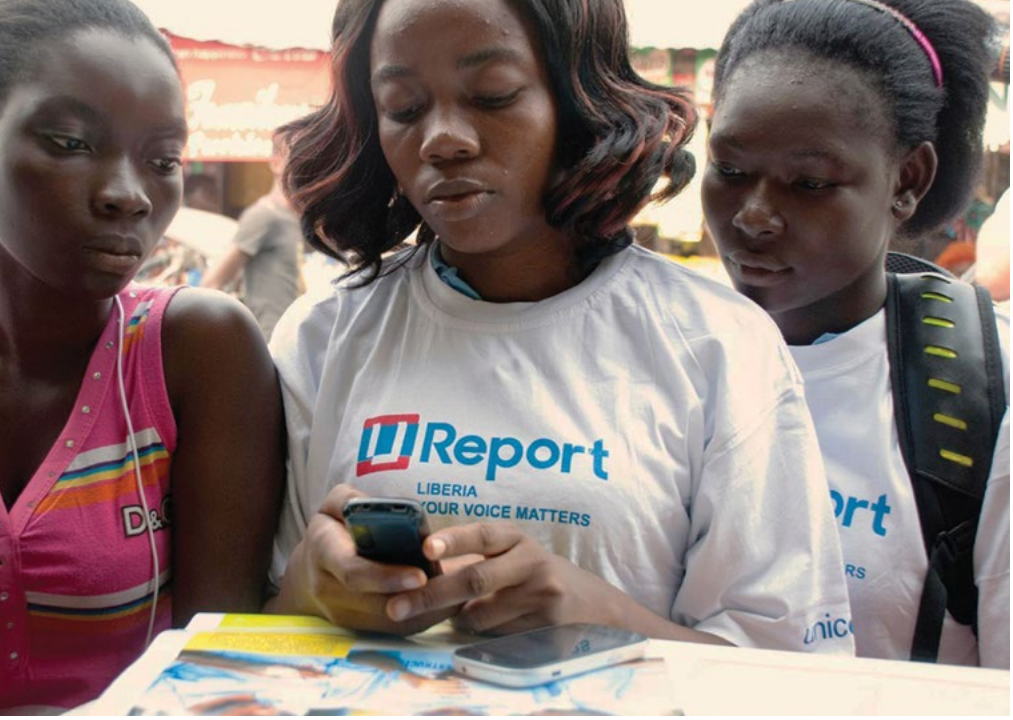


Mark Naftalin

The following SMS was sent to 46,000 U-Reporters: "Do you know how to prevent yourself from getting Ebola?" Out of those who responded, 38% had no knowledge.

U-Report: Fighting Diseases Across Borders

IMPLEMENTATION DATE: April 2014 to Present

Text-based youth engagement tool with real-time data analysis

During the Ebola outbreak of 2014, UNICEF identified a need to improve information communication flows between relevant government ministries and the affected communities. This need was identified in Nigeria, where U-Report already existed as a general SMS-based youth engagement platform, as well as in countries where it did not exist, such as Liberia and Sierra Leone.[1]

Once the need was identified, U-Report was used as an innovative solution that could be implemented relatively quickly and be community-led while supporting governments to combat the disease. In partnership with governments, the tool was used to understand knowledge gaps and provide necessary information to fill them, as had previously been done during Ebola outbreaks in Uganda in 2012. The application of lessons learned combined with the improved transferable SMS RapidPro technology underlying U-Report enabled swift implementation.[2,3]

About U-Report

U-Report is a social monitoring tool designed for youth and other community members to strengthen community-led development and citizen engagement. It uses community communication to identify health needs, raise awareness, identify health sector gaps, and establish a strong long-term system post-emergency. It provides a forum for youth empowerment, sends alerts to key stakeholders about the issues being faced in their communities, and feeds back useful information to the U-Reporters, so they are empowered to work for change and improvements in their localities.

As of April 2015, U-Report has been launched in 12 countries with over 650,000 young people participating as U-Reporters in Burundi, Democratic Republic of Congo, Indonesia, Liberia, Mali, Nigeria, Sierra Leone, Swaziland, Uganda, Zambia, Zimbabwe, and Central African Republic.

Application of the program to Ebola-affected countries included a twin strategy: (1) Utilize U-Report in Nigeria where over 100,000 young people were already engaged and some Ebola cases had been recorded; and (2) set up new U-Report programs in Liberia and Sierra Leone, build a user

base (called U-Reporters), and empower it with relevant information to combat the disease.

In Nigeria, the existing U-Report community was engaged to understand the level of knowledge around Ebola prevention. For example, the following SMS was sent to 46,000 people: "Do you know how to prevent yourself from getting Ebola?" Eight thousand people responded, 3,000 of whom had no knowledge. The results were mapped, providing UNICEF and the government with an approximate picture of where knowledge on Ebola prevention was most lacking. UNICEF was also able to assess which tactics the community thought were working best and worst in combating Ebola: 59 percent said raising awareness was working well and that hand sanitizers had a perceived minimal effect. All U-Reporters subsequently received advice on how to prevent Ebola from spreading.

In Liberia and Sierra Leone, the approach was different as the system had to first be set up and U-Reporters needed to be recruited. The UNICEF team, in partnership with the respective government ministries responsible for health, was able to get the programs live within four weeks. This included acquiring short codes, agreements with telecommunications networks, coordination with ministries, staff recruitment, technical implementation, and forming partnerships with local organizations.[4]

In Liberia, the program is being used to deal with the impact of the Ebola crisis on children as low school attendance is still being observed.

Evaluation and Results

The programs in Liberia and Sierra Leone jointly engage over 33,000 young people, and there were over 170,000 U-Reporters in Nigeria as of March 2015. Liberia is one of the fastest growing U-Report programs in existence with 20,000 people signing up over a 10-day period in early 2015, demonstrating demand for the service that UNICEF has seen in other countries across the continent.

Response rates remain strong, with 23 percent responding to the most recent polls in Liberia and 19 percent responding in Sierra Leone—both above the international benchmark of 15 percent for response to quantitative questions. All countries have subsequently diversified youth engagement topics to work on areas including child protection, education, and fighting other diseases such as HIV/AIDS. Gender representation isn't equal but is in line with mobile phone ownership. Where countries skew to over 60 percent male, the recruitment strategy for U-Report requires adjustment to ensure female U-Reporters have an equal voice.

During the course of the Ebola efforts to date, over 320,000 SMS messages have been sent aimed at understanding the needs of young people and providing them with information. Over the same period, UNICEF has received over 86,000 messages about Ebola, each one the voice of a young person contributing to a community-based effort to stop the disease.

Lessons Learned

- It is important to have young people write the outgoing SMS questions so they are understood. In Liberia, an SMS framed as, "Are you aware of the Ebola disease?" becomes *"do pple no abt Ebola?"* In order to resonate with young people at scale, they must be part of the process.
- Media-based recruitment activities will skew male in the aforementioned countries unless there is a strategic approach that targets gender-based issues specifically.
- It is possible to launch a program in emergency circumstances and start engaging with communities within four weeks.
- While launching during an emergency is possible, and sometimes necessary, having the infrastructure in place before a crisis strikes makes it more far-reaching, and therefore arguably more impactful, when a health emergency takes place.

Conclusion

The key element that all U-Report programs have in common is sustainability before, during, and after a crisis. By approaching young people, mothers, and children as a whole, U-Report stays engaging and can be used for long-term strategic planning by government ministries to strengthen systems post-crisis around a variety of issues. Involving young people at scale in government decision-making processes reduces the gaps between the voices of the people and their representatives. As a direct consequence, young people can have input into development planning, and in return receive important information that they need to fill knowledge gaps. ■

Geographic Coverage: Global

Implementation Partners: UNICEF

Donor: UNICEF

Contact Information: Kidus Asfaw, Product Manager, UNICEF, kasfaw@unicef.org

Partners for Development

An intervention combining breastfeeding education, cell phone messaging, and microcredit programs improved breastfeeding practices.

ALIVE & THRIVE

IMPLEMENTATION DATE: November 2011 to August 2012

Integrating breastfeeding education, cell phones, and microcredit to improve breastfeeding practices in Nigeria

Alive & Thrive (A&T) is an initiative to save lives, prevent illness, and ensure healthy growth and development through improved breastfeeding and complementary feeding practices. Good nutrition in the first 1,000 days, from conception to two years of age, is critical to enable all children to lead healthier and more productive lives.

A&T tested the effect of an intervention—combining breastfeeding education, cell phone messaging, and microcredit programs—on breastfeeding practices in urban and rural areas of Bauchi State in northern Nigeria. The University of North Carolina at Chapel Hill collaborated with Partners for Development to implement the project with funding from A&T's small grants program. The goal of the small grants program, managed by the University of California, Davis, was to identify new solutions for scaling up effective and sustainable interventions to improve infant and young child feeding by linking research to program delivery.

The project promoted optimal breastfeeding behaviors—early initiation of breastfeeding (within the first hour after birth) and exclusive breastfeeding (giving babies only breast milk with no additional foods or fluids for the first six months). Exclusive breastfeeding improves child survival, growth, and development, yet only one-third of infants less than six months of age are exclusively breastfed in sub-Saharan Africa.[1] The rate is even lower in Nigeria, declining from 17 percent in 2003 to 13 percent in 2008.[2,3]

About Alive & Thrive

From 2010 to 2011, the project encouraged pregnant women involved in microcredit programs to practice early initiation of breastfeeding and exclusive breastfeeding. Trained credit officers led monthly breastfeeding learning sessions during regular microcredit meetings over 10 months. Each 20 to 30-minute session contained one to three key messages and included counseling cards, posters, and leaflets. To extend breastfeeding support between monthly microcredit meetings,

Participation among pregnant women (ages 15 to 45) involved in microcredit programs

- 69% of participants attended all seven breastfeeding learning sessions
- 96% of cell phones received all text and voice messages
- 85% of small groups presented a song or drama at least once per month

the project gave each small group of borrowers (five to six women) a single mobile phone. The project sent weekly text and voice messages prompting each small group to discuss the messages and create a song or a drama based on the breastfeeding content to present at the next meeting.

The phone was usually given to the leader of the small group. She was instructed to share the messages with her group members weekly, by either visiting them individually or inviting them to listen as a group. Women in the small groups lived in close proximity, which offered opportunities for them to interact and discuss the messages frequently, even outside their regular meetings.

Evaluation and Results

The intervention successfully improved breastfeeding practices among participants. Using a cluster-randomized controlled study design, the project compared breastfeeding practices in women receiving microcredit plus breastfeeding promotion with a microcredit-only control group. Among the 390 pregnant women interviewed during the final survey, those participating in the intervention had higher rates of early initiation of breastfeeding and higher rates of exclusive breastfeeding at three and six months. Intervention participants were also less likely to give fluids other than breast milk in the first three days of life (see Table 1 below).[4]

Table 1. Breastfeeding outcomes for each study group

	Control group	Breastfeeding education plus cell phones
Early initiation of breastfeeding*	48%	70%
Exclusive breastfeeding at 1 month	61%	73%
Exclusive breastfeeding at 3 months*	58%	71%
Exclusive breastfeeding at 6 months*	43%	64%
Gave only colostrum in the first three days*	71%	86%
Gave water before six months*	49%	24%

* *Significant difference between groups*

Lessons Learned

- A program that integrates breastfeeding promotion into women's microcredit using face-to-face counseling and cell phone messaging can successfully improve breastfeeding norms and behaviors.
- Providing a group cell phone was feasible. Many participants said that sharing a phone worked well or very well.
- Qualitative data collected at the end of the intervention indicated that participants spread the messages to other women in their communities and they were interested in extending the program to other maternal and child health topics.

Conclusion

An intervention integrating breastfeeding education, cell phones, and microcredit improved breastfeeding practices. This intervention could be scaled up in Nigeria, where local organizations provide microcredit to more than 500,000 clients. With more than 150 million women, many of childbearing age, involved in microfinance globally, other countries and programs can adopt the approach to promote healthy growth and development of children. ■

Geographic Coverage: Bauchi State, Nigeria

Implementation Partners: Alive & Thrive (Managed by FHI 360); University of California, Davis; University of North Carolina at Chapel Hill; Partners for Development/Nigeria; Gerewa Women Multipurpose Cooperative Society; Rahama Women's Development Program; Women Development Association for Self-Sustainers; and Wurno Kowanaka Community Development Centre (Nigeria)

Donor: Bill & Melinda Gates Foundation

Contact Information: Jean Baker, Project Director, Alive & Thrive, jbaker@fhi360.org

PATH, 2014

A significant unanticipated finding from this study was the high percentage of women who shared the PH messages with others.

PROJECTING **HEALTH**

IMPLEMENTATION DATE: April 2012 to May 2015

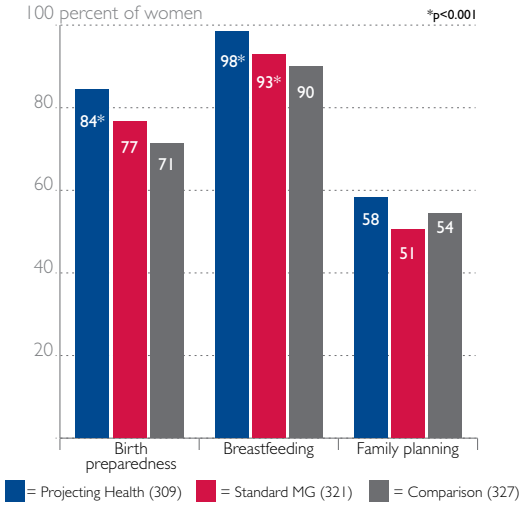
Catalyzing behavior change through visual communication

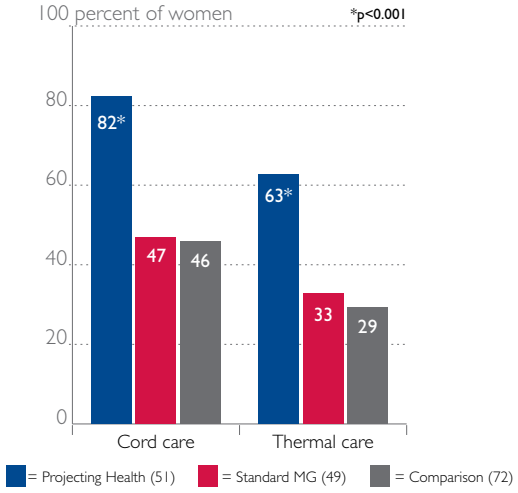
India accounts for one-third of the world's annual maternal deaths; in the country's most populous state of Uttar Pradesh, the maternal mortality rate was 440 per 100,000 live births in 2011, and the neonatal mortality rate was 50 per 1,000 live births. India as a whole accounts for 28 percent of the world's newborn deaths. In resource-poor settings, simple interventions such as birth spacing, birth preparedness, hygienic delivery, thermal care, and immediate breastfeeding could prevent the majority of these deaths. Effective, novel, and low-cost strategies for achieving improved health practices at the home and community levels are needed, especially in areas where staffing shortages and low literacy levels are common.[1]

About Projecting Health

Projecting Health (PH) focuses on community-led use of digital media to improve health knowledge and behaviors. The new method equips communities with basic skills and low-cost technologies for targeted message creation and delivery bolstered by scientific evidence and visual demonstrations. PH transforms traditional social and behavior change communication by using customized educational videos that are developed and produced by the communities and shared via low-cost, portable projectors and other mobile devices. PATH successfully integrated the PH model into an existing community program in India through local nonprofit partners Gramin Vikas Sansthan and Nehru Yuva Sangathan Tisi.

Community members were involved in all aspects of video production. Community health workers and mothers groups (MGs) have led disseminations, which have also taken place at village health and nutrition days. Accredited social health activists (ASHAs), or frontline health care workers, facilitated video screenings and led group discussions around the key messages and lingering questions pertaining to the issues raised in the videos. Traditionally, ASHAs relied on verbal communication, games, and printed job aids to convey key health messages. The videos offer a medium through which ASHAs could promote healthy behaviors with increased accuracy, ease, and effectiveness. By equipping community members with new tools for effectively promoting health behaviors and mobilizing communities to improve health outcomes, the approach is shifting the driving force for change from health experts to the community.





Evaluation and Results

The evaluation of PH as an effective model for behavior change took place in two phases. The first phase explored whether communities were equipped to produce videos and if the target community would accept the approach. The second phase looked at whether PH would be more effective for changing the behavior and practices of the community over traditional methods. During the one-year feasibility study (2012), the project produced 20 videos on five key maternal and neonatal health topics: birth preparedness, thermal care, cord care, breastfeeding, and family planning, and reached 10,000 women from 27 villages. Based on successful feasibility findings, a study to investigate the effectiveness of the PH intervention was carried out, comparing three arms: the PH intervention, standard MGs, and a nonintervention arm. Among the 14,000 women who participated in PH in this phase, a subsample of 302 mothers (with children under one year of age) participated in this evaluation to assess their current knowledge and health practices. In addition, 321 mothers from standard MGs and 327 mothers from the nonintervention arm participated in the evaluation (a total of 950 women). Preliminary analysis of end-line data suggest significant differences in both knowledge and practices in the PH arm compared to the other two study arms. Compared to those who participated in standard MGs, PH participants showed a difference in knowledge on temporary family planning methods, cord care, and exclusive breastfeeding by 40 percent, 31 percent, and 26 percent, respectively. Among the 172 mothers who delivered at home (18 percent of the total sample), 82 percent reported practicing cord care followed by 47 percent in standard MGs and 46 percent in the nonintervention group.

Lessons Learned

The PH model consists of several key elements that enhance video production and stimulate community engagement:

- A community advisory board to identify video topics and guide activities
- Community-level training on basic digital media technology for video production
- Production of videos featuring community members
- Facilitator-led dialogue sessions before and after video screenings

A significant unanticipated finding from this study was the high percentage of women who shared the PH messages with others: 75 percent of women who participated in PH groups reported sharing the messages, compared to 61 percent in the standard MGs and 41 percent in the nonintervention group. Additionally, nearly one-third of women (28 percent) from PH groups shared information about family planning with their husbands.

Conclusion

Findings from this evaluation suggest that women who participated in PH groups reported higher levels of knowledge, uptake of maternal and newborn health practices, and sharing what they learned with others. The PH model presents an unprecedented cutting-edge opportunity for demonstrating significant global health impact. By shifting the driving force for change from health experts to community members, the model has the potential to be exceptionally effective for modifying behaviors in many health areas across a range of global settings. PATH envisions that all future health programming could easily incorporate the PH approach to achieve wide-scale adoption of healthy behaviors. PATH is currently pursuing expansion to other geographic regions and key topic areas to validate replicability and scalability. ■

Geographic Coverage: Uttar Pradesh, India

Implementation Partners: PATH; Digital Green; University of Washington

Donora: Donations from private foundations and individuals to the PATH Health Innovation Portfolio, National Science Foundation, Department for International Development

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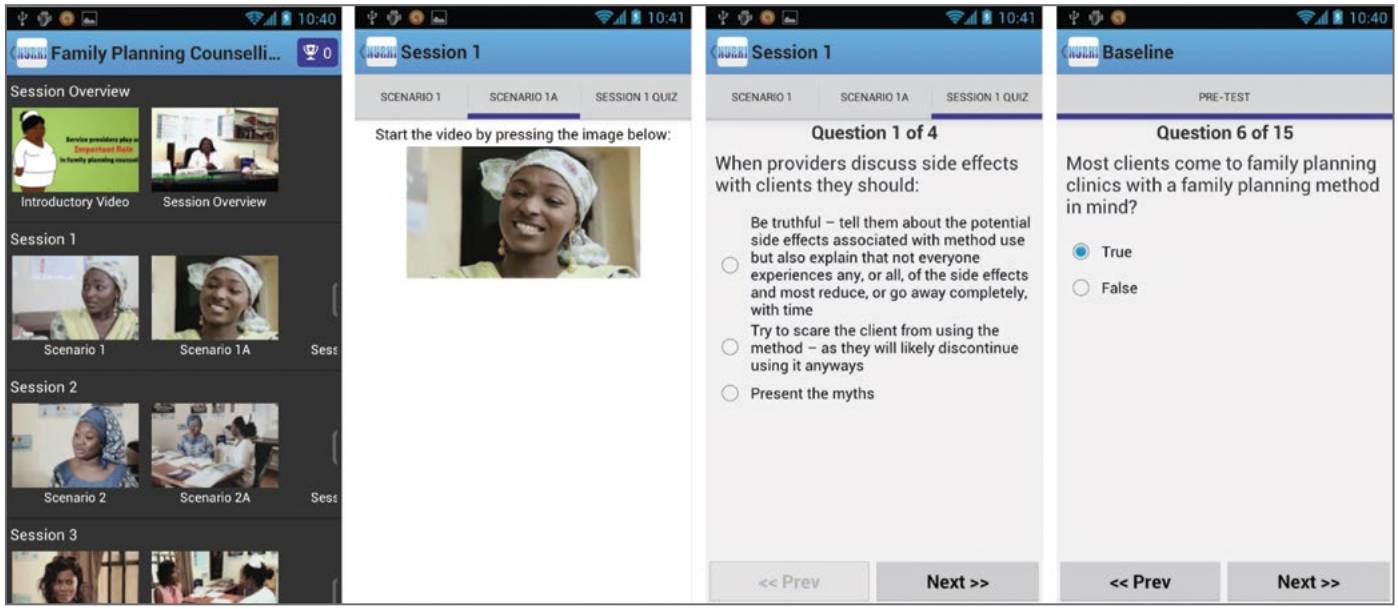


iDEA: Interactive Distance Education Application

IMPLEMENTATION DATE: October 2013 to March 2015

Providing health workers with mobile-based video instruction and reference materials

Nigeria has one of the highest population growth rates in the world. The United Nations projects that the current population estimates of roughly 160 million will increase to almost one billion by the end of the century. Despite the pressing need, Nigeria has had a stagnant contraceptive prevalence rate (percent of currently married women who use contraceptives) of only around 15 percent and a fertility rate of 5.5 births per woman for nearly 10 years.[1] The Nigerian Urban Reproductive Health Initiative (NURHI) managed by the Johns Hopkins Bloomberg School of Public Health Center for Communication Programs (CCP) discovered that the service providers in the cities of Abuja, Ibadan, Ilorin, and Kaduna were restricting the use of many family planning methods based on internal biases and reasons that included the client's age, parity (number of births), their marital status, and whether their spouse had granted consent.

About iDEA

NURHI staff found that provider bias is difficult to change, and often remains even after refresher training. Due to the midwives' work schedule, the desire to use videos as the medium for information sharing, and the need to track progress, a mobile-based solution was proposed. As a result, NURHI launched the Interactive Distance Education Application (iDEA) system for midwives in order to provide a platform for providers to access relevant educational content and resources from Android-based smartphones or tablets.

iDEA is adapted from the Digital Campus open source application OppiaMobile. Educational content is integrated into the application to reinforce skills after training to increase a provider's ability and willingness to deliver family planning methods that are appropriate and based on clients' desires and medical eligibility. NURHI, in conjunction with a local production company, developed instructional videos with an entertainment-education approach. Each video scenario features examples to help providers recognize their biases and then address them by suggesting alternative approaches towards counseling. Each scenario has a pretest and a posttest to gauge learning.

iDEA is integrated with Moodle, a popular open-source learning management system, which provides users with the ability to create educational modules complete with videos, images, text, or audio in minutes. OppiaMobile automatically converts the modules for use with Android, which users

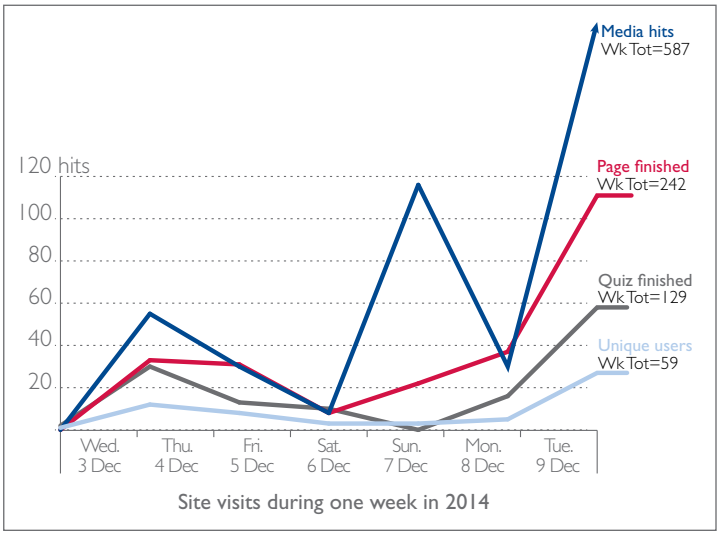


Figure 1. Usage statistics

can install from Google Play. With a one-time connection to the Internet, users can download the app, install the educational content, and register, and then can run the application and content offline. (See image left page.)

Evaluation and Results

In Nigeria, pretests determined midwives' knowledge of counseling techniques prior to exposure to educational content. The average pretest score was 70 percent while the ensuing post-test showed an average improvement of about 5 percent. One likely explanation for the relatively minor improvement in scores was that the midwives already knew the material; what they did not recognize, until a video role play was provided, was their own tendency to display a negative bias towards their clients. Qualitative interviews demonstrated that the midwives recognized themselves in the "bad" example of client counseling and they then felt uncomfortable with their own behavior. Focus group discussions were held; some midwives expressed guilt at having prevented clients from making their own decisions.

The self-assessments were typical in that the videos reflected and helped them recognize some of their biases. This was confirmed during the pilot test and during follow-up focus group discussions several months after initial deployment.

Usage statistics are routinely collected by the application and are uploaded to the administration server whenever there is a connection. The graph below reflects the typical usage rates where, for example, over the course of one week, 59 different users accessed 242 pages in the family planning module, attempted 129 quizzes, and viewed 587 media sources. (See Figure 1 above.)

An evaluation is planned for early 2015 using a two-arm quasi-experimental design with client exit interviews to compare providers with and without phones. Interviews will be conducted with providers to document perceptions about iDEA and assess diffusion. The provider interviews will help supply an explanation of the findings of the client exit interviews.

Lessons Learned

- **Convenience:** As an offline application, connectivity costs are minimal so there is no requirement to enter into negotiations with mobile network operators.
- **Sustainability:** By registering the application through Google Play, the odds for project sustainability are greatly enhanced because midwives are able to update the application themselves. However, connectivity in remote areas is still so problematic that this registration process is not always achievable.
- **Dissemination of messaging:** It is important to assume that the smartphone itself will be shared, and in some cases personal media will be loaded onto the phones. There are a variety of measures that can be employed to reduce file tampering, such as password protection, which should be explored.

Conclusion

The public health community is in the midst of exploring whether wide-scale deployment of mobile technology will improve frontline health worker and health system performance. There are several parts to this question, including: (1) technical feasibility; (2) usability; (3) acceptability among users; (4) improvement in health outcomes; and (5) sustainability. The deployment of iDEA has satisfactorily addressed the first three issues, while a planned evaluation in 2015 will begin to address the fourth. The design of the program will, with time, prove to be sustainable given the low cost and accessibility of the open source components of the application and learning management system that form the core of the technology. With a planned integration of the mPowering Initiative's media sharing platform, these components could provide a complete architectural design of an end-to-end educational media distribution system that any national or regional initiative could adopt in the future. Further plans for an open collaboration in the refinement of the tools and the overall distribution system will further enhance functionality and reduce the cost of future deployments. ■

Geographic Coverage: Four Nigerian cities: Abuja, Ibadan, Kaduna, Ilorin

Implementation Partners: Johns Hopkins Bloomberg School of Public Health Center for Communication Programs; Digital Campus

Donor: Bill & Melinda Gates Foundation

Contact Information: Mike Bailey, Systems Development Manager at Johns Hopkins Center for Communication Programs, mike.bailey@jhu.edu

Johnson & Johnson

The services are free to the user, and messages are currently available in six languages and will shortly be available in all eleven official South African languages.

MOMCONNECT

IMPLEMENTATION DATE: August 2014

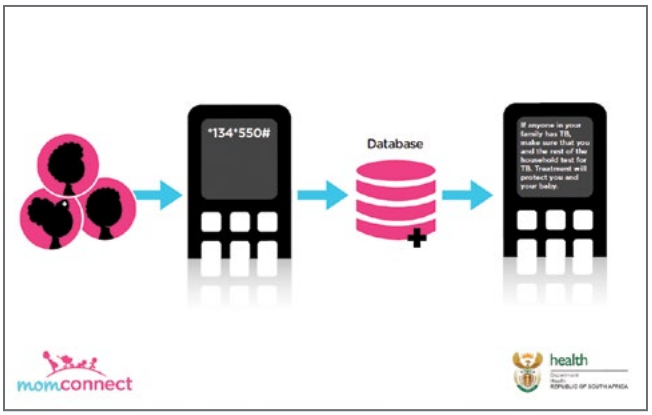
Promoting maternal and child health well-being through mobile health messaging

Although there are numerous projects in South Africa seeking to use mobile technology to reach pregnant women and mothers, MomConnect is the first large-scale mHealth implementation run by the National Department of Health. This is significant in the context of South African mHealth but also enormously important for the mHealth community as a whole as it is one of the few instances globally where an mHealth initiative has been adopted by a national health department and is being implemented nationwide. MomConnect seeks to mitigate the negative outcomes around pregnancy and childbirth. In South Africa, 40 out of every 1,000 children die before the age of five and for every 100,000 births, approximately 140 women die during pregnancy and childbirth. These statistics are substantially higher than the Millennium Development Goal targets for South Africa.

About MomConnect

MomConnect seeks to register all pregnant women, ensure that they visit an antenatal clinic, and provide them with information about pregnancy, birth, and care of an infant. The initiative forms part of the South African national government's efforts to promote maternal and child wellbeing and reduce mortality, as well as efforts to strengthen health services. The initiative was fully launched in August 2014 in the context of unsatisfactory maternal and child health indicators in South Africa.

MomConnect has three main objectives: 1) Register each pregnancy at a government health facility; 2) Send stage-based, personalized short message service (SMS) texts to each mom in the registry; and 3) Allow women to engage with the health system through help desk tools and feedback services. The services are free to the user, and messages are currently available in six languages and will shortly be available in all 11 official South African languages. MomConnect is a "point of care" system, meaning that during the interaction between the woman and the health worker at the clinic, a mobile phone is used to register the pregnancy and subscribe the women to the messaging service.



The registration of the pregnancy and linkage to the SMSs directly feeds into a national database. Women accessing the service before confirming their pregnancy at a government health facility are provided basic information and directed to a clinic, promoting early antenatal care. A woman registered on MomConnect receives regular stage-based health messages during her pregnancy and for the first year of the infant's life. Messages cover "hard" topics such as diet and nutrition, HIV, hypertension, immunization, and breastfeeding, as well as "softer" messages aimed at getting the mother to bond with the baby. MomConnect also enables pregnant women to get information on frequently asked questions and to give feedback on the quality of health services they received. The feedback is passed on directly to the clinic involved; health workers will receive compliments and complaints, which they are asked to remedy.

Evaluation and Results

The Universities of Stellenbosch and the Western Cape are monitoring and evaluating the program for the first 18 months of implementation. As of March 2015, over 31,000 health workers have been trained to register pregnant women on the system from 86 percent of all government health facilities in the country. Just over 329,000 women have been registered on the system, the vast majority of these by health workers at government facilities. Since the launch of MomConnect in August 2014, 229 complaints have been received through the feedback system while 1,234 compliments have been received, including positive feedback on MomConnect specifically, as well as positive feedback on facilities.

Lessons Learned

- The lessons learned to date include key issues such as the enormous importance of partnerships, as well as the importance to adopt user-centered design principles from the start, the need for support from mobile network operators (MNOs) to ensure sustainability and the challenge of privacy and security.
- The need to determine less expensive ways of providing certain services has also been highlighted, with new alternatives being explored to reduce the costs of SMS-based messages.

Conclusion

MomConnect builds on the lessons learned through the Mobile Alliance for Maternal Action (MAMA), the partnership that delivers vital health messages to new and expectant mothers in developing countries via their mobile phones. MomConnect also builds on other maternal and child mHealth initiatives, but importantly takes these programs to the next level by integrating them into a national health system at scale. MomConnect is the culmination of a massive combined effort between government, donors, nonprofit organizations, MNOs, academics, and various other organizations and individuals. The lessons learned will be of enormous value to mHealth initiatives on other content issues in South Africa and for other countries attempting to roll out nationwide maternal health mHealth services. ■

Geographic Coverage: South Africa

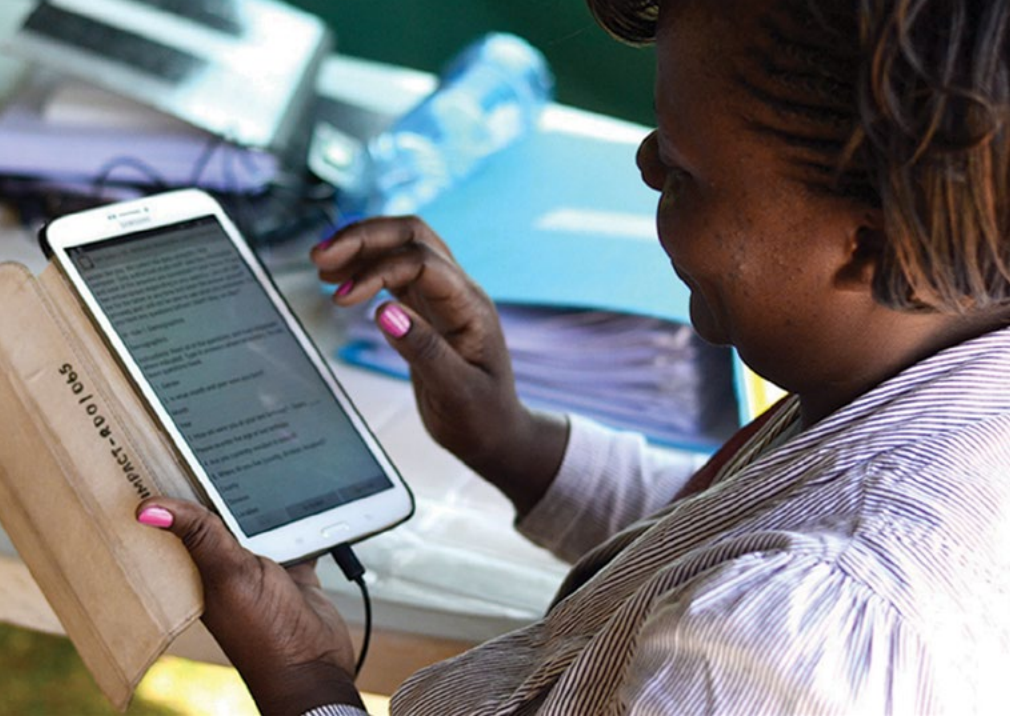
Implementation Partners: South African National Department of Health; nine Provincial Health Departments; Praekelt Foundation; Jembi; GMSA; Soul City; HealthEnabled (previously mHELP); CSIR; ICF; HISP

Donors: US Government; Johnson & Johnson; ELMA Philanthropies; Discovery Foundation; South African National Department of Health

Contact Information: Dr Yogan Pillay (Deputy Director-General: HIV, TV and MCWH) Tel: +27 12 395 8000; ypillay@intekom.co.za

DATA COLLECTION

Elana Fiekowsky, Angola



Jasmine Buttolph, NYU

The use of ICT tools in this field-based approach to HIV prevention for at-risk youth in Kenya has been critical to success of efficient service delivery and data collection both at mobile events and during the follow-up period.

MP3YOUTH

IMPLEMENTATION DATE: November 2014 to July 2015

Implementing a smartphone-based biometric system for participant identification and tracking

Sub-Saharan Africa remains the region most heavily affected by HIV with nearly 70 percent of the 34 million people living with the disease globally residing in the region nearly three decades into the epidemic.[1,2] Youth aged 15 to 24 bear the highest burden of new infections and account for 80 percent of the 1.9 million new infections in sub-Saharan Africa each year.[3] HIV is a major crisis in Nyanza, Kenya, with HIV prevalence of 15.1 percent among those aged 15 to 49 compared to national prevalence of 5.6 percent.[4] Few Ministry of Health facilities are tailored specifically to the needs of youth in this region. MP3-Youth is a pilot study to evaluate the feasibility and acceptability of a gender-specific combination HIV-prevention package in high-burden settings. MP3-Youth aims to pilot the combination package in a mobile health delivery format using an integrated HIV combination/HIV prevention services approach in Kenya. Feasibility and acceptability will be determined by examining uptake and coverage of the intervention package among youth.

About MP3 Youth

The MP3-Youth package for all youth includes HIV counseling and testing (HTC) and linkage-to-care for the HIV infected. For males it also includes condoms and medical male circumcision (MMC). For females it also includes contraception (male/female condoms) and family planning. HIV-uninfected females who meet high-risk criteria and are out of school can access pre-exposure prophylaxis (PrEP) or, for eligible girls in-school, conditional cash transfer (CCT) to continue with classes. Youth subcohorts are followed up for 12 months to document behaviors/adherence related to selected interventions via unstructured supplementary service data (USSD) and short message service (SMS).[5]

Study procedures (combination HIV-prevention package) are offered in a mobile event in tents erected for two weeks. At enrollment, each participant's biometrics are collected using Mobiotrics, a smartphone-based system for identification and follow-up at the different service delivery points.[6] Mobiotrics is an offline/field-settings biometric system

running on Android devices. A fingerprint reader attached to the device captures participant fingerprints. Mobiotrics converts the fingerprint image to an alphanumeric identifier; the image is not stored. Once registered, fingerprint scans identify MP3-Youth participants at different service delivery points. Biometric information is stored locally on the tablet and synchronized across devices in different tents via a secure Wi-Fi direct connection; this guards against double enrollment and enhances tracking of participants' access to multiple intervention components.[7] Via the secure wireless local area network, the biometric data are available in real time as participants move from tent to tent. Study staff use the software to collect data in each tent, ensuring all staff know what services the participant has accessed, the results of tests (HIV, pregnancy, etc.), and key responses to behavioral questions collected in other tents. Tablets are used to collect data via Open Data Kit (ODK). ODK is an Android application used on smartphones/tablets for electronic data collection. In our study, ODK is used for behavioral and clinical data collection.[8]

Evaluation and Results

The mobile events will be completed in 2015, and evaluation will include feasibility, acceptability, and impact measures. The aim is to reach n=1,000 youth through 10 to 15 mobile events. In the first five events, 466 youth were screened and 364 were successfully enrolled in the study using biometrics and electronic data capture. Of those enrolled, 58 percent (212) were female. All but one participant was able to be successfully identified at all service points.

All participants were tested for HIV. A total of 37 participants were HIV positive (10-percent HIV prevalence) and all received a facilitated referral. Most eligible participants enrolled in the HIV-positive cohort (33/37). Of those eligible, n=195 women were tested for pregnancy. Of the 36 eligible males, three consented for and received MMC. CCT uptake was high, 56 were screened and 37 were verified eligible. PrEP reach may be somewhat limited based on our extensive eligibility criteria; approximately 15 percent of women in our sample are potentially eligible for and willing to take PrEP.

Cohort enrollment recently began and follow-up data is not yet available. Medication adherence for the HIV-infected youth on antiretroviral therapy and HIV-uninfected youth in the PrEP cohort will be measured. The feasibility of CCT to keep girls in school based on school attendance and cohort retention will also be evaluated.

The use of technology in the field has been successful. The research assistants have reported no major challenges. By using portable backup batteries, the devices are powered, even when there is no electricity. Youth have not opposed having their biometrics taken as part of registration and they are comfortable answering questions entered into a tablet. Consistent with other studies, participants have no objections to follow-up data being collected via mobile phone text message survey.[5]

Lessons Learned

- Plan for adequate training and troubleshooting of new technology.
- Use portable backup-batteries that can charge devices in the field without disrupting use.
- Sensitize investigators and ethical review committees on new forms of data safety; mistrust around new digital platforms exists, including around SMS security, hosting data in the cloud, and data sharing across devices, etc.
- Plan for potentially lengthy biometric registration because many finger images need to be taken to facilitate re-identification, which is fast.
- Establish a secure Wi-Fi network. All fingerprints and data need to be synced and available in real time at all service points. Using Bluetooth for the data synchronization was tested, but was not as efficient as the Wi-Fi network. The network does not require airtime or cellular reception as it is a local network.

Conclusion

The use of ICT tools in this field-based approach to HIV prevention for at-risk youth in Kenya has been critical to success of efficient service delivery and data collection both at mobile events and during the follow-up period. Study staff has readily used tablets and participants have used phones. Similar to other studies, our biometric system has allowed efficient enrollment in the study and unique identification of participants once enrolled.[7] Participants can be identified at all service delivery points during the event as well as off-site during follow-up. The use of biometrics in the registration and identification of participants is accurate, feasible, and acceptable for use in field settings. Training on the use of new technologies, troubleshooting issues immediately, and maintaining open communication about the system are essential for the success of an information and communication technology system in field settings. ■

Geographic Coverage: Homabay County, Nyanza Province, Kenya

Implementation Partners: New York University, University of Nairobi, Impact Research and Development Organization

Donor: National Institute of Health/National Institute of Allergy and Infectious Diseases NIH/NIAD R01A1094607

Contact Information: Dr. Ann Kurth, Professor, NYUC Global; Dr. Irene Inwani, Pediatrician, KNH-UoN; Dr. Kawango Agot, Director, IRDO; Paul Macharia, Data Manager, UoN; Jasmine Buttolph, Project Director NYU jb3436@nyu.edu

PMI AIRS

Having immediate access to the data, along with observations in the field, AIRS Angola identified high refusal rates quickly in two villages.

PMI Africa Indoor Residual Spraying (AIRS)

IMPLEMENTATION DATE: October 2013 to November 2013

Increasing data collection efficiency through mobile phones in Angola

Many global health monitoring and evaluation (M&E) systems rely on paper-based data collection and data verification in the field. Supervisory staff members inadvertently overlook data errors during quality control, and data clerks commit data entry errors when transferring data from paper forms to electronic databases. Program staff members spend significant time transporting data from remote villages to data centers and entering data. These challenges affect the data quality and accessibility and impede corrective action to improve program operations. To overcome these supervisory issues and increase the speed with which project management staff received data, The President's Malaria Initiative Africa Indoor Residual Spraying (PMI AIRS) Project implemented mobile data collection in Angola.

About PMI AIRS

During the 2013 spray campaign, AIRS Angola piloted a mobile data collection and verification system as an alternative to the standard, paper-based data collection and quality assurance tools in Bailundo Capital, a commune in Huambo province, Bailundo Municipality (~15,000 targeted structures). Given the advantages of using mobile data collection applications (i.e. "real-time" data accessibility, elimination of data center, data entry clerk, and data transport costs, etc.), the results of the mobile pilot are provided and the implementation and feasibility of using mobile data collection and verification in a low-capacity setting for an indoor residual spraying campaign are examined.

In October 2013, The PMI AIRS Project piloted mobile data collection and data verification in Huambo, Angola. Forty-eight field staff were initially tasked to record data on smartphones from roughly 12,000 households and electronically submit to a cloud-based system accessible to the M&E manager at the home office. Eight team leaders were then provided with Android tablets to simultaneously review the data to supervise staff performance and data quality. Phones were programmed with validation checks to prevent skipping mandatory fields and avoid data errors commonly found on paper forms.

Due to low literacy, 23 staff exhibiting poor understanding of the mobile system were reassigned to paper-based data collec-

tion within four days of the pilot onset. The technical capacity was successfully built for ~25 staff and six team leaders and data was collected and analyzed concurrently. TThe length of training is recommended to be extended from three days to 10-14 days for low literate staff and a modified system is proposed to increase field data verification and data cleaning speeds.

Evaluation and Results

Overall, 25 spray operators used smartphones to collect spray data during the campaign. Six team leaders used tablets to verify their team data at the end of the day. Once the spray data was uploaded onto the server, the team leader opened the tablet and viewed the verification table that listed the key indicators for their spray teams for that day. If any issues were identified in the data, the team leader flagged the spray operator form electronically and noted the issue in a text comment for the M&E team to correct, as necessary. The M&E team downloaded the data and team leader flags from the "cloud" and reconciled any errors in a master dataset. Having immediate access to the data, along with observations in the field, AIRS Angola identified high refusal rates quickly in two villages. AIRS Angola deployed a mobilization unit the next day to circulate in the specific villages and surrounding neighborhoods with a loudspeaker to disseminate IRS messages in order to increase awareness and willingness to participate. Thanks to the real-time data provided through the mobile data collection system and subsequent efforts of the AIRS team to return to low acceptance communities in order to reinforce mobilization messages, IRS acceptance rates increased in these areas.

For the weekly spray progress and end-of-spray reports, the M&E team used an Access-based query programmed by their technology partner, Client Technology Center. This system allowed the team to export the master mobile dataset and arrange the data in the same reporting format as the Access data for seamless integration of both datasets. The integration of both datasets allowed the M&E team to have a better understanding of spray operator performance and spray progress throughout the campaign.

Lessons Learned

- Low literacy prolonged training and hands-on supervision. The project recommends piloting in PMI AIRS countries with higher literacy and education levels.
- The pilot occurred in a new IRS area, thus new spray operators were learning both spray skills and phone data entry skills. In the future, PMI AIRS recommends implementing mobile data collection with personnel experienced in IRS and allocating more time for training.
- The spray operator submitted data at the end of the day rather than by structure, which made data validation difficult in the required format. Henceforth, the modified system should allow spray operators to submit data after every structure sprayed so team leaders can validate data throughout the day.
- Technological "bugs" in the team leader verification system the first week of spray (i.e., filtering and sorting difficulties) made data supervision difficult. PMI AIRS recommends developing and testing a modified data aggregation system.

Conclusion

While the team encountered some difficulties during early stages of implementation, the advantages of shorter delays between data entry and the opportunity for data analysis were clear. The mobile system successfully allowed the AIRS Angola team to detect a number of performance issues and adapt operations to address the problems in a timely manner. Following the success of this pilot, the PMI AIRS team decided to implement innovative mobile systems in all project countries conducting spray operations.

This year, The PMI AIRS Project will implement three mobile systems to assist in the monitoring of environmental compliance and performance supervision, daily operational data reporting, as well as to send mass communication for daily reminders and motivational messages. The systems will utilize a varied range of phones, from Android phones to the simpler short message service-enabled brick phones. By using the different types of phones, The PMI AIRS Project will be able to engage with personnel at all levels of operations and in more remote areas where Internet connectivity may have otherwise posed difficulties. Through the experiences in Angola, The PMI AIRS Project will be able to capitalize on lessons learned and ensure improved performance across all countries. ■

Geographic Coverage: Huambo Province, Angola

Implementation Partner: Abt Associates, Inc.

Donor: USAID | Bureau for Global Health, President's Malaria Initiative (PMI)

Contact Information: Laura McCarty, Senior Manager, Communications, Abt Associates Inc., Laura_Mccarty@abtassoc.com

Crystal Stafford, IMA World Health

Donors of nets can now click on any point and see exactly to whom their net was given and where, providing a new level of transparency and accountability never seen before in net distributions.

HANG-UP AND TRACK

IMPLEMENTATION DATE: October 2014 to December 2014

Increase bednet distribution accountability and usage in households through mobile data collection

Malaria is one of the deadliest diseases in the Democratic Republic of Congo (DRC), where an estimated 500 children under the age of five die each day from this disease. Research has shown that the use of long-lasting insecticidal nets (LLINs) is effective in preventing malaria.[1]

To address malaria prevention through LLIN distribution, IMA World Health, with approval from the Programme National de Lutte contre de Paludisme (PNLP) of the Ministry of Public Health and funding from the Against Malaria Foundation (AMF) and UK Aid, kicked off a mass LLIN distribution campaign in eight health zones in Kasai-Occidental province. IMA World Health devised a Hang-up and Track (HUT) campaign in which community health workers (CHWs) not only distributed the LLINs, but they also installed and hung them up in each household and recorded household registration data using smart phones to ensure accountability and accuracy.

About Hang-Up and Track

The LLIN distribution campaign is one cornerstone of PNLP's national strategy to decrease the burden of malaria through prevention by ensuring that all households in the DRC receive and use LLINs.[2] In this campaign, IMA World Health, with net funding from AMF and non-net costs funded by UK Aid, was tasked to distribute LLINs in eight health zones in the western Kasai-Occidental province. In order to increase accountability and household utilization, the strategy devised was to "hang-up and track." The strategy is two-fold: First, instead of distributing LLINs to beneficiaries, LLINs were hung up and installed in the beneficiaries' households. Second, smart phones were used to track distribution data for each household that received LLINs.

When the LLINs were being installed, one of the CHWs within the team was tasked to track the progress by entering household registration data into a smart phone. Open Data Kit (ODK) software was installed on each smart phone with a form specifically designed for the hang-up. The ODK form

Table 1.

Health Zones	Households	Sleeping places	Quality LLINs	LLINs installed
Kitangwa	22,188	54,465	3,796	50,643
Mutena	27,509	67,369	1,265	66,104
Kamonia	39,869	85,491	1,492	83,999
Kamuesha	42,140	99,766	2,242	97,524
Banga Lubaka	16,001	42,229	1,039	41,190
Kanzala	26,966	70,449	1,216	69,233
Tshikapa	37,643	105,474	1,594	103,880
Kalonda	44,317	113,824	1,865	111,959
Total	256,633	639,067	14,509	624,532

collected distribution data on the number of sleeping places and the amount of LLINs given and installed. But to increase further accountability, the form also asks for the global positioning system (GPS) coordinates, signature of consenting household, and a picture of the LLINs installed. Socioeconomic, malaria perception, and malaria treatment data for each household was also collected. All the data were then uploaded to a supervisor's laptop using ODK Aggregate VM server software, and later aggregated at a central level.

Once the distribution was completed, a table was created that included the name of the head of household, the GPS coordinates of that household, how many nets were distributed to that household, and a photo of the recipient and their newly hung net. All recipients photographed signed a release within the ODK allowing us to use their photo. If they did not wish to be photographed only the net was pictured. The table was then uploaded to Google Fusion Tables and an interactive map was created. Donors of nets can now click on any point and see exactly to whom their net was given and where, providing a new level of transparency and accountability never seen before in net distributions.

Evaluation and Results

The LLINs distribution in western Kasai-Occidental lasted from October 2014 to December 2014. In the chart submitted here, the HUT campaign captured data for each of the visited households. For each household, the ODK form asked the number of sleeping places in the household, which coincided with the number of nets given and installed in that household. However, if there were already good quality LLINs assessed in that household, ODK will automatically calculate and subtract the number of good quality LLINs from number of LLINs installed to avoid giving more LLINs than necessary. ODK will also disallow the CHW to give more LLINs than the number of sleeping places reported. It was estimated that by using the HUT strategy, 93 to 99 percent of households in the eight health zones where LLINs were distributed were reached.

Lessons Learned

- Infrastructure deficiencies, especially electricity, need to be assessed before distribution.
- CHWs need to be thoroughly assessed due to literacy and lack of technology training.
- Data analysis needs to be incorporated into the distribution campaign schedule better due to amount of incoming data.
- Although originally translated the ODK form to local languages and dialects for CHWs, French was still preferred because local dialects were often not written languages.
- Rugged mobile phones and hardware are recommended.

Conclusion

IMA is the first organization in the DRC to leverage mHealth technology like ODK for mass LLIN distribution campaigns. By using the HUT strategy, not only was each household pinpointed through GPS, but the entire distribution was aggregated visually through GIS. This, along with the signature file and photo of LLIN installation within the household, increased accountability that the LLINs reached the beneficiaries and decreased fraudulent activities. The utilization rate of LLINs by the beneficiaries will be measured every six months to assess user adoption. In the next phase, the malaria perception and treatment data collected will be used to formulate better behavior change communication and messaging, and incorporate that into a more holistic approach in the next LLIN distribution campaign. ■

Geographic Coverage: Eight health zones in western Kasai-Occidental province, Democratic Republic of Congo: Kitangwa, Mutena, Kamonia, Kamuesha, Banga Lubaka, Kanzala, Tshikapa, and Kalonda

Implementation Partner: IMA World Health

Donor: Against Malaria Foundation, UKAID

Contact Information: Crystal Stafford, Project Coordinator, Malaria Program, IMA World Health, crystalstafford@imaworldhealth.org; Charlotte Ndolerire, Project Coordinator, Malaria Program, IMA World Health, CharlotteNdolerire@imaworldhealth.org; Andrew Chou, Consultant–Mobile Technology, Malaria Program, IMA World Health, yuheng.andrew.chou@gmail.com

Kara Cherniga

In addition to transmitting real-time data, the mobile application also improved the proper management of cases and facilitated interpersonal communication and counseling to caregivers. Without a doubt, the tool allowed for rapid data analysis by a variety of decision-makers.

CRS SENEGAL mHEALTH PILOT

IMPLEMENTATION DATE: April 2013 to April 2014

Using mobile phones to improve diarrhea case management for children under five

Across four community health projects, Catholic Relief Services (CRS) Senegal directly works with 2,139 unofficial community health workers (CHWs), and through this work identified a challenge in ensuring quality and timely data collection, reporting, and effective health messaging/sensitization. Specifically, CHWs are delayed in transmitting important information at the health hut level to the health post or CRS staff, lack proper documentation of available and expired medicine, and delay communication on important health information until the end of the month when information from daily consultation is compiled.

Furthermore, data analysis from the health huts is analyzed quarterly, often when trends such as high malaria rates have already occurred and timely messaging or response is subsequently late and ineffective. The current paper reporting system does not allow for timely community sensitization and responses regarding increases in illness.

About CRS Senegal's mHealth Pilot

To respond to this need, CRS and CommCare jointly developed a real-time cell-phone and web-based application that was used by CHWs in a pilot program to manage child diarrhea cases. By testing mobile phone and database applications, CRS and the community health team aimed to have access to real-time data focused on precise numbers and illness trends at the community level facilitated by a cell phone application. The app could provide appropriate messaging and steps for CHWs to increase the quality of health services or reference to the next level health post. The approach would also allow district health authorities at the health post level to take appropriate and quick decisions and reinforce CHWs to educate the community on health concerns. The app that was developed was able to collect data that is accessible via a central database, trigger referrals, and transmit key behavior change messages to mothers through pictures and voice recordings in local languages.

Furthermore, the pilot supported the Government of Senegal's Ministry of Health and Social Action objectives within an ongoing five-year community health program (PSSC II) funded by the US Agency for International Development to target 10 CHWs based in 10 health huts in the Diourbel Health District to increase quality health care and services at the first point of contact for health services. The program further aligned with the national strategy by contributing towards: 1) an emphasis on improved care and case management at community level; 2) building the technical capacity of CHWs; 3) reducing infant diarrhea cases, which will lead to reduction in malnutrition and deaths in children under the age of five; and 4) increasing health professionals' ability to conduct timely data analysis in order to identify timing, trends, and drug stock-outs, and strengthen the impact of integrated management of childhood illness.

Evaluation and Results

The pilot allowed CRS to test the integration of technology and an approach that has the ability to change the way CRS Senegal collects and analyzes data and subsequently allows for timely and higher quality health responses. The cell phone application also has the ability to directly impact the quality of service offered by CHWs by providing consistent and uniform guiding questions, reminders and key messages to reinforce with beneficiaries. Project success was measured by two key indicators: 1) number of timely and complete monthly reports from health huts; and 2) reduction of time between identification of significant trends and response (community message, campaign, increase of medicine supply, and expiration of medicine). At the end of the pilot, CHWs reported that there was an overall increase in the completeness and timeliness of reports and that the use of mobile phones to collect and transmit data did, in fact, reduce information transmission delays (data that was once only available monthly or quarterly was suddenly available in real time), eliminate the need to travel every month to collect information and prepare reports, and serve as a very user-friendly platform that was very easy to master and maintain. Additional findings demonstrated that in addition to transmitting real-time data, the mobile application also improved the proper management of cases and facilitated interpersonal communication and counseling to caregivers. Without a doubt, the tool allowed for rapid data analysis by a variety of decision-makers. Other positive, but unintended results demonstrated that the use of the mobile technology elevated the status of CHWs within communities and increased the perception of improved health outcomes on the part of community members.

Lessons Learned

- **Ensure consistency of messages.** The ability to play a recorded message in the local language helped to ensure beneficiaries were receiving the exact same messages related to promoted behaviors, such as identifying warning signs of diarrhea and treating it.
- **No availability of electrical power charging points.** Because most of the health huts did not have access to electricity throughout the day (long-lasting power cuts), the health workers had to travel to the nearest Poste de Santé to have their phones recharged. Future design should consider solar charger devices.
- **Ensure that merit is recognized and showcased.** Openly recognize CHWs that are submitting their data regularly and are encouraging others to do the same. The project can purchase airtime for a health worker's personal cell phone as an incentive to encourage continuous submission of data for the next six months.
- **Provision for spare devices.** The project team should have a contingency plan for devices in case of needed repairs or replacements.

Conclusion

The second phase of the larger community health program requires integrating and establishing a larger number of health hut sites as well as the integration of new services in the current health package. The majority of activities in the second phase include strengthening quality standards and sustainability of the health hut system to be integrated into the formal health sector under the health post. CRS presented the methodology, progress, and results of its CommCare pilot to other members of the PSSC II consortium and offered exchange visits. In addition, as the local implementing partner is the Government Health District, CRS worked closely with regional government authorities to ensure understanding and implementation of the approach for future replication. The application also allows for direct timely communication by integrating technology at the community level and for reporting serious health cases to the health post. Based on results, best practices and lesson learned, CRS will continue to support integration of this approach in other health districts and programs. ■

Geographic Coverage: Diourbel, Senegal

Implementation Partner: Catholic Relief Services

Donor: Dimagi, Catholic Relief Services

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Clément Tardif, IntraHealth International

In Senegal, the availability and reliability of health data was constrained due to a number of causes. The SEDA mobile phone-based reporting system for health data assists in easier and more timely reporting.

SEDA Automated Health Data Exchange System

IMPLEMENTATION DATE: October 2011 to Present

Applying mHealth to improve data monitoring in Senegal

In Senegal, the Automated Health Data Exchange System (SEDA) is an integrated health data and stock-out monitoring system that uses inexpensive and ubiquitous mobile phones for data collection, reporting, and supervision. Data are aggregated in a web-based central system to visualize and manage decision support. SEDA targets the IntraHealth International-led Health Services Improvement (HSI) project's aim to improve the quality and frequency of data collected at the district and regional levels in partnership with Senegal's Ministry of Health and Social Action. A prime goal of SEDA is to transform the methods and speed with which health workers, supervisors, and senior-level ministry staff use collected data to make decisions about maternal, neonatal, and child health programs, and to prevent stock-outs of essential medicines and contraceptive products. Prior to SEDA, available data were often outdated, incomplete, and unreliable. This situation left the ministry unable to make timely decisions to improve health programs, appropriately deploy health workers, or positively influence the health of clients and their families.

About SEDA

SEDA analytics allow health system managers to visualize data submitted from health facilities via mobile phone. In collaboration with the ministry, HSI developed 70 specific health indicators that address key health issues in Senegal, including family planning, maternal and child health, malaria, HIV/AIDS referrals, and health commodities/products. These facility-level indicators are reported into a web-based data analytics platform that creates custom data visualizations and dashboards. Supervisors at all levels of the health system can use SEDA to monitor and ensure data consistency and completeness, and analyze data through the system's predefined dashboards.

SEDA employs user-centered design principles and aligns with existing technologies to provide key indicators. It is possible to scale SEDA nationally wherever GSM networks (the most widely used cell phone technology) are available. Moreover, using ubiquitous and inexpensive technology supports sustainability. SEDA's open source technology includes Ubuntu

server software using a standard GSM gateway, GAMMU SMS texting software, and JSON forms on mobile phone SIM cards to collect structured data. The system protects privacy and security by using phone numbers to authenticate data from the local level. Web-based authentication and security methods protect data at the central server.

SEDA aligns with the Ministry of Health's district-level deployment of DHIS2 by interoperating with DHIS2 as a mobile data collection tool. Aggregate-level data reported into the mobile system from health facilities are automatically uploaded into DHIS2 once validated.

Evaluation and Results

Benefits of SEDA include the use of inexpensive mobile phones and related infrastructure to reliably upload data for analysis and decision-making. Collected operational data are useful to supervisors and health care providers because they allow for timely and direct feedback about data reporting and errors. SEDA has also helped to eliminate the repetition or omission of data, reduced duplication of effort during reporting, and made data more transparent and available. Likewise, the HSI project has found that SEDA encourages participation in the information-reporting cycle since it permits providers to directly see how their performance corresponds to district, regional, and national indicators.

By the end of 2014, 35 ministry staff and over 500 health workers in 21 districts in four regions covering 318 service delivery points (SDPs) were using SEDA. In 2015, the HSI project anticipates adding an additional 100 health workers from 800 SDPs in 54 districts in 10 regions to the system. An analysis of data uploaded by providers into SEDA shows that in districts using SEDA for reporting, 80 percent of pregnant women received intermittent preventive treatment for malaria, 96 percent of births received active management of third stage of labor, and 82 percent of newborns received a check-up by a qualified provider one to three days postpartum. With SEDA, providers, supervisors, and district and regional health teams are better able to directly analyze, monitor, and improve performance in a timely and efficient manner.

Despite SEDA's success, challenges still exist to enabling all health workers to access and use the system. Facilities and health districts often grapple with the high cost of mobile services, experience insufficient wireless coverage, or a lack of reliable electricity. Furthermore, providers in some health districts have commented on the need to further expand the current list of indicators to respond to emerging issues such as Ebola.

Lessons Learned

- The automatic recovery and analysis of health data by mobile technologies is reliable and inexpensive.
- The use of data collected at the operational level adds value and is a source of motivation for providers and district health teams.
- Automated reports are time savers and improve data management.
- Data can be easily analyzed at all levels of the health system.
- Constraints include insufficient wireless coverage in some areas of the country; limited Internet access in certain areas; and barriers of electricity and cost, which can prevent some health districts and providers from accessing and using SEDA.

Conclusion

In Senegal, a number of factors previously constrained the availability and reliability of health data, including health worker data retention, lack of infrastructure in rural health facilities, limited resources, and inadequate staff engagement. IntraHealth, in collaboration with the Ministry of Health, is addressing these issues by implementing the SEDA mobile phone-based reporting system for health data. SEDA's benefits include the use of inexpensive mobile phones and related infrastructure to reliably upload data for analysis.

When operational data are routinely and reliably collected, they can be useful to the health workers implicated in the reporting process. By assisting the government of Senegal to build an efficient health information system accessible to all cadres of health workers, the HSI project is ensuring that health data can be more easily reported and acted upon. The new and easy-to-use SEDA technology—which streamlines the collection and exploitation of health data by providers, supervisors, and district and regional health teams—will strengthen decision-making and ultimately improve the health of communities. ■

Geographic Coverage: 10 out of 14 regions in Senegal

Implementation Partners: IntraHealth International; Ministry of Health and Social Action; Medic Mobile

Donor: USAID

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WHO

OpenSRP meets the workflow and information needs of health providers, decision-makers, and the populations they serve.

OPEN**SRP:** Open Smart Register Platform

IMPLEMENTATION DATE: 2013 to Present

Connecting frontline health workers to national health systems

Frontline health workers (FHWs) form the backbone of the health system in low- and middle-income countries (LMICs). They are the first contact for primary health care for millions of underserved people, yet are often burdened by archaic paper systems. Paper registers present strategic challenges for tabulation and access to real-time data for decision-making, monitoring FHW performance at district or national level, and providing a reasonable level of accountability for authentic and complete individual data records. Paper-based data also do not facilitate continuity of care between visits or across providers. Consequently, clients who have missed services or appointments are not identified in a timely fashion, leading to a missed window of opportunity for intervention. Lastly, governments struggle to supervise this large workforce, ensure data quality and timeliness of reporting, and facilitate appropriate and equitable care under low-resource conditions.

About OpenSRP

Open Smart Register Platform (OpenSRP) offers a government-owned and -operated enterprise-grade solution to improve primary health care service delivery, strengthen accountability, and generate real-time data for improved monitoring and evaluation. OpenSRP was purposefully designed with end-users to complement other robust and widely-deployed information technology solutions, including DHIS2 and OpenMRS. OpenSRP is now being maintained and enhanced in functionality by a governance mechanism and multi-vendor community of software developers committed to open-source software.

Health providers interact with the OpenSRP application using mobile handsets while providing health services to their clients. All data entry is done using the platform, which can run on any Android device. The platform integrates previously discrete, proven innovations, including: a client registry for enumeration and continuity of care; birth and death registration; electronic forms with embedded logic and decision-support, including checklists and algorithms for risk assessment; work-planning, scheduling and service reminder tools; multimedia and interactive voice response (IVR) content for client counseling and reminders; and automated reporting into subdistrict and national reporting systems. This mix of

mobile technology, information system, and support materials is designed to facilitate and support various aspects of FHWs' work, and enable a flow of communication between community members, health workers, and health facilities. The system also aims to facilitate more effective workflows for skilled health workers focused on RMNCH, ensuring that they have more time to deliver needed services to their clients. OpenSRP focuses on family planning, maternal and child health, nutrition and early childhood, with plans to include additional health domains, including tuberculosis.

Evaluation and Results

Although OpenSRP is currently being piloted across four sites, the platform builds on previous work and best practices, including findings from the United Nations International Working Group mHealth Catalytic grant mechanism-funded project Zindagi Mehfooz, that used financial incentives to drive vaccination coverage and is led by Interactive Research and Development (IRD) Pakistan. The strategies from the program, now incorporated into OpenSRP, observed a 20 percent increase for pentavalent vaccine coverage in the Pakistan deployment. Furthermore, OpenSRP also includes strategies reflected in the mCare deployment in Bangladesh, which demonstrated near tripling of antenatal care coverage.

In each of the new project sites, OpenSRP implementers are currently researching site-specific adaptation requirements, implementation components per cadre of health worker, fidelity of use among health workers, and the time-motion effect on the performance of health workers delivering RMNCH interventions. Furthermore, the multi-site study is focused on development of systematic and replicable methods that can be used by other countries for adaptation of the OpenSRP platform into other health topics, cadres, and context. Lastly, the findings of this study will be used to inform a second phase of research, also to be coordinated by World Health Organization's Department of Reproductive Health and Research (WHO-RHR/HRP), which aims to measure coverage, quality of implementation, cost-effectiveness of health system gains, and resulting impact of OpenSRP across different cadres focused on delivering RMNCH interventions.

Lessons Learned

- **Conduct thorough formative research.** A critical part of the OpenSRP development has been an emphasis on thorough formative research with the primary end-users and the network of secondary users that will be interacting with the platform.
- **Establish technical steering committees to guide national scale-up.** In-country stakeholder engagement is crucial in ensuring other key players, including the Ministry of Health, are involved in further adapting or prioritizing necessary changes to the systems preceding scale-up.
- **Balance preservice training with continuous field support and shadowing.** Allow for sufficient in-service learning that is directly linked to the routine workflow of the health worker

Conclusion

The deployment of OpenSRP is currently being led by the Technologies for Health Registries, Information, and Vital Events (THRIVE) consortium. Its mission is to develop, test, and mainstream an enterprise solution for FHWs in low-resource settings focused on universal health coverage of essential interventions. The OpenSRP deployment fits into a broader multisite research study coordinated by WHO- RHR/HRP in order to facilitate common objectives, methods, and indicators, as well as joint learning and metaanalysis with investigators in each deployment. Additionally, in-country working groups/steering committees, constituting both local and international THRIVE project members and in-country key stakeholders will be held to ensure local ownership and governance of the project.

To date, five countries have been identified where government engagement and readiness would allow for OpenSRP to be refined, tested, and scaled as exemplars for other LMICs. Over the next four years, the THRIVE consortium will consolidate several best-of-breed solutions guided by the principles of user-centered design, incorporating both end-user needs and workflows and the enterprise architecture necessary for national health information system integration. ■

Geographic Coverage: Gaibanda District (Rangpur Division), Bangladesh; Lombok District (West Nusa Tenggara Province), Indonesia; Sindh Province, Pakistan; Koppal District (Karnatka State), India; Nagpur, Wardha, Yavatmal districts (Maharashtra State), India

Implementation Partners: WHO-RHR/HRP; Ona Systems; ThoughtWorks; mPower Social Enterprises; Summit Institute of Development; Interactive Health Solutions; Johns Hopkins University Global mHealth Initiative; Harvard University School of Public Health; Summit Institute of Health; Interactive Research and Development (IRD); Foundation for Research in Health Systems (FRHS)

Donors: WHO RHR-HRP, NORAD, Grameen Foundation, Welcome Trust

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SIGHTSAVERS

For the first time, treatment data could be monitored in real time, increasing the speed and the impact of the campaign.

SMS FOR LIFE: SIGHTSAVERS

IMPLEMENTATION DATE: April to October 2014

Increasing efficiencies and impact in programs to eliminate neglected tropical diseases

Cameroon is endemic to multiple neglected tropical diseases (NTDs), including trachoma, schistosomiasis, lymphatic filariasis (Lf), onchocerciasis, and soil-transmitted helminths.[1] There are 21.4 million people at risk for one or more of these NTDs, and in 2013 alone Sightsavers distributed 10.3 million treatments to protect against them in Cameroon.[2] Communities are censored and treated during mass drug administration (MDA) either on an annual or biannual basis. The SMS for Life platform, created and supported by Greenmash, was designed to connect health facilities, health district services, and the regional delegations of the Ministry of Public Health on one platform. In 2014, Sightsavers, along with the NTDs Unit of the Ministry of Public Health, used SMS for Life to collect weekly data during the onchoseriasis/Lf MDA of Mectizan and Albendazole in the Southwest region of Cameroon. For the first time, treatment data could be monitored in real time, increasing the speed and the impact of the campaign.

About SMS for Life

SMS for Life in Cameroon was set up by the National Malaria Control Programme (NMCP) in 2013, and later joined by Sightsavers' NTDs program. Though SMS for Life was originally designed to alleviate the issue of stock-outs at the health facility level, the program now embraces a variety of partners in a public-private initiative, including the NMCP, Clinton Health Access Initiative, UN Population Fund, Germany's GIZ, North American Aerospace Defense Command, MTN, Malaria No More, Novartis, and Sightsavers. Greenmash's mango platform is the technical backbone. Cloud-based mango accepts data through smartphones, SMS, Unstructured Supplementary Service Data (USSD), and web with data available in online reports, by email, and as text reminders. The benefits of working with Greenmash go beyond the technology itself—they also work to get lower rates and secure shortcodes from mobile operators, are available 24 hours a day for tech support, and assist with user training—both on mobile, for data uploaders, and on the web platform for district managers.[3]

Sightsavers worked in 10 districts; Bangem, Buea, Konye, Kumba, Limbe, Mbonge, Muyuka, Nguti, Tiko, and

Tombel, which included 74 health facilities. Eight indicators were collected:

- Censured (M/F)
- Treated (M/F)
- Adverse effects (M/F)
- Refusals (M/F)

As usual, thousands of community-directed distributors implemented the MDA across the region. But this time they brought their data to the health facilities on a strict weekly basis. Health facility workers then aggregated and uploaded the data via short messaging service (SMS) using a set of codes. To assure that they sent in data, health facility workers were sent an automated SMS each week alerting them that it was time to upload. If they sent in data before end of day, they were automatically sent an incentive of phone credit.[4]

As SMS messages with data came in from the 74 facilities, the 10 district managers were able to view live weekly census/treatment reports on the system and immediately follow up on problem areas.

Evaluation and Results

All eight indicators were collected through the period of the Mectizan and Albendazole MDA. In total, details of 955,511 censors and 777,631 treatments came in via SMS. Using SMS for Life cut down on time spent in the field by one-third. During an MDA, community-directed distributors also do a census to understand how many drugs are needed (this community census often differs from government estimates, so it is necessary). Historically, census and treatment happen at the same time, with drugs being sent only as district managers receive paper-based data. Using SMS for Life, the census was done first, and utilizing online reports the appropriate amount of medication was sent to each community. District managers were also able to watch as the census happened and see how close each community was to its target census number. When a community was behind, someone could call or be sent to intervene. In the districts using SMS for Life, the census and treatment process lasted two months. In all other regions, it lasted three months.

These efficiencies increased the amount of people censured and effectively treated. In the areas using SMS for Life, the number of people censured increased 10.9 percent from 2013, and number of treatments increased 10.2 percent; in a neighboring area not using SMS for Life, the number of people censured increased 4.9 percent from 2013, and number of treatments 3.5 percent.

Reporting was also much improved; where data was collected electronically, 90 percent of community-based data were available during district appraisal meetings and 100 percent before the regional appraisal meeting in November. In the other districts, only 40 percent of data were available during district appraisal and 55 percent during the regional appraisal meeting.

Lessons Learned

- **Don't reinvent the wheel.** Find out what platforms are already being used in a country and combine forces. This will not only save time and money, but also makes sense for the country to be as harmonized as possible.
- **Incentivize data collectors.** Asking people to upload data via mobile phone usually creates more work for them—a small but consistent incentive shows that their efforts are appreciated.
- **Don't train too early.** Sightsavers left too much time between training in April and when data collection started in August; many uploaders needed a refresher.
- **Don't overestimate phone literacy.** Many older users had trouble typing out SMS messages—ensure there is adequate time in any training to cover the basics.
- **Start with the paper.** Though Sightsavers is using mobile, health facility workers still needed to extract data from paper registers and aggregate it to send in. This required a morning of training, but was essential to the program.

Conclusion

Building on the success of this pilot, Sightsavers plans to continue in the Southwest region and scale into three more regions throughout 2015, tracking MDAs on trachoma, lymphatic filariasis, and onchocerciasis. The team will ameliorate the training and implementation design, learning from challenges encountered, to bring an improved system into new areas of Cameroon. The hope is to not only grow this within Sightsavers but also bring other NTD programs on board to cover the entire country, all the while building capacity within the Ministry of Public Health and leaving a lasting, and useful, legacy. The team is also planning to conduct research in 2015 and 2016 with leading health economists on the efficiencies, cost savings, and impact improvement of such interventions. It's essential that not only Sightsavers, but the NTD community at large, quantify how moving to mobile can improve the way we deliver programs and accelerate the path towards elimination. ■

Geographic Coverage: Cameroon, Southwest Region

Implementation Partners: Sightsavers, Neglected Tropical Diseases Unit of the Ministry of Public Health, Greenmash

Donor: Sightsavers

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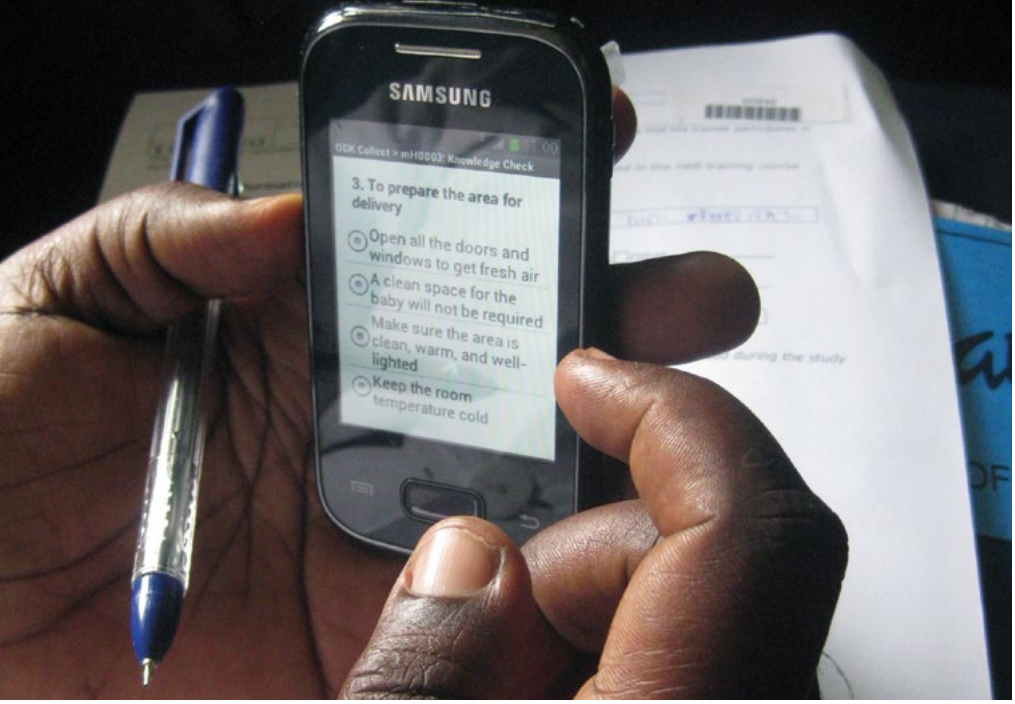
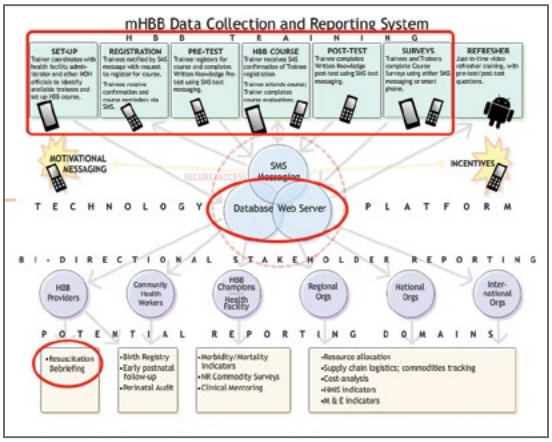


Figure 1. The mHBB pilot phase focused on select training and quality improvement indicators (red circles).



mHBB

mHBB

IMPLEMENTATION DATE: January 2013 to June 2014

Using mobile phones to support Helping Babies Breathe in Kenya

Intrapartum asphyxia, the inability to breathe at birth, is a leading cause of newborn death, killing an estimated 814,000 infants every year. Resource-limited settings bear a disproportionate burden of asphyxia-related mortality, with global epicenters located in sub-Saharan Africa and South Asia. Helping Babies Breathe (HBB) is a simple, inexpensive, evidence-based, and skills-focused program designed to facilitate improvements in knowledge, skills, and performance for neonatal resuscitation (NR) among birth attendants in resource-limited areas. HBB has been launched in more than 70 countries since June 2010, and has been shown to improve the NR knowledge, skills, and performance of birth attendants, and reduce newborn mortality.[1–6] However, monitoring and evaluation (M&E) efforts have struggled to keep pace with the rapid global roll-out of HBB. Data collection and reporting of key M&E indicators are constrained by a cumbersome paper-based data collection system. The resulting gaps, time-lags, and bottlenecks in information make it difficult for stakeholders to know when, where, and how HBB is being implemented, ascertain its effectiveness, and efficiently allocate resources.

About mHBB

The goal of the mHBB initiative is to develop a comprehensive and integrated mobile phone-based data collection, reporting, and "just-in-time" refresher training system to support global HBB implementation and scale-up for a wide variety of end-users, stakeholders, and partners (Figure 1). Key objectives include creating a system that is simple, affordable, sustainable, feasible, effective, interoperable, and adaptable within a wide variety of low-resource settings.

The mHBB proof-of-concept study was focused on assessment of feasibility and acceptability of mobile phone-based methods for collection of HBB training and quality improvement data among facility-based birth attendants in Kenya, and qualitative comparison of experiences among end-users regarding paper vs. mHBB web-based vs. mHBB open data kit (ODK) app-based data collection systems. Kenya was selected as the pilot-test location due to high mobile phone penetration, long-term HBB efforts, and a strong collaborative relationship between Indiana and Moi universities. Utilizing funding from the Laerdal Foundation for Acute Medicine, 12 existing HBB paper forms were digitized for use on Android mobile phones (Table 1).

Table 1. Description of data collection forms, end-users, and when forms are filled during HBB implementation in the mHBB pilot study

HBB Form	Training or QI form?	Who is end user?	When is the form filled?		
			Pre-course	Post-course	Clinical service
Learner registration	Training	Learner	X		
Course registration	Training	Master Trainer	X		
MCQ[1]	Training	Learner	X	X	X
BMV checklist[2]	Training & QI	Master Trainer/ QI monitor	X	X	X
OSCE A[3]	Training & QI	Master Trainer/ QI monitor	X	X	X
OSCE B	Training & QI	Master Trainer/ QI monitor	X	X	X
Teacher feedback	Training	Master Trainer		X	
Learner feedback	Training	Learner		X	
Delivery checklist	QI	Master Trainer/ QI monitor			X
Resuscitation debriefing	QI	Birth attendant/ QI monitor			X
Perinatal death audit	QI	Birth attendant/ QI monitor			X
QI visit[4]	QI	Master Trainer/ QI monitor			X

[1]MCQ=multiple choice questionnaire; [2]BMV=bag-and-mask ventilation; [3]OSCE=Observed Structural Clinical Examination; [4]QI=Quality Improvement

Evaluation and Results

Convenience sampling was conducted among 253 birth attendants at 23 rural community health facilities in western Kenya and one large teaching and referral hospital in Eldoret that were participating in a large-scale HBB implementation initiative. Participants had varied experience and baseline levels of comfort with mobile phones and technology. Their prior experience with HBB paper forms ranged from one to three years. Birth attendants from health facilities defined as high-volume (more than 150 deliveries per month), medium-volume (50 to 149 deliveries per month) and low-volume (less than 50 per month) were included.

Five experienced HBB master trainers (MTs) and quality improvement monitors were provided with Android study phones and prepaid data bundles. Birth attendants who owned Android-based mobile phones, tablets, or laptops were encouraged to download the web-based and/or ODK mHBB app to their own devices, use as desired, and 27 of these users from 12 facilities were subsequently interviewed in-depth.

The web-based and ODK-based mHBB systems were pilot tested simultaneously with a focus on questions related to the technical feasibility and acceptability of mobile phone-based HBB data collection in the Kenyan context, as compared to the current paper-based system.

Both the web-based and ODK mHBB systems were found to be preferred over the existing paper-based HBB data collection system, with the mHBB ODK app preferred overall. The primary disadvantage cited for the web-based system was an often slow and interrupted internet connection that caused data loss. Advantages of ODK mHBB include its convenience and simplicity, its ability to reduce the rate of data errors and decrease reporting lag times, and its improved efficiency, both in time and cost, of data collection.

Lessons Learned

The most crucial lessons learned were regarding potential sustainability and scalability of the mHBB initiative. Key informant interviews revealed three key suggestions:

- Preference that an inexpensive Android phone, preloaded with the mHBB-ODK app, be provided to each health facility and incorporated into the health facility infrastructure, rather than a phone be provided to individual birth attendants
- All facility birth attendants receive an orientation to the mHBB-designated Android phone, and training on use of mHBB-ODK
- That the mHBB equipment (phone), software, and data collection training package described above be integrated as a standard part of the general newborn resuscitation training and commodities package at the county and national levels

Conclusion

Implementation research has shown that the mHBB ODK-app is preferred by end-users and is the most feasible, acceptable, efficient, and effective of the three data collection solutions available in Kenya.

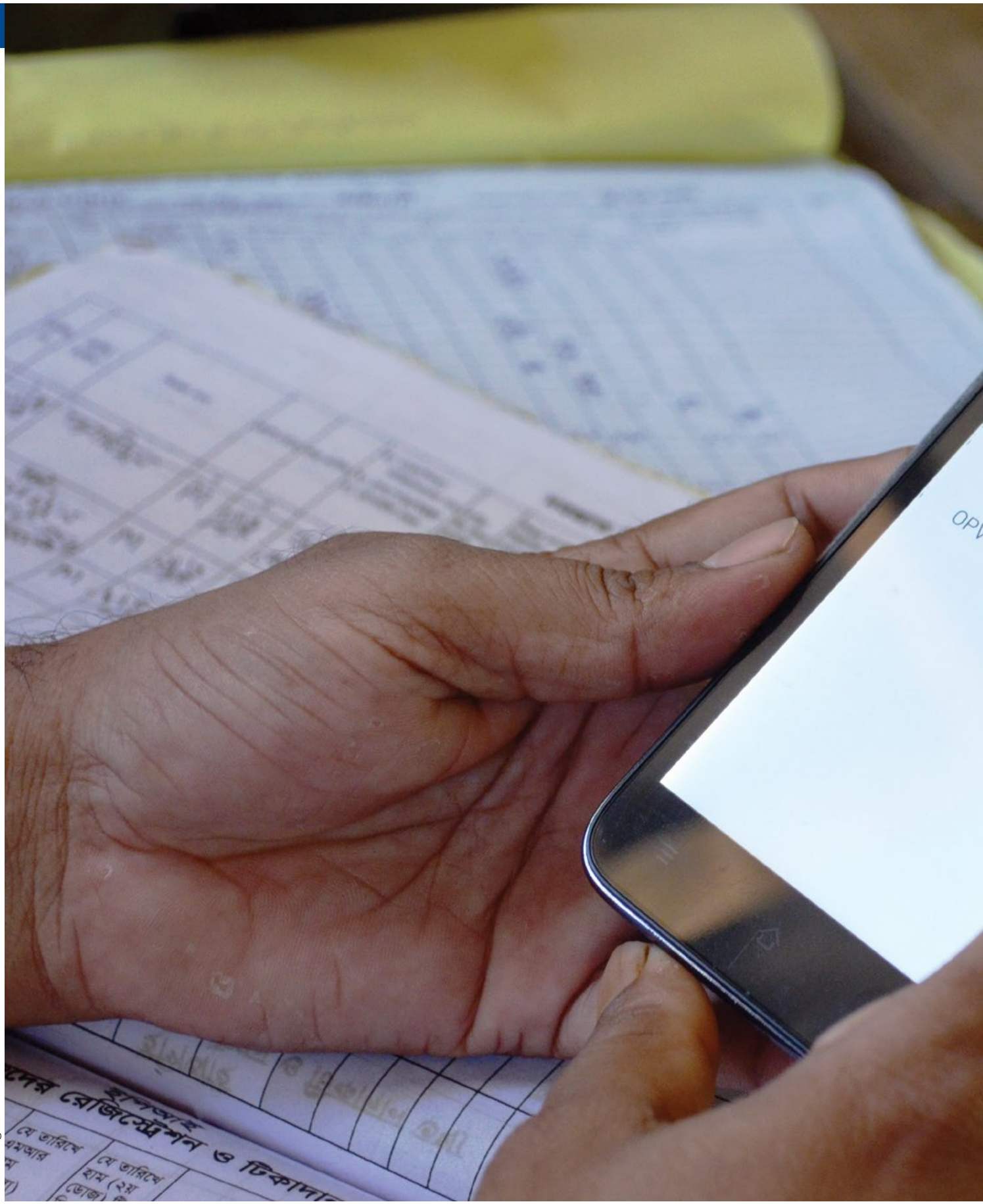
Next steps include performing a limited implementation trial of mHBB in Kenya; assessing the potential feasibility and acceptability of mHBB in other resource-limited settings where HBB implementation is ongoing; expanding mHBB to include functions related to motivational messaging, incentives, refresher training, and integration with health management information systems; and developing integrated mobile data collection systems for other Helping Babies Survive programs, including Essential Care for Every Baby and Essential Care for the Small Baby. ■

Geographic Coverage: Western Kenya, 23 health facilities in Bungoma, Busia, and Kakamega counties; Moi Teaching and Referral Hospital in Eldoret, Kenya

Implementation Partners: Indiana University School of Medicine; Moi University School of Medicine; Indiana University School of Informatics and Computing; Clark University

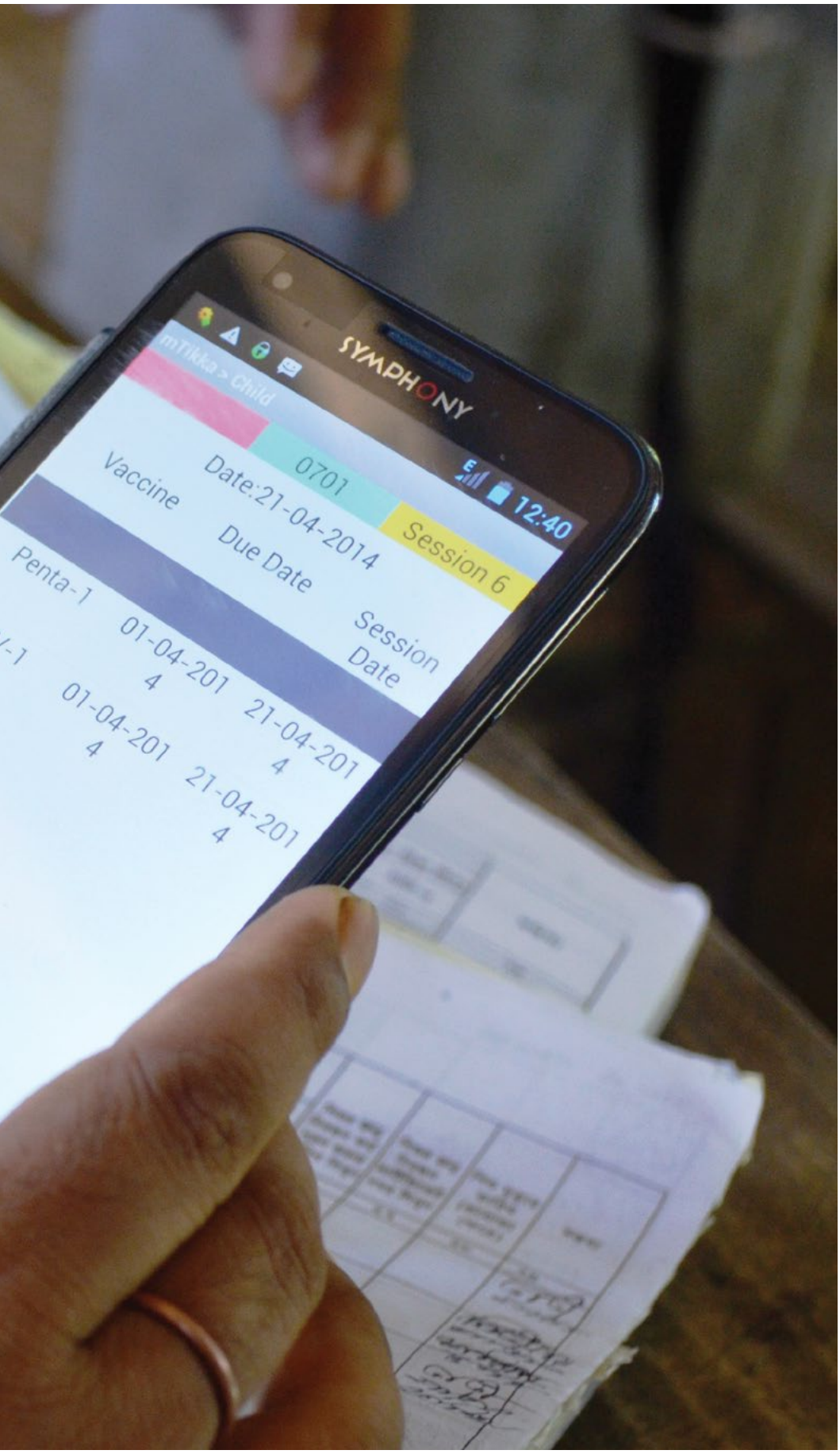
Donor: Laerdal Foundation for Acute Medicine

Contact Information: Sherri Bucher, Principal Investigator, Indiana University School of Medicine, shbucher@iu.edu



Neelu Singh

FINANCE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Rachel Lieber

Example of service delivery report sent vis SMS

A=# clients attended
B=# U5 attended
C=# U5 with malaria
G=# U5 with pneumonia
F=# U5 with diarrhea
D=# U5 referred
E=# clients received FP pills

ACCREDITED Drug Dispensing Outlet

IMPLEMENTATION DATE: April 2012 to May 2015

Improving regulatory capacity to enhance pharmaceutical product and service quality

Many people in rural Tanzania seek health care and medicines from retail drug shops, which historically had unqualified, untrained and unsupervised sellers.[1] 1 Launched in 2003, the Accredited Drug Dispensing Outlet (ADDO) program sought to improve access to affordable, quality medicines and pharmaceutical services in underserved areas through a combination of training, incentives, and regulatory oversight of set standards.[2] One of the goals of Management Sciences for Health (MSH)'s Sustainable Drug Seller Initiatives (SDSI) program was to assure the ADDO program's long-term sustainability by increasing access to data for informed program decision-making. With nationwide scale-up and over 9,000 shops accredited or nearly accredited in Tanzania, the Pharmacy Council of Tanzania (PC) needed a comprehensive database to organize information on ADDO and pharmacy facilities and personnel. In addition, PC was interested in using mobile technology to improve its communication, reporting, and fees collection systems for these facilities. SDSI collaborated with Invention and Technological Ideas Development Organization (ITIDO), a local group, to help PC meet its needs.

About ADDO

Working with MSH and PC, ITIDO developed a web-based database of information on private sector drug outlets' premises and personnel, including facility registration, personnel qualifications and certifications, inspections, and payments of associated fees. ITIDO also developed mobile applications that link to the database and include a mobile payment component for premises and personnel fees, a short message service (SMS)-based reporting module for outlets to report on standard service delivery-related indicators, and an SMS-based information exchange module, which allows ADDO and pharmacy personnel to send and receive information, for example, on accreditation requirements or drug recalls. The applications work with the basic mobile phones that ADDO personnel

already own, precluding the need for smartphones.[3] SDSI tasked ADDO, pharmacy, and PC personnel with identifying features they wanted to see in the system; stakeholder input on the system design helps ensure sustainability. In addition, ITIDO developed the technology using JAVA-based open source software to ensure affordability and adaptability.

PC, MSH, and ITIDO introduced the technology in the Dar es Salaam and Pwani regions in May 2014 to determine its ease of use and whether it improves regulatory capacity and efficiency. The pilot involved 289 ADDO owners and dispensers from Pwani, 218 pharmacy owners and personnel from Dar es Salaam, and PC staff. A process evaluation and qualitative interviews were conducted to assess user experiences with the integrated mobile technology and database.

After the pilot, ITIDO used the findings to refine the applications. PC has entered into the system basic information on ADDOs and pharmacies nationwide, including GIS coordinates, in preparation for the technology's scale-up. SDSI and ITIDO also helped PC draft a technology scale-up and sustainability strategy. Drug shop regulatory agencies in other countries have already expressed interest in adapting and implementing the technology.

Evaluation and Results

During the four months of the pilot, all applications worked well: 129 people used mobile money to pay more than 12 million Tanzanian shillings or 6,443 USD in fees; over three months, more than 750 service delivery reports were received from participating ADDOs (illustrated top left); and PC sent out 13,000 text messages and received over 200 queries.[4] In-depth interviews were conducted with 28 ADDO owners/dispensers in Pwani region, eight pharmacy representatives in the Dar es Salaam region, and five PC staff members.[5] Interviews provided perspectives on the utility of service delivery reports, the two-way helpline, and mobile money.

Respondents reported that all three applications saved them time and money:

- Service reports: "This has made not only our life easier but also for PC themselves. They do not need to come to the outlets to collect the reports, and we do not need to go all the way to the district councils to submit them. It saves time and money." (Dispenser, Kibaha)
- Helpline: "Oh yes, this service is good. You can send a question asking about the process of opening a drug shop and you get all the information." (Dispenser, Bagamoyo)
- Mobile money: "It is also safe, you don't need to carry money every time; you might get robbed. Paying through M-Pesa is very safe." (Dispenser, Bagamoyo)

Although feedback was mostly positive, some pharmacy personnel felt their training on the helpline was inadequate. Others noted delays in receiving report confirmations or answers to queries from PC. Mobile money had allowed PC to collect fees quickly, and PC staff reported that mobile technology had improved communication between themselves and ADDOs. A challenge was that not all PC departments were using the database, which limited its usefulness. Despite challenges, PC staff were eager to see that the tools were used effectively to improve their own operations and those of ADDOs and pharmacies.

Lessons Learned

- Engaging and training all potential technology users in the regulatory organization is critical to realizing the technology's full potential and benefits.
- Something as simple as a helpline may not be intuitive to all, which limits its use; therefore, training time needs to be adequate to suit everyone's needs.
- End-users, such as ADDO and pharmacy personnel, should receive aggregated feedback on service reports so that they know the data are being used.

Conclusion

The pilot of the database and mobile applications suite demonstrated that low-cost technology using basic mobile phones is a viable option for regulatory authorities seeking to collect data from remotely located private sector outlets. The majority of ADDO and pharmacy users picked up the mobile applications with ease and expressed appreciation for the technology. If taken to scale, the technology has the potential to improve PC's ability to locate and manage rural ADDO facilities, track professional licensing status and collect related fees, and better communicate with the outlets. In addition, MSH has been working with regulatory authorities in Uganda and Liberia to adapt this database and applications to increase their own oversight efficiencies related to their accredited drug seller initiatives. ■

Geographic Coverage: Tanzania

Implementation Partners: Management Sciences for Health; Pharmacy Council of Tanzania; Invention and Technological Ideas Development Organization (ITIDO); Dr. Angel Dillip, Apotheker Consultancy Inc.

Donor: Bill & Melinda Gates Foundation

Contact Information: Jafary Liana, Senior Technical Advisor, MSH Tanzania jliana@msh.org

Mark Leong, WHO

There is no single, standalone component of the program that increased facility delivery and postpartum attendance rates. The combined counseling, permission-seeking, and escorting aspects—all supported by mHealth—served to motivate, comfort, and even convince families when needed.

mHEALTH for Safer Deliveries

IMPLEMENTATION DATE: October 2011 to December 2014

An integrated intervention to improve the quality of care during delivery in Zanzibar

In Tanzania, despite high rates of antenatal care and relatively good access to health facilities, maternal and neonatal mortality remain high at 310/100,000 live births and 28/1,000 live births, respectively, and almost half of all deliveries are performed at home without a skilled attendant.[1,2] Through commitment to Millennium Development Goals (MDGs) 4 and 5, as well as the government strategy for growth and reduction of poverty, the Revolutionary Government of Zanzibar has made a strong commitment to prioritizing this issue.[3] However, significant reduction in mortality will not be achieved without increasing skilled care at birth. Hence, the Ministry of Health (MOH) has set specific targets to increase facility delivery from approximately half of deliveries up to 80 percent. D-tree International has been partnering with the MOH at the central and district levels since 2011 to help achieve this target.

In Zanzibar, through the mHealth for Safer Deliveries project, D-tree and the MOH seek to reduce all of the "three delays" to receiving quality care at birth: (1) the decision to seek care; (2) reaching skilled care; and (3) the provision of adequate care at the health facility.[4] The project ensures that mothers and their newborns reach care when they need it by engaging community health workers (CHWs) at the lowest levels and arming them with the knowledge, tools, and motivation to serve families at home.

About mHealth for Safer Deliveries

CHWs are trained to use a simple phone with a decision-support application so that with a single device the CHW can:

- develop a birth plan with each woman based on medical and obstetrical history;
- counsel the mother and family on healthy behaviors and recognizing danger signs;
- record permissions from husband and family members agreeing to a facility-based delivery;
- screen women (and their babies) for complications from pregnancy up to a week after delivery and refer them as needed to the health facility;

- use mobile banking instead of cash to pay for transportation to the health facility when the woman is in labor or in case of complications;
- use text or voice communication to notify a health facility that a woman is in transit to ensure the facility is prepared.

The phone also provides an electronic record for the mother and infant that can be viewed both by CHWs on the phone and by supervisors or government officials on an online dashboard. D-tree worked with local leaders and health facilities to enroll drivers into the program and prenegotiate fair rates for transport. D-tree also worked with local telecom company Zantel to expand pay points and reporting for the CHWs' mobile banking accounts and developed a real-time online tracking system to trace account activity. After an initial pilot in two districts in 2011, Phase 2 (2012–14) supported 223 CHWs in six districts, including 112 wards recognized as having particularly low facility delivery rates and significant transport challenges.

Evaluation and Results

The mHealth for Safer Deliveries project now reaches over half the rural population of Zanzibar. The facility delivery rate has reached 75 percent compared to an average of 35 percent.[2] Among women who had given birth at home for their previous delivery, a subset considered most "at-risk" of home delivery, 63 percent delivered in a health facility. The impact on postnatal care attendance is also striking, with 88 percent within 10 days compared to only 10.9 percent within a week during the year prior to project implementation.[5]

In total, CHWs registered 13,690 pregnant women during the project. They conducted 38,608 screenings on 12,882 women and made 27,011 postpartum visits. They made 14,940 referrals and overall, the program initiated close to 40,000 mobile money transactions for CHW transport and incentives. The data yielded a number of unexpected, new insights, including the very high number who have serious risk factors or danger signs both before and after delivery. Almost half of the women in the program had a danger sign pre- or post-delivery that required an additional visit to the health facility.

Qualitative investigation increased knowledge of the causes of home deliveries when they did happen, including religious barriers, modesty norms, rumors of witchcraft, the desire of relatives to stay close to the mother, and hidden costs at health facilities. Interviews also revealed that there is no single, standalone component of the program that increased facility delivery and postpartum attendance rates. Despite the importance of transport being available, it was by no means the sole determinant of a woman getting to a facility. Indeed, the combined counseling, permission-seeking, and escorting aspects—all supported by mHealth—served to motivate, comfort, and even convince families when needed.

Lessons Learned

- When possible, provide a vertical integration of various mobile services, such as decision-support and mobile money, to enhance program impact.
- mHealth interventions should be tailored to the cultural setting and be used as a tool to enhance other evidence-based approaches, such as behavior change interventions.
- mHealth program models should be scalable and sustainable, creating incentive and/or revenue for all parties involved.
- Data obtained as a byproduct of many mHealth interventions should both dictate and be dictated by a rigorous monitoring and evaluation plan.
- Multiple levels of government should be involved in shaping the intervention from the beginning and be included in all phases of planning and implementation.
- Building rigorous tracking systems to reconcile the mobile money (financial) and mobile health (programmatic) data, while time consuming, can greatly facilitate scale-up and increase accountability.

Conclusion

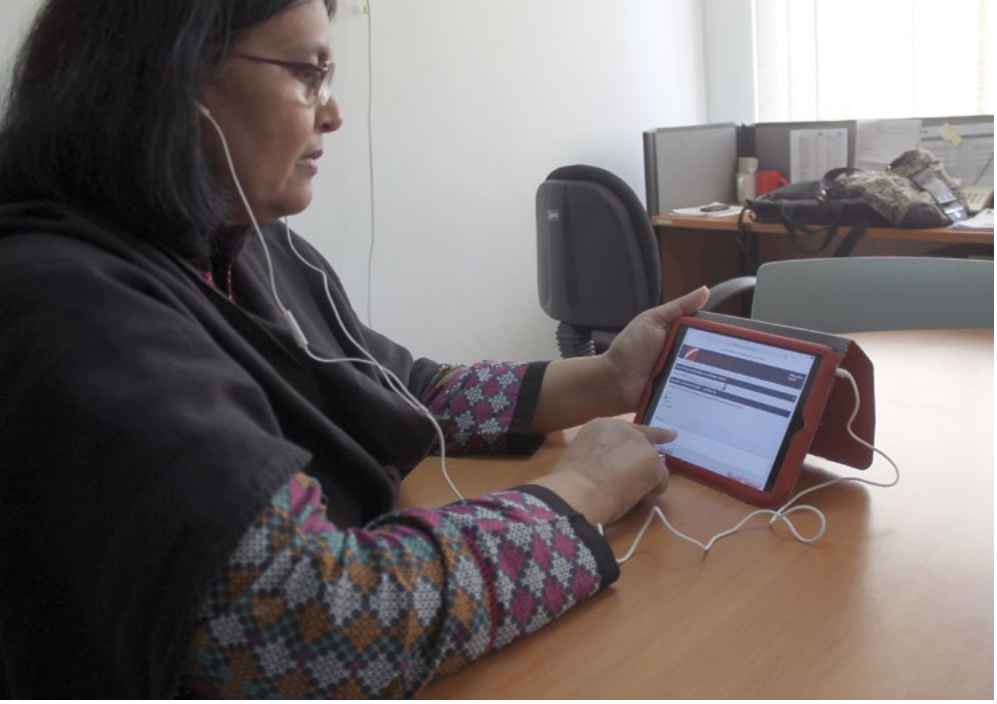
The success of the Safer Deliveries program came from integrating novel mHealth health approaches—including decision-support, data storage, mobile banking, and communications—into a community intervention that effectively linked the institutional and community levels to overcome barriers to hospital deliveries within Zanzibar. It was this combination that has spurred the beginning of a "culture shift" in delivery practices in Zanzibar and shows a great potential of improving maternal health outcomes and reaching MDG 5 within Zanzibar, across Africa, and around the world. ■

Geographic Coverage: Unguja and Pemba, Zanzibar

Implementation Partners: D-tree International, Jhpiego, Ministry of Health, Zanzibar

Donor: Bill & Melinda Gates Foundation

Contact Information: D-tree International: Marc Mitchell, President mmitchel@hsph.harvard.edu



Heartfile

Requests from pre-registered hospitals arrive as SMSs, which trigger the system. Automated alerts go to patients and doctors to gauge a patient's eligibility for assistance. Once a procedure is done or services are delivered, a monitoring officer confirms completion.

Heartfile Health Financing

IMPLEMENTATION DATE: 2010 to Present

Financial risk protection for people with non-communicable diseases in Pakistan

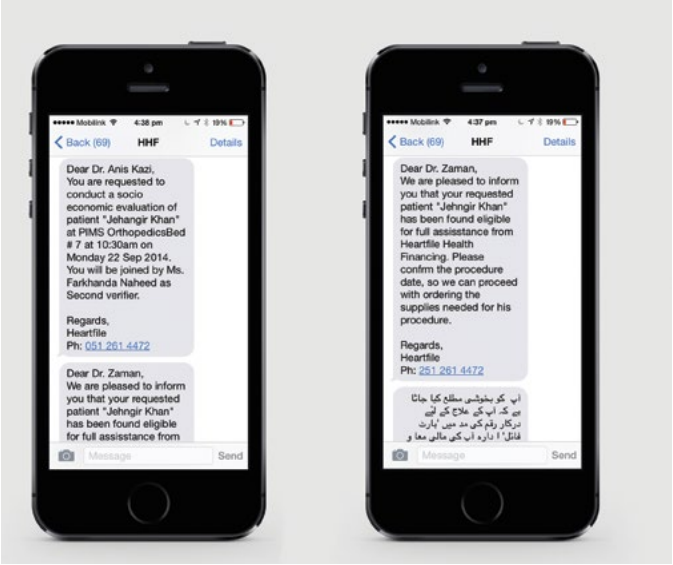
There are two health systems models operating in the world: the Beveridge system, in which revenues fund public facilities and services, and the Bismark system, where pooled funds and intermediary agencies procure services from the private sector for those employed in the formal sector. These models are limited in their ability to offer financial risk protection to the poor working in the informal sector, especially in countries with mixed health systems where public and private service providers coexist but out-of-pocket payments remain the major means of health financing.

In such settings, public sector facilities do not offer free onsite services for the entire spectrum of needs. Therefore, individuals seeking care for major illnesses, especially non-communicable diseases, end up spending catastrophically on healthcare and are either pushed into poverty or forgo healthcare altogether. These problems exist in Pakistan as well as in most developing countries with mixed health systems. Access to financial services has been termed as one of the three impediments to seeking healthcare in WHO's World Health Report on Health Financing, 2010. Heartfile has developed a health system model to overcome this gap.

About Heartfile Health Financing

Heartfile Financing is an mHealth-enabled fund-based purchasing system. The fund currently has a full grant and a partial grants window in operation. Because of the unique donor empowerment features (real time micro-transaction alerts, full web viewing of grant allocation to individual patients, etc.), these windows have expanded overtime and are now being supported by a range of donors—individual philanthropy, bilateral and multilateral agencies, and institutional donors. Two other windows are planned for introduction in an effort to move towards sustainability. A mobile saving program backed by telco-microinsurance linkages helps to underwrite partial health costs and a health loans program.

The Heartfile Financing system runs on mobile phones. The SMS function is being used as the backbone of communi-



cation rather than smartphone features in order to make the program widely available in developing countries where smartphone penetration is still low. Requests from pre-registered hospitals arrive as SMSs, which trigger the system. Automated alerts go to patients and doctors in local vernacular to gauge a patient's eligibility for assistance. Automated SMS-based decisions are conveyed to patients and doctors, followed by SMS-based purchase orders to suppliers and pre-registered hospitals ordering supplies and/or procedures for a particular patient.

Once a procedure is done or services are delivered, a monitoring officer confirms completion with a cell phone message and the doctor acknowledges the same. This segregation of responsibilities helps to protect against abuse and the possible introduction of a 'ghost patient' in the system. A donor is then matched with a patient according to donor preferences and an SMS alert is sent to convey case closure. The cell phone messaging is part of a workflow algorithm. For each patient, this workflow is performed on tablets in the field and on a technology platform at the clearing house at Heartfile. Unique transparency features enable tracking of individual patients on a web platform, linking doctors, patients, and service providers.

Evaluation and Results

Both impact and process evaluations are currently in the final phase of analysis. A series of ethnographies of beneficiaries of the program from across Pakistan were conducted. This study has completed the data collection and analysis phases. A process evaluation is also underway. Expressions of interest for third party evaluations and case studies have been solicited.

Lessons Learned

- Innovations have to be developed at multiple levels and in a holistic way in order to build an innovative system to overcome a specific challenge. Innovations in partnerships, technology, systems, and procedures have to be integral to this process.
- Building a system is an iterative process—initial development, deployment, operationalization, learning from implementation experiences, and evidence-based modifications have to be part of the process.
- The use of cell phones has made this new model widely acceptable to all stakeholders, especially users, as they do not have to make an investment in hardware and do not have to spend much time learning new skills.
- The transparency of the program has been valued by all stakeholders.

Conclusion

Heartfile Financing is a health systems model which aligns with mixed health systems to achieve financial risk protection for the poor in the informal sector. The model is scalable and replicable in settings other than Pakistan, where it was developed and is being tested. The key variables for scale-up and replication are a reliable cell phone network and internet connectivity for the clearing house. The features and controls built into the system help protect against abuse, improve efficiency, and achieve value for money. ■

Geographic Coverage: Pakistan

Implementation Partner: Heartfile

Donors: Dr Sania Nishtar, Founder; Royalty of the book, *Choked Pipes*, published by the Oxford University Press; Rockefeller Foundation; Individual donors and private foundations in Pakistan; Pakistan Poverty Alleviation Fund; Canada's International Development Research Center (IDRC); USAID; John Snow International; KFW Bankengruppe; partnerships with the Clinton Global Initiative (a joint commitment) and the World Economic Forum's International Partnership for Innovative Healthcare Delivery (IPIHD)

Contact Information: Dr. Sania Nishtar, Founder, Heartfile, sania@heartfile.org

Carolyn Florey

Overhead funding is saved by foregoing cash-based transfers of incentives, time is saved because the mobile mechanism transfers the funds to the beneficiaries efficiently, and security risks are decreased because the mobile transfers are more secure than handling cash.

m4Change + mCCT

IMPLEMENTATION DATE: January 2014 to Present

Facilitating mobile money transfers to improve maternal and newborn health in Nigeria

Nigeria has one of the world's highest rates of maternal mortality. Each year, for every 100,000 live births, 630 mothers die during childbirth. The government of Nigeria launched the "Information Communication Technology for Saving One Million Lives" (ICT4SOML) initiative in 2012; this initiative intends to increase government response to maternal mortality and bring Nigeria closer to reaching the Millennium Development Goals related to maternal and child health.

Mobile interventions and applications have been shown to improve health outcomes related to maternal health by providing decision support to patients and community health workers, improving case management of pregnant women and new mothers, and providing efficient, secure means for conducting financial transactions related to health care. Mobile money also has the potential to reach many patients who do not currently have access to banking services. The Nigerian government's Subsidy Reinvestment and Empowerment Program (SURE-P) is currently implementing a conditional cash transfer (CCT) scheme through which mothers are incentivized to attend a continuum of maternal and neonatal health services. SURE-P is using a cash-based disbursement system that is both expensive and inefficient and has partnered with Pathfinder International to integrate mobile solutions into the SURE-P CCT program.

About m4Change + mCCT

Pathfinder International provides sexual and reproductive health services in over 25 countries, including Nigeria, where Pathfinder has worked for more than 50 years. The m4Change project was launched by Pathfinder in 2012; through m4Change, 20 primary health centers in Abuja and Nasarawa states were able to use a mobile decision support application which helped them track pregnant women and provide them with improved antenatal care. In 2014, Pathfinder built on the m4Change project's success and launched m4Change + mCCT with funding from the UN Founda-

tion, IWG mechanism. A mobile application is used to track pregnant mothers through ANC, delivery and child's first year of life who are enrolled in the CCT scheme, improving health workers' ability to collect data and verify that mothers are receiving services. A data dashboard was built to support the government to easily access the data, facilitating client payment approvals, decision making and reporting. The program is designed for clients to receive their payments via mobile money. Overhead funding is saved by foregoing cash-based transfers of incentives, time is saved because the mobile mechanism transfers the funds to the beneficiaries efficiently, and security risks are decreased because the mobile transfers are more secure than handling cash. Furthermore, clients are able to provide feedback, encouraging swift and accurate improvements to be made to the system.

Evaluation and Results

The original m4Change project, which was implemented from December 2012 to December 2013, resulted in 150 community health extension workers and supervisors being trained. Pre- and post-intervention studies were conducted in order to assess the impact on the quality of antenatal care being provided by these facilities. 266 patients were interviewed from 10 of the participating facilities. Scores increased, with statistical significance, in the categories of overall quality, technical quality, and counseling quality. 98 percent of providers said they would recommend continuing the use of the application and that it should be adopted by the government at other health facilities. However, around half (48 percent) of providers also noted that using the application increased their workload and the amount of time it took to engage with patients.

The m4Change + mCCT program seeks to increase the use of the m4Change application and expand its coverage to include tracking of beneficiaries of the CCT program. It is being designed and piloted for scale-up nationwide. It has also been designed to collect data for reporting purposes including over 100 national health indicators, data about new mothers and babies through their first year of life, and tracking of approvals for the payment disbursements. Lessons learned from the data collected from these mechanisms will inform the national scale-up strategy.

Lessons Learned

- There are numerous mobile money providers in Nigeria; making an application that works across platforms is ideal, but challenging. Also, in Nigeria, both banks and mobile network operators control the mobile money services. Bringing this application to national scale must be done with consideration for the many diverse stakeholders involved.
- The literacy rate of mCCT clients must be considered during development. Some clients were unfamiliar with mobile technology and mobile money.
- Phone ownership, especially in rural Nigeria, is not yet universal. Only 39 percent of rural Nigerian populations have access to mobile phones. Some clients were issued SIM cards to participate in the program.
- Strategic partnerships with the private sector are helpful when seeking to address some of the challenges related to navigating the complex environment of banks, mobile network operators, and other value-added service aggregators who participate in the mobile money market.

Conclusion

Mobile money is an emerging tool in Nigeria; its use has the potential to transform conditional cash transfer implementation. In collaboration with private and public stakeholders, SURE-P and Pathfinder International are working to develop an efficient, cost-effective strategy for rolling out a mobile money transfer intervention at the national scale. The m4Change + mCCT intervention uses a data-driven approach to track progress of pregnant women enrolled in the CCT scheme with the ultimate aim of improving maternal and newborn health outcomes. ■

Geographic Coverage: Kaduna and Abuja/Federal Capital Territory, Nigeria

Implementation Partners: SURE-P Government of Nigeria, Pathfinder International

Donor: United Nations Foundation

Contact Information: Marion McNabb, Senior Technical Advisor, mHealth, Pathfinder International, mmcnabb@pathfinder.org; Farouk Jega, Pathfinder Nigeria Country Representative, Pathfinder International, fjega@pathfinder.org

JSI

A unique partnership between insurance and telecommunications companies proves a different path to increase access to health financing.

Airtel Insurance with MicroEnsure

IMPLEMENTATION DATE: January 2014 to Present

Sustainable health microinsurance at scale

Health insurance penetration in Africa remains under 1 percent, serving fewer than 3 million people, despite there being over 400 non-profit and private health insurance schemes active across the continent. Along with a range of other factors, the high expense of traditional health insurance keeps it out of the hands of the mass market. While public health insurance projects are underway in many markets, MicroEnsure decided to pursue a complimentary private solution with Airtel, a pan-African telecommunications company.

By introducing consumers to a free, basic health insurance product, establishing trust through transparent, reliable operations, and then offering iterative up-sell products to allow customers to increase their coverage by paying larger premiums, MicroEnsure believed it could create an alternative path to health insurance coverage.

About Airtel Insurance with MicroEnsure

MicroEnsure and Airtel launched their first simple health insurance product in Ghana in January 2014 and have since launched in seven other African markets. The product is relatively straightforward: Airtel rewards loyal customers (who registered for the product by dialing a shortcode) with free insurance as long as they spent a minimum amount of airtime (usually $2). The more a customer spent with the telecom, the more health insurance could be earned. Customers were educated as to how the product works via a Unstructured Supplementary Service Data (USSD) menu showing policy information and through monthly SMS communications informing them the amount of insurance they earned for the following month.

The health insurance offered a simple benefit, consistent across every market: qualifying customers received one month of hospital cash as a lump sum of up to $150 paid to them via mobile money if they spent three nights or more in any hospital across the nation, for any medical reason, with no exclusions. This wide-open claims model was designed to eliminate the fine print traditionally associated with insurance and to demonstrate a reliable product. Furthermore, even a small amount of health insurance coverage represent-

ed a massive improvement over the status quo in these developing markets, and provided a preliminary foray into health financing.

SIM-card swapping is common in Africa and there is generally a low level of brand loyalty towards many African telecoms. Because the MicroEnsure-Airtel product was expected to increase brand loyalty as well as revenue for the telecom, Airtel paid the premiums to MicroEnsure and its partner insurance companies in various markets. The customer's airtime was not deducted but rather the cover was provided for free and paid by the telecom on the basis of the overall increase in value to their core business (via airtime spend) from the portfolio of insured customers.

This business model therefore offered a "win-win-win" for the patient, distributor, and insurer alike. The patient received free and reliable means of mitigating risk, the distributor received a product to increase revenue and brand loyalty, and the insurer saw millions more customers become policyholders on a financially viable basis as premiums exceeded the cost of claims.

Evaluation and Results

The major objectives for this project concerned scaling health microinsurance, financial sustainability, and creating new market penetration by offering customers their first-ever health insurance policies. While health insurance enables access to inpatient hospital care, the impact of this product on health outcomes is not yet known.

In 2014, more than 3.1 million customers enrolled in simple, free health insurance through Airtel and MicroEnsure. As of May 2014, the product has expanded to eight African markets and all products are still available. Surveys across operating markets have indicated that for 86 percent of Airtel/MicroEnsure's customers, Airtel Insurance was their first insurance policy of any kind.

Lessons Learned

- Low health insurance penetration is not a result of a lack of demand but rather a function of high cost, low trust, poor access, and product complexity.
- A simple health insurance benefit is perceived as better than having no health insurance at all; it is not necessary for the uninsured customer to enroll for full health coverage from the start.
- Mobile channels offer important assets to enhance an mHealth service, but the telecom will only unleash those assets if they will directly benefit in their own core business growth; the benefit must be clearly communicated to show the mutual gains received through the initiative.

Conclusion

Airtel and MicroEnsure received positive first-year results from and testimonials about Airtel Insurance. Contrary to many common assumptions about health financing, the partners have proven a different path to increase access to health financing and anticipate continued product development.

Plans for the product moving forward include offering higher amounts of coverage for which customers would pay. In March 2015, Airtel and MicroEnsure began offering an up-sell product which provided double the amount of coverage for the subscriber; the same coverage was also offered to a family member. Within the first two months, more than 50,000 customers had purchased the up-sell and many said they were excited to do so based on the provenance of the initial free insurance product.

Later in 2015, MicroEnsure and Airtel will launch mHealth services to Airtel Insurance customers, allowing them to enjoy health financing as well as health education products in a simple package that can be offered at scale from day one. ■

Geographic Coverage: Ghana, Zambia, Burkina Faso, Nigeria, Niger, Madagascar, Kenya, Malawi

Implementation Partners: MicroEnsure; Airtel Africa

Donor: None

Contact Information: Steve Knight, Communications Manager, MicroEnsure, steve.knight@microensure.com

Julia Ruben, D-tree International

LOGISTICS

Clément Tardif, IntraHealth International

By using specialized and regionally based logistics professionals to carry out logistics tasks such as quantification, data collection, and distribution, logistics performance improves and health workers are free to focus on what they do best—health service provision.

INFORMED **PUSH MODEL**

IMPLEMENTATION DATE: August 2013 to Present

Scaling logistics management information systems via push models for increased family planning access and use

In Senegal, the absence of a well-functioning family planning product supply chain has been a barrier that has contributed to Senegal's low contraceptive prevalence rate (CPR) (12.3 percent in 2010) and high unmet need for family planning among married women (29 percent). Recurrent family planning product stock-outs at nearly 80 percent of public service delivery points (SDPs) continue to hinder the government's ability to achieve its goal of more than doubling CPR to 27 percent by 2015. To improve the supply chain and ensure the steady availability of contraceptive products, IntraHealth International is expanding the approach known as the Informed Push Model (IPM) nationally in Senegal. Successful IPM implementation depends on the availability of routine SDP-level product consumption data, but the data have historically been unreliable or unavailable in Senegal. IntraHealth is collaborating with Dimagi to solve this problem by implementing a customized version of CommTrack as the IPM's logistics management information system (LMIS).

About IPM

The IPM is a distribution model that adapts principles used in commercial distribution to the public health sector. The IPM addresses common supply chain obstacles of transportation, quantification, data availability, and financial flows. The model involves dedicated logistics professionals, who deliver contraceptives from the regional level directly to SDPs on a monthly basis.

A key component of the IPM project's success has been the use of an LMIS. CommTrack is an open source turnkey product designed to strengthen logistics management through the use of mobile technology. With this support from Dimagi, the IPM project has identified a low-cost and highly scalable mHealth solution that makes it possible to substantially reduce contraceptive stock-outs and broaden Senegalese women's access to a wide range of family planning products.

IPM's key features include:

- Task shifting. By using specialized and regionally based logistics professionals to carry out logistics tasks such as

quantification, data collection, and distribution, logistics performance improves and health workers are free to focus on what they do best—health service provision.

- **Public-private partnerships.** The Senegal IPM uses private operators, or third party logistics providers, to store and distribute the family planning products.
- **Payment based on consumption.** Before the IPM, SDPs were required to pay for family planning products at the time of order, which resulted in cash flow problems and a broken cost-recovery system. With IPM, payments are based on quantities of product delivered and consumed.
- **Aligning incentives.** The IPM aligns the incentives of all parties involved in making sure that family planning products reach SDPs and clients.
- **Open LMIS.** The logistics professionals enter logistics data into CommTrack on tablets at the moment of delivery, and CommTrack automatically calculates delivery quantities based on previous consumption.

Evaluation and Results

Most public health medicine distribution systems involve high numbers of users at each level of the system, with each level required to contribute data to the LMIS. In Senegal, the IPM has decentralized logistics management tasks to the regional level. The result has been a dramatic reduction in the number of individuals interacting with the LMIS, from approximately 1,450 providers, supervisors, or facility workers to 14 logistics operators (one per region).

Among its many benefits, the small number of LMIS users required by the IPM results in simplified training needs and less costly hosting and maintenance. Also key to the IPM approach is the flexibility and mobility of the LMIS. Previously, data were entered via paper registers. Now, users are able to access and enter data directly into the system via portable tablets at each facility or depot anywhere in Senegal.

By customizing open source software, the IPM project has kept development costs to a minimum. Implementing CommTrack as the IPM's LMIS costs less than $140 per SDP and has proved to be a low-cost, highly scalable mHealth solution.

As the IPM and its customized LMIS undergo national scale-up, health workers who are using the model have described it as a "revolution." Now, providers are able to more accurately plan for and receive contraceptive products. Moreover, clients are benefiting from the regular resupply of family planning products and—because providers' time is freed up—increased provider-client interactions. Clients are expressing greater satisfaction with family planning services, and providers report greater job satisfaction, improved work flow, and better-quality reporting of data.

Lessons Learned

- The IPM's distribution of products directly from the regional level to SDPs allows district health teams **to maintain their focus on management of SDPs** and service provision rather than being sidetracked by physical supply chain operations.
- The IPM's task-shifting approach leverages the limited supply chain management expertise in Senegal by **using a small number of trained professionals** to serve a large number of SDPs.
- Shifting nonmedical tasks from health providers to logistics professionals **frees up providers' time,** improving service quality and ensuring that women have access to a steady supply of family planning products.
- The IPM **strengthens public-private partnerships** while incentivizing all parties to ensure that facilities and communities have access to family planning products.

Conclusion

IntraHealth International, in collaboration with Senegal's Ministry of Health and Social Action, is expanding access to—and use of—family planning by reducing contraceptive stock-outs. Implementation of the IPM reinvests proceeds from clients' contraceptive purchases back into the public contraceptive supply system to ensure the constant flow and availability of products. By making a wide range of family planning commodities available, the IPM enables women to more freely choose the methods they want at affordable prices. The model also generates data on the consumption of family planning commodities, which can then be used to inform and improve how health services are provided.

With the IPM, the logistics management burden is shifted from health workers to dedicated logistics professionals, leaving more time for providers to focus on service delivery quality. Over time, therefore, improvements in the family planning commodity supply chain have the potential to boost health worker retention, improve client satisfaction, and increase women's access to contraceptives. The IPM also strengthens the quality of service delivery, reinforces provider roles and responsibilities, and improves workflow at the facility level. ■

Geographic Coverage: National scale in all 14 regions of Senegal to cover 1,400 service delivery points

Implementation Partners: IntraHealth International; Dimagi

Donors: Bill & Melinda Gates Foundation, Merck for Mothers

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D-tree International

The three components to the mHealth application are synergistic in providing a comprehensive array of tools and a supportive supervisory framework for HSAs to do their jobs well.

mHEALTH for Integrated Community Case Management

IMPLEMENTATION DATE: July 2012 to December 2016

Improving the quality of child health care at the primary level through integrated decision-support tools

Malawi is among nine low-income countries that successfully reduced its under-five mortality rate by 60 percent or more between 1990 and 2011.[1,2] Despite this progress, large numbers of children continue to die unnecessarily from conditions that are easily preventable and treatable. A large proportion of children in Malawi are still at increased risk of mortality due to common childhood infections. The leading causes of under-five mortality in Malawi are malaria (13 percent), AIDS (13 percent), pneumonia (11 percent), diarrhea (7 percent), and neonatal conditions (31 percent). The Ministry of Health (MOH) has been collaborating with partners to scale up a package of high-impact interventions to reduce under-five child mortality since 2007 under the Accelerated Child Survival and Development (ACSD) strategy. These efforts have included integrated community case management (iCCM) in hard-to-reach (HTR) areas to complement fixed or scheduled facility-based services. To improve the quality of care provided to under-five children, D-tree International is providing mHealth to support the implementation of iCCM.

About mHealth for iCCM

The primary end-users of the mHealth application are community health workers (CHWs) in Malawi, called health surveillance assistants (HSAs). There are three components to the mHealth application, each of which strengthens the ability of HSAs to deliver effective and efficient care. These components are synergistic in providing a comprehensive array of tools and a supportive supervisory framework for the HSAs to do their jobs well and enable improvement on access and quality of care at the primary level of health care.

The first component of the iCCM application captures all elements of the village register used by the HSA. The application has built-in functionalities that support HSAs to register children between the ages of two and 59 months only

and adhere to standard protocols. It supports HSAs to make the appropriate decisions on treatment and enables them to accurately report on time. The mHealth application therefore enforces adherence to clinical protocols and iCCM holistically.

The second component of the application is the supervisory tool for those who are managing and supervising HSAs. It is based on the new routine supervision checklist developed by the (MOH) and Save the Children and focuses on a few key indicators of performance by the HSAs. The tool facilitates both collection and interpretation of data and has a dashboard that enables users to see at a glance the status of the work being done by HSAs.

The third component links the iCCM application to the logistics management system to improve the availability of needed drugs at the rural clinics where HSAs see patients. This work has been coordinated with the existing John Snow Inc. (JSI) cStock program to improve the use of cStock in tracking drug inventories. D-tree International developed a simple user interface within the application through which health workers can report stock levels and then submitted the data to cStock.

Evaluation and Results

D-tree International carried out an evaluation to determine the clinical effectiveness of the electronic iCCM. A mixed approach was used to collect both quantitative and qualitative data. The results showed similar or higher scores in assessment, identification of danger signs, referrals (diagnosis), treatment, and counseling among HSAs using the mobile application. These are the key elements in the management of under-five child illnesses.

Adherence to assessment using the iCCM application was 90 percent compared to 91 percent among those using paper. With the phone application, all questions are asked and recorded before going into the next phase, requiring the HSA to go through the complete assessment. Phone users correctly identified and recorded 100 percent of the danger signs, while only 83 percent of the danger signs were correctly identified and picked by paper users. Adherence to treatment guidelines was lower among paper users (62 percent) than phone users (73 percent). While the phone provides the recommended treatment, the actual treatment given depends on the availability of needed drugs and supplies. Sixty percent of cases were referred appropriately in the intervention group compared to 48 percent in the control group. Counseling and treatment advice were also seen to be higher in the phone users than the paper users at 92 percent compared to 83 percent.

Much positive feedback was recorded during HSA and caregiver interviews. HSAs felt more confident using the iCCM application. They also felt a reduction in frequency of visits by the same children as compared to before, which they attributed to the comprehensiveness of the assessment and care given to the child when using the phone. HSAs using the phone expressed knowledge gain as a result of the prompts, advice, and counseling messages they receive from the application. HSAs also expressed improved follow-up rates for cases. However, they were concerned with double entry of data as they use both the phone and the paper registers.

Lessons Learned

- It takes time and effort to train and generate interest among stakeholders to use data generated through the implementation of mHealth applications.
- The involvement of communities in managing phones is critical to their sustainability.
- The implementation of mHealth is not a panacea to fix all problems within the health system. It is, and should be, part of an integrated system in order to achieve greater results.

Conclusion

The project has trained over 350 HSAs and 15 supervisors across Malawi and equipped them with mobile phones with the mHealth iCCM application. There are plans to train over 1,000 HSAs and supervisors, one-third of the total in the country. The project has built capacity within the MOH in mHealth by training trainers and champions to provide support to the system, and mHealth has been added to the national eHealth strategy. More importantly, the mHealth application is improving quality of care for under-five children due to strict adherence of assessment protocols by health workers. Malawi is on its way to becoming a leader in the wide-scale embrace and use of mHealth activities to strengthen the health system. ■

Geographic Coverage: Ntchisi and Dedza Districts, Malawi

Implementation Partners: D-tree International, Ministry of Health, Malawi (IMCI Unit), Things Prime

Donor: Barr Foundation

Contact Information: Eric Saforo, Country Director, D-tree International – Malawi, esaforo@d-tree.org

JSI

IQSMS provides district, regional, and national stakeholders with up-to-date, vital information and assists with decision making about the distribution and re-distribution of HIV commodities to avoid disruption in the testing of pregnant mothers and exposed infants.

IQSMS
International Quality Short Messaging System

IMPLEMENTATION DATE: October 2012 to March 2016

Using mobile technology to improve distribution and availability of HIV commodities in remote health facilities in Tanzania

The Local Partners Excel in Comprehensive HIV & AIDS Service Delivery (LEAD) project, funded by the Centers for Disease Control under PEPFAR, supports prevention of mother-to-child transmission (PMTCT) services at 509 facilities in the Mara and Tanga regions of Tanzania. Most are health centers and dispensaries in remote locations with unreliable or no sources of funds to transport reports and travel to collect medical supplies. These factors contribute to regular stock outs of health commodities needed for HIV testing of pregnant women and exposed infants. In July 2010, LEAD introduced the use of International Quality Short Message Software (IQSMS) to support facilities to share HIV commodity information.

About IQSMS

IQSMS uses healthcare workers' mobile phones to send preformatted commodity reports to a central server via SMS. Messages sent to the server undergo quality checks, with responses sent to the sender before the data is integrated into the server. These messages contain key HIV stock status for Determine, Unigold, and Dried Blood Spot (DBS) test kits. The stock reports are then retrieved, analyzed, and shared with key stakeholders for immediate action.

The application enables facilities, districts, and implementing partners to make profitable decisions about HIV commodities ordering cycles and quantity levels, from product consumptions to product reallocations and forecasting. Districts and facilities have been able to boost HIV testing services, improve proper medicines distribution according to consignments, and ensure successful preparations of Report and Request (R&R) forms. The application at glance provides real time data from the root cause at health facilities; the tool facilitates health care workers to submit national core reporting indicators that are found on the national reporting tools (MTUHA), capturing monthly data. In a single button click, the tool enables districts to receive a full order of all commodities as quantified by the system based on what has

actually been consumed. All quantifications and calculations are handled by the system with consideration to physical stock taking.

To avoid parallel reporting, the system is now interoperable with both DATIM and DHIS2, based on OpenHIE using DXF2. The system is able to use Application Program Interface (API) to feed data collected from the health facility level directly into DHIS2's central server. During data exportation, IQSMS performs information comparison to see if data has already been captured by DHIS2 and quantifies the relationship.

Evaluation and Results

Using a snapshot of reports sent by 509 sites in October 2013, analysis indicated that 77 percent of 12,475 newly enrolled pregnant women were tested. A total of 44 facilities had no Determine, 58 had no Unigold, and 194 had no DBS test kits. A total of 25,071 Determine, 4,820 Unigold, and 1,791 DBS kits were available at the sites, which could enable testing of all pregnant women enrolled. This information helped program, district, and facility staff to support re-distribution of test kits to sites that had none. The November 2013 PMTCT stock report indicated 90% of 13,564 newly enrolled pregnant women in all 509 sites were tested, there were no stock-outs of Determine, and only three facilities reported no Unigold. A total of 797 stock status and PMTCT reports sent to the IQSMS server were exported to the national DHIS2 system. This reduced multiple entries of the same data in various systems because district health care workers could export their data from IQSMS directly into DHIS2.

IQSMS was also used to identify infants who were not tested for HIV during their initial clinic visit in 293 facilities in Tanga region. Through automated monthly reports generated by IQSMS, an analysis of the reports for infants who had not been tested was sent to the respective facilities whereby multidisciplinary teams, including home-based care providers, traced the untested infants using the infants' mother/guardian home address, mobile phones, or treatment supporters' contact information retrieved from the facility register. Between October 2013 and September 2014, there were 1,757 registered exposed infants from 293 facilities located in remote areas with limited resources in Tanga region. A total of 1,749 (99.5 percent) were traced and tested for HIV within 12 months of their birth using DNA-PCR; of these 50 (2.9 percent) were diagnosed HIV positive. Of the identified positive, 39 (78 percent) initiated treatment, six were reported dead, and five were lost to follow up.

Lessons Learned

- Combining both a mobile system and a Web-based system helps ensure that data collected from facilities are made easily available for use by MOHs and are interoperable with systems at the central/national level.
- Mobile phone SMS technology is a cost-effective, quick, and simple mechanism that requires minimal training for system use and implementation by health care workers.
- The use of IQSMS to trace exposed infants has reduced the number of infants lost to follow up rates and can be applied across various program areas for effective monitoring.

Conclusion

IQSMS provides district, regional, and national stakeholders with up-to-date, vital information and assists with decision making about the distribution and re-distribution of HIV commodities to avoid disruption in the testing of pregnant mothers and exposed infants. This mHealth innovation has also enabled data collection and direct reporting from lower level health facilities to sub-national and national levels. IQSMS reduces the burden of paper-driven data collection and assists program implementation in areas where challenges are inevitable. ■

Geographic Coverage: Tanzania

Implementation Partners: Futures Group International, Catholic Relief Services (CRS), MGIT, Tanzania Ministry of Health, CSSC, IMA

Donor: Centers for Disease Control and Prevention, Tanzania

Contact Information: Bobby Jefferson, Director, Futures Group International, BJefferson@futuresgroup.com

Management Sciences for Health

eLMIS Bangladesh

IMPLEMENTATION DATE: 2014

Mobile alerts to increase reporting rates and reduce potential stock outs of family planning commodities

The Government of Bangladesh has made noteworthy progress over the past decade in increasing access to family planning (FP) methods. From 2001 to 2011, the total fertility rate decreased by 23 percent (from 3.0 to 2.3 births per woman), the maternal mortality ratio decreased by 40 percent (from 322 to 194 maternal deaths per 100,000 live births), and the percentage of married women with an unmet need for FP decreased from 17 percent to 14 percent.

As part of the FP 2020 global partnership, Bangladesh has further committed to reduce the total fertility rate to 2.0 by 2016 and 1.7 by 2021 by increasing adolescent-friendly sexual reproductive health and FP services to one-third of maternal, newborn, and child health centers. However, ensuring uninterrupted availability of FP commodities is crucial to meet these targets. Though recording and reporting on stock levels is a critical component of the supply chain management cycle, the linkages between facility-level information and national-level program policies and plans have traditionally been weak. Thus, accurate forecasting of essential FP commodities remains a challenge.

About eLMIS Bangladesh

Ensuring access to life-saving FP methods requires strengthening the national supply chain system so that quality products are available when and where needed. Since 2011, the USAID-funded Systems for Improved Access to Pharmaceuticals and Services (SIAPS) program, implemented by Management Sciences for Health, has been using a systems approach to increase availability of reliable and timely data for decision making in Bangladesh. Available and accurate data is critical for making informed decisions on FP commodities, monitoring performance of the supply chain, and improving availability and use of products.

SIAPS developed an electronic Logistics Management Information System (eLMIS) that collects data on consumption and availability of FP commodities from all districts and sub-districts. Data from service delivery points

(SDPs) is consolidated and entered into the Supply Chain Information Portal (SCIP) that has an interactive dashboard presenting easy-to-understand charts, maps, and tables on stock levels throughout the country. By and large, it was assumed that increasing data accessibility would naturally lead end-users to review and act upon the available data. However, the program observed that even a visually-engaging dashboard with actionable data does not sufficiently guarantee effective data use at the local level.

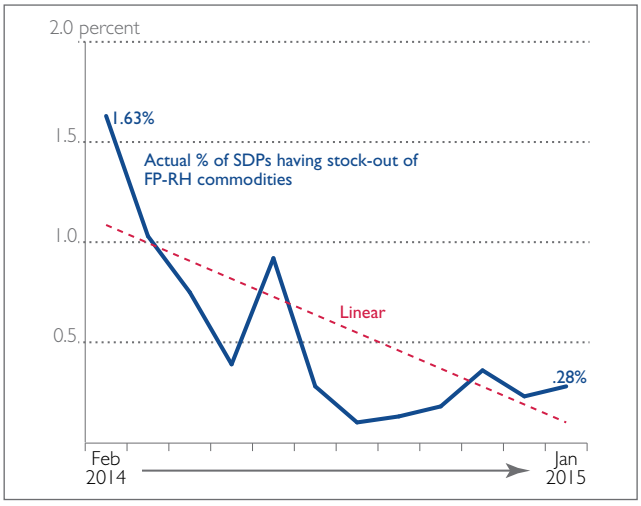
To address this, SIAPS incorporated scheduled Short Message Services (SMS) features and email alerts in SCIP to 'push' data to users, producers, and their supervisors. This system generates SMS alerts, sent in the name of the Ministry of Health and Family Welfare (MOHFW)/ Procurement and Logistics Management Cell (PLMC), which are received by users who might not be using such systems or might be more attuned to a reactive model of addressing supply chain management failures rather than proactively preventing them. The alerts are sent in the following instances: (1) Action reminder - time to report; (2) Tracking report submission against timeline; and (3) Alerts for potential stock imbalance/stock out of FP commodities.

Evaluation and Results

Increased facility level reporting rates contributed to informed decision making. Direct uploading of logistics data from the Upazila Inventory Management System (UIMS) to the web-based eLMIS has improved significantly: from 49 percent in February 2013 to 98 percent in March 2015. This on-time reporting has positively affected prompt decision making by managers at all levels.

Improved logistics information systems have also contributed to a more responsive supply chain. A pre-post analysis showed a significant reduction in contraceptive stock out rates at sub-district levels (n=488) from 5.9 percent in August 2009 to 0.7 percent in December 2014. At the facility level, a reduction of stock-out rates for implanon was also observed, from 69 percent in August 2009 to 1.0 percent in December 2014. Finally, among SDPs, stock out rates for contraceptives reduced from 1.63 percent in February 2014 to 0.28 percent in January 2015 for selected sub-districts.

Figure 1. Percent of SDPs having stock-outs of FP-RH commodities between Feb 2014 and Jan 2015



Lessons Learned

- Policy makers are proactively reviewing the SCIP/eL-MIS and tracking data in order to make evidence-based decisions that have a positive impact on the entire FP supply planning process.
- This push notification system has been facilitating the transition process for local managers from having a "data producing role" to employing a "data use culture", thus improving decentralized decision making.
- This level of performance visibility also has profound motivating effects in terms of recognition of excellence and transparency.

Conclusion

A systematic and functional national supply chain ensures availability of affordable, safe, and effective FP commodities, including contraceptives, at the point of need. This begins with sustainable, effective LMISs that make data accessible to managers, ensuring evidence-based supply planning of essential commodities. It is also crucial to analyze and share available information across systems and stakeholders for improved decision making. This mechanism ensures good governance and accountability and creates stronger partnerships among stakeholders. Improving coordination, governance, and LMISs leads to cost-savings, streamlined procurement systems, a responsive supply chain, and, ultimately, increased availability of FP commodities, saving the lives of women and children. ■

Geographic Coverage: Bangladesh

Implementation Partners: Management Sciences for Health (MSH), through the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) project

Donor: USAID

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Clément Tardif, IntraHealth International

With its picturesque, easy-to-use, and touch screen-adaptable features, DrugStoc can be used by any type of facility or individual with minimum training.

DRUGSTOC

IMPLEMENTATION DATE: 2015

A hybrid eHub of drugs and medical consumables in Nigeria

The Nigerian healthcare market is characterized by an abundance of substandard, counterfeit drugs. In 2001, it was estimated that about 50 percent of all drugs within the market were fake. This rate is said to have fallen over the next five years by about 80 percent following aggressive action by the Nigerian National Agency for Food and Drug Administration and Control (NAFDAC).

This problem is further exacerbated by a fragmented drug system, where health providers often purchase from multiple wholesalers, directly from manufacturers, and from open air drug markets simultaneously. This system leads to inefficiencies in the drug market, where prices are incomparable and opaque, and where health providers are unable to certify the quality of the drugs bought in the open drug markets or from unscrupulous distributors of drugs. No collated database exists that allows hospitals to view all available brand variations and make purchasing decisions based on the right pricing for their market. As a result of this fragmented system, prices often change sporadically and variety is limited to the health provider's exposure to products they are familiar with. To put this in context, average drug prices in Nigeria range from two to 64 times the international prices in both private and public health facilities, according to a recent UNIDO report on the Nigerian pharmaceutical sector.

About DrugStoc

DrugStoc is a hybrid between an eCommerce website, a desktop application, an Android application, and a networked chain of GPRS/SMS-enabled Android printers working in tandem to (1) eliminate reliance of medical facilities on the open air market for drug purchasing; (2) consolidate the drug supply commodity chain increasing the barrier of entry for substandard products; (3) improve the profitability of hospitals and the pharmaceutical industry by translating efficiency gains into monetary profit; and (4) build a database of location-based live pricing for drugs, consumables, and medical equipment in Nigeria.

DrugStoc launched its Beta site in 2015 at the co-creation hub in Yaba, Lagos. It was attended by the Director of Pharmacovigilance at NAFDAC as well as other relevant stakeholders.

With its picturesque, easy to use, and touch screen-adaptable features, DrugStoc can be used by any type of facility or individual with minimum training. Support call centers are manned by staff who can help facilities place and manage their orders. DrugStoc also offers a low-tech alternative for health facilities that are not connected to the Internet or which have poor computing infrastructure. This comes in the form of a catalog with designated operator codes which are linked to commodities on DrugStoc. These codes can be used to check for prices and place orders using the Android app, text messages, or the DrugStoc call center.

Evaluation and Results

Qualitative questionnaires were distributed among hospitals and pharmacies in Lagos State, Nigeria, while focus groups were conducted with health facility owners, procurement officers, and pharmacists. A limited Version 1.1 of DrugStoc was introduced in 12 facilities that completed the questionnaire. The key findings related to the efficiency in timing, pricing, and orders.

Fragmented ordering and the use of multiple sources for the same drug item was noted. Preliminary results from the closed pilot indicate a 94 percent average reduction of time spent ordering and managing supplies observed when the facility used Version 1.1 of DrugStoc to place orders. Price efficiency was also tracked: most facilities kept handwritten notes on the last purchase price of a drug item. Purchase price changes were sporadic and supplier dependent with the facility being informed about the price change during the re-ordering process. No maximum retail price (MRP) was observed with multiple suppliers offering the same drug item at a different price.

Finally, order supply time can vary between suppliers and is dependent on a distributor's logistical capabilities, the distance from the supplier, and the monetary value of the items supplied. Item stock outs among suppliers were also noted, forcing facilities to look for alternative suppliers or asking the supplier to send an alternative brand within the same price range. All these factors reduce the efficiency and reliability of medicines orders, which DrugStoc aims to improve.

Lessons Learned

- Scaling up the logistics unit is essential to maintaining a low service failure rate. Right now, DrugStoc relies on the logistics provided by the pharmaceutical distributors while optimizing specific parts of it. However, in order to run an efficient system, DrugStoc needs to invest in a fully developed logistical infrastructure that will complement its order generation capability.
- Drugstoc has also developed a strategy for non-IT savvy users. Use of the DrugStoc catalog and call center presents an easy and efficient way for users to check prices and order items on DrugStoc via text messages, direct calls, or QR code scanning.

Conclusion

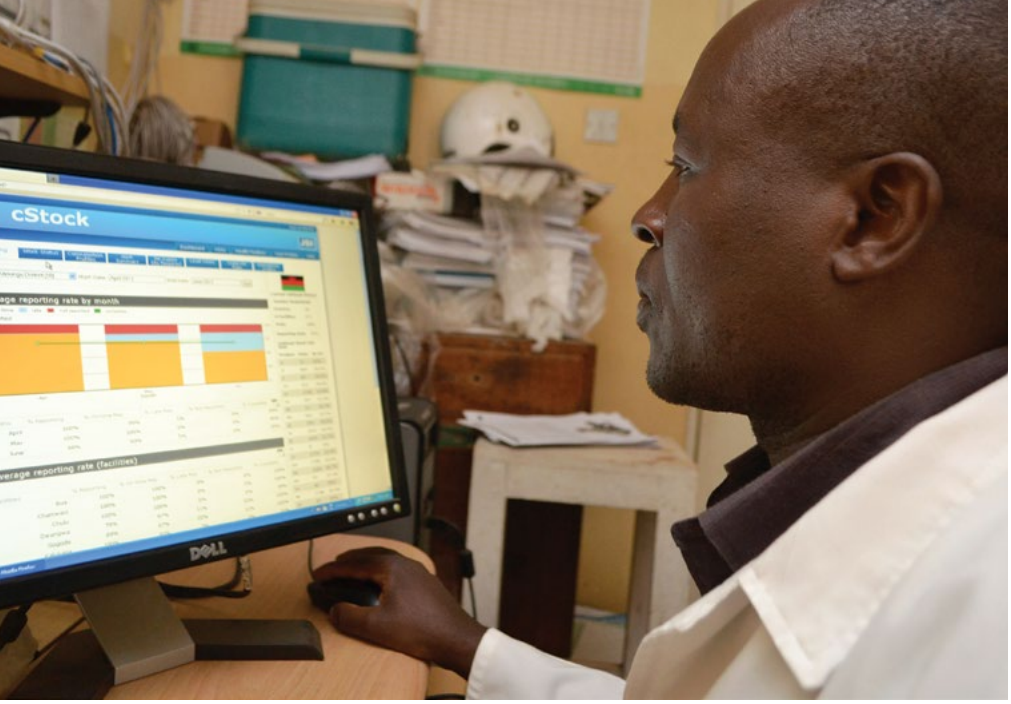
DrugStoc is an innovative hybrid online/offline drug distribution and inventory management solution that creates an efficient drug supply chain for health facilities while reducing order time, enhancing purchasing power, and significantly reducing the risk of purchasing counterfeit or substandard products. ■

Geographic Coverage: Lagos, Nigeria

Implementation Partner: Integra Health Nigeria

Donor: Private initiative – self-funded

Contact Information: Adham Yehia, Integra Health Nigeria, adhamyehia@integrahealth.com.ng



cStock

Results demonstrated that cStock was feasible and acceptable across all users, but implementing cStock with teams was essential for achieving superior supply chain performance and ensuring supply reliability.

CSTOCK
Supply Chains for Community Case Management

IMPLEMENTATION DATE: 2011 to Present

Using mobile technology to increase community access to life-saving medicines in Malawi

In Malawi in 2010, the mortality rate among children under 5 years old was above the global average at 112 deaths per 1000 live births.[1] Despite the introduction of community case management in 2008 to improve children's health in remote areas, poor infrastructure and lack of access to stock information resulted in regular stock outs of critical medicines. A 2010 assessment[2] showed that only 23 percent of health surveillance assistants (HSAs) had in stock the four key life-saving medicines needed to treat all three targeted childhood illnesses (malaria, pneumonia, and diarrhea). At the same time, central land district-level managers had little access to community logistics data, limiting their ability to respond to local needs.

About cStock

The Improving Supply Chains for Community Case Management of Pneumonia and Other Common Diseases of Childhood (SC4CCM) project was funded by the Bill & Melinda Gates Foundation and implemented by JSI Research and Training Institute Inc. (JSI R&T) from 2009 to 2015. The project's goal was to identify, demonstrate, and institutionalize supply chain management (SCM) practices that improve the availability and use of essential health products in community-based programs. In Malawi, SC4CCM designed and piloted cStock, a text message (SMS)-based, web accessible logistics management information system for community-level health products. By improving communication on stock levels, cStock facilitated decision-making throughout the supply chain and reduced transport time and costs. cStock was introduced as an integral component of two broader intervention strategies – Enhanced Management (EM) and Efficient Product Transport (EPT). Multilevel District Product Availability Teams, or DPATs, were an essential component

of the EM intervention. Teams used cStock data to monitor performance targets and problem solve around supply-related issues. The EPT intervention addressed transport barriers, and provided training and tools for bicycle maintenance.

HSAs sent a toll-free SMS using their personal mobile phones reporting current stock levels and medicines received for up to 17 products. cStock automatically calculated resupply quantities and notified staff at health centers, who checked their stock levels and advised HSAs whether stock was available for pick up or alerted health facilities and district managers that there was insufficient stock. District- and central-level managers could then monitor supply chain performance, using over 10 indicators displayed on a web-based dashboard, and take actions to address supply imbalances.

cStock is being used for reporting and resupply by over 3000 HSAs providing CCM in Malawi. Master trainers in each district facilitated roll-out training sessions in newly added districts – even without JSI staff presence. To encourage long-term shared ownership, the Ministry of Health established the Medicines for Community Health Innovations Taskforce to guide and coordinate scale-up and sustainability among partners.

Evaluation and Results

Both EM and EPT interventions were tested in three districts for a 12-month period and then evaluated against a feasibility, acceptability, and effectiveness framework. The 2013 mixed-methods evaluation employed a facility-based survey, focus groups, and routine monitoring data from cStock dashboard reports to compare EM and EPT.

While EM and EPT performed equally well on feasibility and acceptability indicators, EM performed significantly better on measures of effectiveness. Mean stock reporting rate was 94 percent in EM group (n=393) and 79 percent in EPT group (n=253). Lead time for drug resupply was, on average, 12.8 days in EM and 26.4 days in EPT, and mean stock out rates for 6 tracer products were significantly lower in EM (5-7 percent) compared to EPT group (10-21 percent).[3]

Results demonstrated that cStock was feasible and acceptable across all users, but implementing cStock with teams was essential for achieving superior supply chain performance and ensuring supply reliability.

Lessons Learned

- **Consider sustainability – scalability, institutionalization, and integration – from the design phase.** Engage the MOH and other partners from the outset.
- **Understanding the local system, bottlenecks, and resources is critical** to design context-specific solutions that improve supply chain performance for HSAs.
- **Implement mobile technologies along with other system strengthening interventions** that connect the tool to the health system.
- **Iterative learning approach:** Once you implement, put a process in place to monitor how the tool is used, get feedback from the users, refine the intervention, and improve results.

Conclusion

In 2013, Malawi's MOH formally endorsed cStock as its information system of choice for community programs, along with the establishment of District Product Availability Teams. By improving the visibility and use of community logistics data, cStock has enabled more informed decisions on supply levels, reduced stock-out rates, and helped make product allocation more efficient in Malawi. cStock and DPATs have played a critical role in making medicines consistently available for effective child health and family planning services. The challenge now rests in ensuring the sustainability through local ownership of the system. ■

Geographic Coverage: Malawi, national scale

Implementation Partners: JSI Research & Training Institute Inc.; Ministry of Health, Malawi; Dimagi; Johns Hopkins University

Donor: The Bill and Melinda Gates Foundation

Contact Information: Yasmin Chandani, Project Director, JSI Research & Training Institute, Inc., ychandani@jsi.com

SERVICE DELIVERY

Laura Buback, JSI

USAID
PC
LIBERIA

Warren Zelman

OppiaMobile is being tested to deliver in mobile phones the complete national health extension worker (HEW) training materials, approved by the Ministry of Health.

OPPIAMOBILE

IMPLEMENTATION DATE: August 2013, when started the project and content adaptation, to October 2016

Mobile delivery of health extension worker training materials

Health workers in Ethiopia are generally under-trained. The standard training pedagogy can often involve an excessive use of text-heavy, didactic lecturing that lacks the interactive, participatory pedagogy needed for effective adult learning. Moreover, there is little follow up on how health workers use their newly acquired knowledge and skills.[1] Research on the introduction of ICT in education has shown that it is effective only when developers understand the strengths and weaknesses of the technology and integrate the technology into appropriate pedagogical practices.[2,3,4] To supplement and enhance learning within existing training programs, the UK-based company Digital Campus' technical and medical team have developed OppiaMobile, an open source mobile learning platform for delivering learning content, video, and quizzes, specifically designed for-low resource environments with poor Internet connectivity, such as rural Ethiopia.

About OppiaMobile

The OppiaMobile platform consists of three main components: a Moodle plugin for authoring, the OppiaMobile server, and phone client application. All of the code is open source (GPLv3 license), enabling anyone to set up their own server/client application and customize as necessary. Key features of OppiaMobile include:

Offline access: OppiaMobile assumes that the user has limited Internet connectivity. All features of the learning content and activities are stored directly on the phone's SD card and therefore function even when offline. When a connection is available, the stored tracking information, quiz scores, details of videos watched are sent back to the server.

Supports video/multimedia: Multimedia content can be included in courses; this would usually be copied directly onto the phone SD card to reduce the course package size, especially when the user has poor or slow Internet connectivity.

Embedded quizzes and self-assessment tests: Quizzes can be included in the courses, supporting a range of question types, including multichoice, multiselect, matching, numerical, and short answers. Feedback can also be provided.

Tracking and monitoring: An analytics dashboard on the server allows teachers, trainers, and supervisors to monitor and

track students' progress in almost real time. This includes quiz scores (including responses given for individual questions) and the length of time users spent on a particular activity.

Multilingual content supported: Activities can be provided in multiple languages, allowing users to switch to their preferred language.

Collaborative editing: Moodle is used for course content development, taking advantage of the existing authoring environment and allowing existing courses in Moodle format to be easily converted to run on OppiaMobile.

Automatic notification of content updates: When a course is updated, users are automatically notified that an update is available and they will not lose the progress indicators.

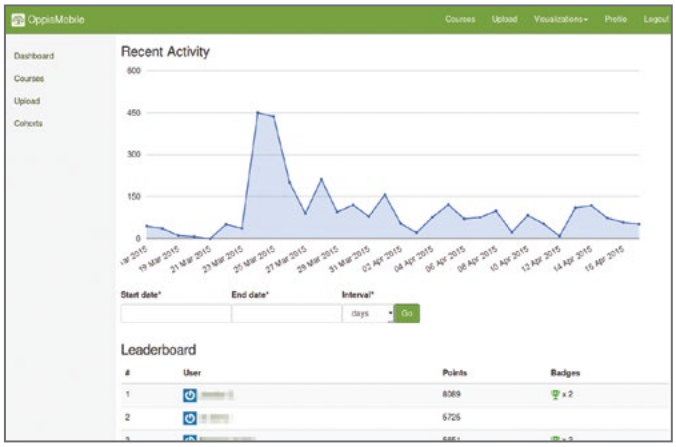
Customized app and server: All the server and app components are open source.

Gamification: Learners can earn points and badges for completing activities, quiz scores, and watching videos.

Evaluation and Results

OppiaMobile is being tested to deliver in mobile phones the complete national health extension worker (HEW) training materials, approved by the Ministry of Health, to upgrade its more than 34,000 HEWs. The main outputs of the first phase of this project (18 months) in Ethiopia has been the technical development of the mobile learning platform and the adaptation of the complete HEW training materials: 13 modules covering all aspects of primary healthcare, with additional video content from Medical Aid Films and Global Health Media Project, and hundreds of new self assessment quiz questions.

This is still an ongoing study, having enrolled a first cohort of 200 HEWs in one training center (Mekelle) in northern Ethiopia from September 2014 to July 2015, with a 15-month follow-up of HEWs when they have returned to their health posts.



The training course, comprised of 13 modules, taught over 8-12 months, covers a variety of health topics, including antenatal and postnatal care, labor and delivery, nutrition, family planning, immunization, adolescent and youth reproductive health, hygiene and environmental health, communicable and noncommunicable diseases, and health management. All the materials are released under a Creative Commons license. It provides a source of information that can be used for both preservice and inservice training and to reinforce critical health messages so that health workers feel confident and empowered to deliver effective services in their communities.

Lessons Learned

- **Use well-established open source software** with a large community of developers and Institutional users.
- **Student engagement increases** when working with official accredited training courses.
- **Always use open source software** and content licenses (GPLv3 license).
- This mHealth intervention requires initial and recurring costs, although OppiaMobile is designed to reduce information and communication technology support to a minimum of mHealth solutions; it **cannot be viewed as a quick fix** to an underlying complex educational system problem. Learning on mobile devices will never replace the classroom; however, if leveraged properly, mobile technology can complement and add value to education.

Conclusion

The OppiaMobile platform allows mobile-ready offline courses to be developed without the need for technical development. The platform is already in use in Ethiopia, Nigeria, Ghana, and India, and collaboration with the mPowering partnership (http://mpoweringhealth.org/) will ensure the platform and adapted content be used more widely. ■

Geographic Coverage: Ethiopia, Nigeria, India

Implementation Partners: Jhpiego

Donors: UKAid; mPowering Frontline Health Workers

Contact Information: Roman Blanco/ Alex Little Digital Campus Ltd. http://www.digital-campus.org

Neelu Singh

Reported SMS literacy was low, but women reported household members could read the messages to them. Pregnant women in intervention groups were three times more likely to access ANC as compared to the control group.

mCARE
Enhancing Neonatal Survival in Rural South Asia

IMPLEMENTATION DATE: October 2011 to January 2015

Connecting people, compressing time, and creating opportunities

Over the past decade, despite marked progress in reducing under-five mortality, neonatal mortality continues to contribute to more than 55 percent of under-five child deaths in Bangladesh.[1] In the rural northwest of the country, around 26 percent of pregnant women receive the World Health Organization (WHO)-recommended four complete antenatal care (ANC) visits, and 27 percent of all women receive a postnatal care (PNC) check-up by a trained medical practitioner within two days of childbirth, a practice considered essential to the health of the mother and the vulnerable neonate.[2] More than 20 percent of infants are born preterm, and nearly half are low birth weight—unprepared to encounter the many challenges home-based deliveries present.[3]

Our community-based research studies, over a span of nearly two decades, of maternal and neonatal mortality within the rural populations of northwest Bangladesh identified information gaps between the rural community and community health workers (CHWs) beginning with low rates of early identified incident pregnancies, no formal mechanisms to remind pregnant women of when an ANC visit is due, the importance of these visits, and a lack of birth reporting timeliness.[4] These all contribute to reaching the mother or newborn in time, compounding referral inefficiencies that interrupt the provision of life-saving strategies which increase the risk of preventable neonatal death. The mCARE study involved extensive formative research, stakeholder engagement activities, and preliminary testing of the mCARE technical system to digitally optimize the workflow of CHWs and create opportunities for them to better connect and engage with their clients (pregnant women and their newborns) via the mCARE system.

About mCARE

The study involved developing a comprehensive mHealth system called mCARE, which is an integrated mobile-phone and server-based software system for CHWs that helps them to digitally manage their daily workflow, beginning with systematic pregnancy surveillance, identify and register pregnant women, provide scheduled ANC and postnatal care reminders, receive labor and birth notifications from clients, and offer referral and emergency support and timely and comprehensive essential newborn care (ENC).

mCARE project was implemented at the Johns Hopkins JiVitA research site in Gaibandha district of rural northwest Bangladesh. JiVitA community health research workers (CHRWs) used mCARE to enroll 800 pregnant women and determined gestational age based on reported last menstrual period (LMP). Based on LMP date, mCARE server automatically scheduled up to four ANC visits for each enrolled pregnant woman, divided into intervention and control groups. SMS reminders to access timely ANC were sent to women in the intervention group, as well as to CHRWs responsible for their well-being, creating both demand and supply-side reminders. Pregnant women in the control group received no targeted reminders by health workers or mobile message. Research data collectors conducted verification visits to assess care utilization in both groups.

Evaluation and Results

Digital census enumeration was conducted for 11,836 women in the study area to determine eligible women for pregnancy surveillance. It found that 6,628 married women of reproductive age were eligible for pregnancy surveillance. Eighty-nine percent of women eligible for pregnancy surveillance had access to mobile phones. Self-reported short message service (SMS) literacy was low, with 73.6 percent women unable to read and 88.1 percent unable to send an SMS. Reported SMS iteracy was low, but women reported household members could read the messages to them. Pregnant women in intervention groups were three times more likely to access ANC as compared to the control group.

Preferred ANC providers were local nongovernmental organizations (NGOs) such as BRAC and Smiling Sun (63 percent), public facilities (25 percent) and private clinics (11.8 percent). Of the women in the control group who did not access ANC, 81.8 percent reported interest in future ANC. Lack of knowledge regarding ANC (35 percent), distance (31.3 percent), and objection from family (8.6 percent) were reported as some of the primary reasons for not accessing ANC by the control group.

Lessons Learned

- mCARE promoted use of reliable supervisory data to monitor performance in real-time and identify gaps in service delivery.
- Labor notification rates are low as there are concerns around the costs of facility-based delivery, forced cesaerean, and distrust of institutional competence.
- Adding a layer of quality to ANC and PNC is recommended.

Conclusion

The integrated mCARE system did improve timeliness, coverage, and utilization of ANC in the intervention group. CHRWs received automated daily work schedules on their phones, enlisting women due for ANC, PNC, ENC, and also received labor and birth notifications. The system provided opportunities to eliminate critical delays due to delayed scheduling, lack of timely decision-making, unidentified "missed" contacts in the ANC or PNC periods. The mCARE system enhances frontline health worker performance by eliminating complex manual processes, tabulation, and paper-based record-keeping.

Based on the success and results of mCARE I, the mCARE II study will be implemented in the summer of 2015 where the primary focus will be to train over 100 Government of Bangladesh CHWs in one entire district of Bangladesh and transfer ground implementation of mCARE II technical system to them. The data collected during this implementation phase will be linked to the national Ministry of Health health management information system in Bangladesh. ■

Geographic Coverage: Gaibandha District, Bangladesh, South Asia

Implementation Partners: UNICEF

Donor: UBS Optimus Foundation, Switzerland

Contact Information: Dr. Alain B. Labrique, Director, Johns Hopkins University Global mHealth Initiative alabriqu@gmail.com

Kelsey Zeller

Preliminary results from the pilot study showing improvements in vaccination timeliness suggest mTikka will improve health outcomes by increasing timely immunization rates.

mTIKKA

IMPLEMENTATION DATE: September 2013 to December 2014

A virtual vaccine record, reminder, and session management system designed for frontline immunizers

Bangladesh has a population of more than 162 million with more than 1 million births every year. The mTikka system was designed to assist Government of Bangladesh frontline immunizers in providing timely immunizations to newborns and children under five by addressing barriers identified during formative research. Barriers identified include the inability to track a child's vaccination history, the lack of timely vaccination reminders, the lack of incentives for families to take children to be vaccinated, and limited awareness about vaccine effectiveness.

mTikka provides solutions to each of these barriers. To ensure availability of vaccination history, mTikka maintains a copy of the child's immunization record on the server that is also accessible by the caregiver's phone number or scanning of a unique identifier code bracelet given to each child at registration. To provide timely reminders, mTikka sends server-generated short message service (SMS) reminders to the mobile number linked to children's records the day before they are due to attend an immunization session. Additionally, the health assistant (HA) pushed alerts the morning of a vaccination session when the HA is actually present and ready to provide immunizations.

To address lack of incentives, mobile flexi-loads were given to vaccine advocates (VA)—individuals nominated by the family to receive and relay these SMS alerts on their behalf—to incentivize sharing immunization reminders and alert messages with the families who nominated them. Lastly, to address limited awareness about vaccine effectiveness, in each child's registration form in mTikka is a vaccine beliefs survey, comprised of 10 true-false questions and answers that serve as a guide for HAs with which to counsel mothers and caregivers on basic vaccine facts.

About mTIKKA

The mTikka system is a virtual vaccination registry and immunization performance tracking system designed to reduce barriers to timely vaccination of infants in rural Bangladesh. mTikka optimizes record-keeping, manages workflows, and connects families to routine immunization services. mTikka is currently deployed in two unions of Gaibandha District, in rural northwest Bangladesh by Johns Hopkins Bloomberg School of Public Health, mPower, and the Ministry of Health of the Government of Bangladesh.

It includes an Android-based mobile application, web portal, server, and SMS portal. The mTikka mobile application, when loaded onto locally available smartphones, allows the health worker to digitally register children, track their immunization records, connect with nonadherent families before vaccination sessions end, and send SMS reminders to families when their children are due for immunization services. mTikka does this by calculating, on the server-side, vaccination due dates based on an infant's date of birth and vaccination history. It also integrates information on when outreach vaccination sessions are scheduled in the area into the scheduling logic to inform parents not just when their children are due for immunization but when their child could actually receive the vaccination from a nearby center. Using this information, the server automatically sends a reminder SMS to parents or caregivers the day before a child's next vaccine dose is due. The immunizer pushes another type of SMS, called an announcement SMS, to clients, alerting them of the time and place of the vaccination session.

The core functions included in the mTikka system were based on known barriers to vaccine schedule adherence but were further optimized to the rural Bangladesh setting after an extensive formative, user-centered design phase, focused on identifying both demand and supply-side obstacles to timely immunization.

Evaluation and Results

Field-testing of mTikka focused on usability of the system and feasibility of implementation. Additional data on immunization records, vaccine beliefs, and attendance at immunization sessions was also collected. There were 210 mother-infant pairs first enrolled and surveyed on socioeconomic status, mobile phone usage, etc. During the next 10 weeks the mothers sought immunization care as they normally would, with the government workers not yet using the mTikka application. Follow-up interviews were conducted after the 10-week period. A second set of mother-infant pairs were enrolled and the same interviews and follow-ups were conducted, except that the government workers used the mTikka system during the 10-week period.

Based on this pre-post design, the effect of the mTikka system on immunizations, session attendance, and vaccination beliefs were analyzed and preliminary results show a significant increase in timely vaccination coverage among children who interacted with the mTikka application during the post-mTikka period compared with children in the pre-mTikka phase.

Lessons Learned

Several existing features of the mTikka system that could be optimized in the future for improved usage and identified, include:

- The immunization workforce in Bangladesh varies widely in terms of comfortably interacting with mobile phones and changing immunization practices. In future trainings additional effort will be made to keep the fast-paced learners interested in the trainings after they've mastered the basic functionality, and to move at a more comfortable pace for those workers who have more difficulty with the device and system functionality.
- Uptake by clients of the birth notification SMS is crucial for increasing early access to mTikka during children's most vulnerable period.

Conclusion

Based on usability and feasibility testing, implementation of a mobile system like mTikka is feasible in the rural Bangladesh context. Preliminary results from the pilot study showing improvements in vaccination timeliness suggest mTikka will improve health outcomes by increasing timely immunization rates and should therefore be a candidate for expanded implementation. Conducting formative research was vital to appropriately mapping and transferring the paper-based immunization process into an intuitive, optimized mobile-powered system. Future iterations of the mTikka system will include more health workers, infants, and a broader geographical area enabling additional reporting on health outcome changes that may be triggered by the mTikka system. ■

Geographic Coverage: Two unions (Kuptala and Konchibari) of the Gaibandha District in rural, northwestern Bangladesh

Implementation Partners: Johns Hopkins University; mPower Social Enterprises; Government of Bangladesh

Donors: Bill & Melinda Gates Foundation, Grand Challenges Exploration Grant

Contact Information: Dr. Alain B. Labrique, Associate Professor, Johns Hopkins University, alabriqu@gmail.com

HELP Project

The HELP platform is scalable, replicable, and adaptable to evolving needs and technology in order to drive positive health outcomes and provide core skills and tools to critical cadres of health workers in Africa.

HELP: Health Enablement and Learning Platform

IMPLEMENTATION DATE: June 2013 to May 2014

Training and empowering community health workers on basic mobile phones

Africa has a drastic shortage of community health workers (CHWs). Although many ministries of health have made a community health strategy an integral part of their approach to universal health coverage, the training and empowerment of CHWs remains a challenge. Many ministries face common challenges, such as expensive classroom training with unpredictable attendance, lack of reliable reporting from CHWs in the field, declining CHW engagement, and a high dropout rate in the absence of paid incentives.

The HELP mobile learning (mLearning) solution is a learning platform, aligned to the Kenya Ministry of Health CHW curriculum, for health worker training and empowerment. It provides initial training, complementary to face-to-face training, and continuous professional development to CHWs to help reinforce critical teachings. HELP employs a structured learning mPedagogy which applies advanced learning principles and approaches to basic mobile channels in a combination of "patterns" that simulate the learning experience and outcomes of traditional face-to-face training methods.

About HELP

A partnership comprising Amref Health Africa, Accenture, Safaricom, and Mezzanine collaborated to design, develop, and implement HELP. The initial pilot phase of HELP aimed to determine the potential of mobile technology to increase the number of well-trained health workers in Africa. An integrated mLearning and community health services platform was developed to empower, train, and motivate CHWs in Kenya. Field research in Kenya indicated that penetration of mobile devices was 98 percent amongst CHWs; 70 percent of these devices, however, were basic or feature phones and smartphones were uncommon. Accordingly, an innovative solution that makes CHW training material available via short message service (SMS) and unstructured supplementary service data (USSD) text, and prerecorded audio (IVR) was designed.

In June 2013, Accenture Foundation and mPesa Foundation jointly funded the 10-month Phase 1 project to build, test, and pilot an initial version of HELP, focusing on providing

multichannel training to 318 CHWs and their supervisors, or community health extension workers (CHEWs) from rural, urban, and nomadic community health units across Kenya. A Ministry of Health (MOH)-approved pedagogical model was employed and nine modules from the MOH's national CHW curriculum were converted into mobile content.

Individualized, contextual, and sequential modules include role plays, decision-tree support, mini-lectures, quizzes, and games in English and Swahili. HELP also includes a group chat feature which allows CHWs to share knowledge and communicate directly with supervisors. CHEWs receive weekly reports on CHW performance and are able to target those in need of additional support. Finally, users have access to a dedicated, toll-free help desk

Evaluation and Results

An evaluative descriptive design using both qualitative and quantitative methods was applied to assess project performance during the pilot phase and document the experience of CHWs and other stakeholders. A control group received only traditional face-to-face 10-day training. A complementary training group covered the curriculum face-to-face and then again for select mLearning topics. The third and last group received the mLearning topics only via mobile phone. All groups received a pretest, a posttest, and a final assessment four months after training was completed.

By the end of the training deployment, over 215,000 content SMSs had been sent to CHWs, 140,000 minutes of IVR audio had been listened to, and 8,500 group chat messages had been sent between CHWs and CHEWs. The results revealed that the CHWs unanimously adopted mLearning irrespective of their location, socioeconomic status, educational level, and previous work experience. Seventy-eight percent of the CHWs completed all the material, with a 95 percent completion rate within any individual topic. The average quiz score was 80 percent (an improvement of up to 20 percent in some areas). Satisfaction rating amongst users was over 90 percent; 55 percent cited that a major benefit of HELP was the ability to access information quickly in an emergency. The remote areas in Samburu and Mwingi showed up to 25 percent higher engagement rates than urban groups, implying that the solution might be needed more where CHWs are geographically dispersed.

Lessons Learned

- mLearning using basic phones is an effective replacement for classroom training, and leads to better results than face-to-face training exclusively.
- CHWs enjoy mLearning and benefit from this continuous, flexible training approach.
- A toll-free help desk enables end-users to access support when they need it.
- Group chat function empowers CHWs to seek support and make decisions.
- Account for the specific context in which the solution will be used, including language preference and basic versus smartphone prevalence, and tailor the solution to that.
- Collaboration amongst partners is crucial for achieving scale and ensuring the solution meets the needs of health workers and implementing organizations.

Conclusion

Amref Health Africa and partners established the potential impact of an mLearning platform to improve the effectiveness of CHW training programs in Kenya. The HELP platform is scalable, replicable, and adaptable to evolving needs and technology in order to drive positive health outcomes and provide core skills and tools to health workers in Africa. Building on these results, the partners have launched the second phase of the project aimed at training 3,000 CHWs and CHEWs across Kenya, incorporating smartphone features, and leveraging other enhanced functionalities. A major aim of Phase 2 is to test the business model with other organizations and implementers in order to refine the solution and value proposition, and test the viability for scale through collaboration. The long-term vision is to build HELP into an "mLearning Academy" that will deliver accredited training across multiple mobile channels to various cadres of health workers and managers. The mLearning Academy would provide access to real-time, on-demand learning and tools, complementing the curriculum and learning opportunities delivered in classrooms, resulting in improved knowledge and practice, and allowing health workers to advance professionally. The ultimate result is improved service delivery and health outcomes. ■

Geographic Coverage: Three different geographical sites in Kenya that represented a varied cross-section of livelihoods in the country: Kibera (urban slum neighborhood of Nairobi); Mwingi (rural district); Samburu (nomadic pastoralist region in Northern Arid Lands)

Implementation Partners: Amref Health Africa; Accenture; Kenya Ministry of Health; Mezzanine; Safaricom

Donors: Accenture Foundation, m-Pesa Foundation

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Action Meningitis

Over the next three years, the Action Meningitis project will optimize the triage system so that it is fully appropriate for the primary level cadre staff, systems, and resources.

ETAT

IMPLEMENTATION DATE: 2012 to 2018

Emergency triage assessment and treatment for primary care

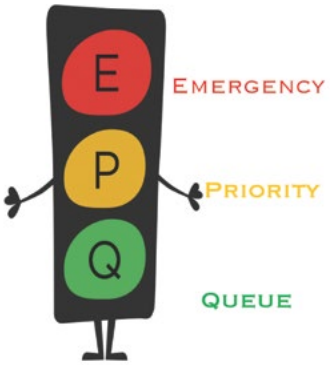
Forty-one thousand children died before reaching their fifth birthday in Malawi in 2013. Over half of these deaths were caused by illnesses (i.e. meningitis, sepsis, pneumonia, and diarrhea) that are both preventable and treatable with earlier recognition and intervention.[1] In the absence of systematic triage at the primary health care level in Malawi, a common challenge is the lack of early and accurate recognition of serious illness requiring urgent referral to a higher-level facility. Patients are seen on a first-come, first-served basis and severe illnesses are often missed as hundreds of children queue for hours.

About ETAT

The Action Meningitis project helps tackle Malawi's high infant mortality rate by introducing triage into primary health clinics. Underpinned by 10 years of clinical research and working closely with the Ministry of Health (MOH), partners Meningitis Research Foundation and D-tree International have successfully integrated an mHealth point-of-care triage system at the primary care level. Using the World Health Organization Emergency Triage Assessment and Treatment (ETAT) protocol, health care workers (HCWs) are enabled to detect vital signs of severe illness. ETAT complements existing protocols and strengthens the overall health care system through improved prioritization of care and resources. Children are given the attention and treatment they would otherwise miss due to overcrowding of clinics and lack of trained health care workers. A movie of the triage tool in use can be viewed online: www.meningitis.org/action-meningitis.

Evaluation and Results

In eight clinics, 192 HCWs have been trained in the use of ETAT using the mHealth tool. The HCWs delivered triage to 215,000 children within two years. Patient flows in clinics are radically improved, enabling swift treatment of sick children or referral to a hospital. Qualitative and quantitative methods of data collection were used in both the baseline and endline studies to examine changes in clinical practice and knowledge among HCWs.



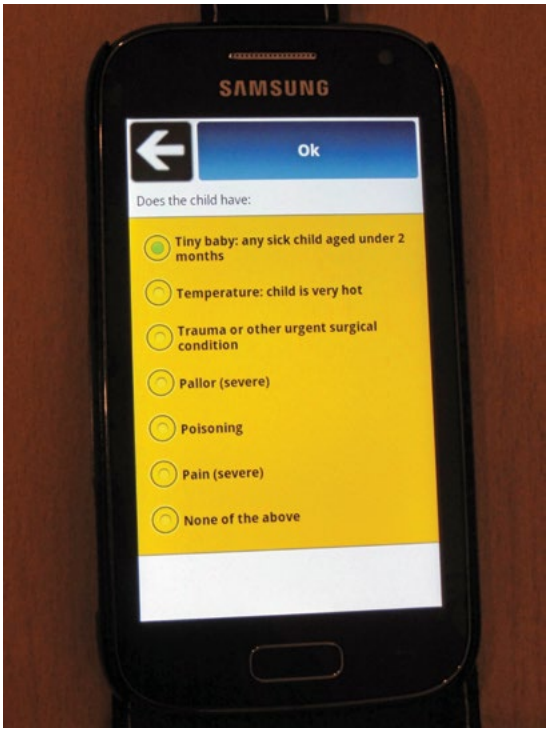
Quality of triage in all primary centers remained high (average 92.2 ± 7.08 percent agreement with ETAT clinicians who re-examined the children). Frequent monitoring visits show there is good patient flow within clinics and that patients are being seen in order of priority.

Mobile phones are an important tool, ensuring that HCWs stick to protocol, acting as a prompt to identify severely ill children. Triage is quick on the phones, taking less than a minute to assess each child. On the few occasions when phones were unavailable (e.g. during use in training sessions), the HCWs still continued to apply the skills they had learned and triage children in the queue.

Clinic waiting times remain encouraging for introduction of a system that prioritizes according to severity of illness. Time taken to be seen by the clinician was on average significantly shorter for emergencies (nine minutes) than priorities (28 minutes) and longest for queue cases (31minutes).

Lessons Learned

- Support from MOH has been achieved through continued close collaboration on the ground at district and local level, as well as engaging at national level.
- Local ownership is important for sustainable impact, and project development is improved by regular consultation with a wide range of local stakeholders (including MH officials and frontline staff).
- The project has been designed with existing resource constraints in mind. Lower-cadre HCWs with no previous triage training are now empowered and responsible for prioritizing the sickest children, relieving overburdened clinicians.
- High turnover of HCWs is endemic in Malawi. A stakeholder meeting enabled discussion of staffing concerns. Recognition/appreciation came out as a highly motivational factor for all staff cadres. Community awareness activities (radio and theatre) are being used to give recognition to those staff carrying out triage.



Conclusion

Better recognition, treatment, and referral of severely ill children at primary level is a key priority for reducing child mortality. The next step is to develop a scalable solution that can be adopted across the primary setting, and current partners are working closely with local, regional, and national-level health officials to develop, refine, embed, and extend the reach of the triage system.

Over the next three years, the Action Meningitis project will optimize the triage system so that it is fully appropriate for primary level staff, systems, and resources (ETAT was originally designed and developed in Malawi for the tertiary setting). Developments will be monitored and evaluated in the existing eight clinics while benchmarking in three new clinics before further implementation. Across the 11 health clinics 440 HCWs will be trained and the reach of triage will be extended to an additional 384,000 children. ■

Geographic Coverage: Blantyre and Chikhwawa District, southern Malawi

Implementation Partners: Meningitis Research Foundation; Malawi Liverpool Wellcome Trust; Things Prime; D-tree International; Malawi Ministry of Health

Donors: The Scottish Government Malawi Development Programme and others

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Pathfinder International

In the four months since the introduction of this system, CHW performance increased dramatically. On average, there was a 522-percent increase in the number of monthly registrations comparing paper- and mobile-based registrations, and a 15-fold increase in the number of follow-up visits.

mHEALTH for Community-Based Family Planning Services

IMPLEMENTATION DATE: November 2014 to September 2016

Using a mobile application to guide community health workers to provide high-quality family planning services in Tanzania

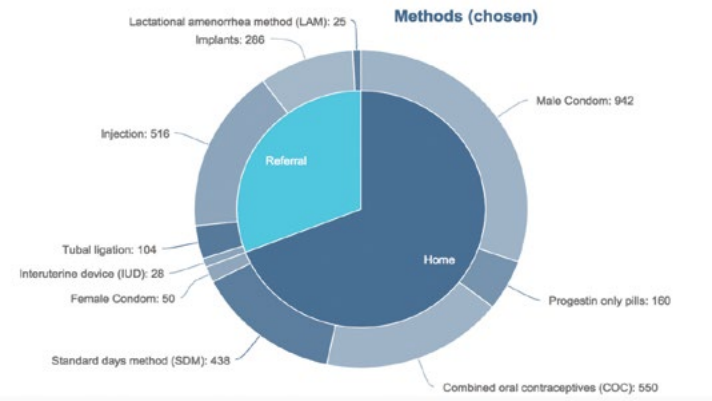
Tanzania is faced with significant sexual and reproductive health challenges, including high fertility rates, low contraceptive prevalence, and elevated rates of HIV/AIDS. In 2010, the contraceptive prevalence rate (CPR) for modern methods among married women was 27 percent, and the unmet need for family planning was 25 percent.[1] In Shinyanga region in northwest Tanzania, 12.5 percent of married women age 15 to 49 use a modern family planning method, less than half of the national average. The total fertility rate (TFR) is 7.1 compared with the national TFR of 5.4, and HIV prevalence is 7.4 percent compared to the national average of 5.1 percent.

In order to improve access to family planning services, Pathfinder International and D-tree International are implementing a community-based family planning program using mobile technology to improve the quality of care. This program is being implemented with 230 community health workers (CHWs) and 32 CHW supervisors in five districts of Shinyanga region.

About mHealth for Community-Based Family Planning

In this program, CHWs use a mobile application to provide counseling following the Balanced Counseling Strategy Plus.[2] Each CHW goes through a well-defined protocol to educate clients about all available methods and draws on their fertility intentions and personal preferences to support the choice most appropriate for their needs. CHWs provide condoms, pills, and Standard Days Method® to clients at their homes and provide referrals to health facilities for clients wishing to receive long-acting and permanent family planning methods and for HIV and sexually transmitted infection services. The mobile application includes reminders to CHWs to follow up with their clients for refills or to confirm if the referral was successful. In addition, the application includes an electronic Citizen Report Card, which is administered by the CHW

Figure 1. Method mix among family planning clients using a method



to all clients who complete a referral to assess the quality of family planning services at health facilities.

To develop a scalable training and follow-up model, Pathfinder and D-tree International are applying innovative strategies to roll out training programs and provide ongoing support, including a:

- cadre of "champion" CHWs who mentor and support newly trained CHWs through regular follow-up visits;
- simple mobile application for project staff and the champions to guide follow-up visits with newly trained CHWs and alert the program team of issues in the field;
- pay-for-performance system with monthly performance targets with real-time performance tracking on the CHW phone and program dashboard;
- system for the field team to monitor data and provide feedback to CHWs on a weekly basis;
- dashboard for reviewing individual providers, district performance and regional performance.

As of March 2015, 109 CHWs who were offering family planning services in two districts of Shinyanga region were trained to use the mobile application.

Evaluation and Results

By March 2015, a total of 3,165 clients had been registered and received family planning counseling. Among these, 93.5 percent are using a family planning method (see Figure 1 for the method mix). Of the 516 referrals given for a family planning method at a health facility, 337 (65 percent) have been completed. During the program, 134 clients (4.2 percent) discontinued a method, while 94 percent of clients reported continued satisfaction with the current method.

To measure the outcome of the mobile system on CHW activity, the project team compared the number of registrations and follow-up visits before and after the mobile system was introduced. In November 2014, 60 CHWs in Shinyanga District Council, who had previously been delivering family planning services using a paper-based system, were trained to use the mobile application. The pay-for-performance system, along with rigorous data monitoring and feedback to CHWs, was also introduced at this time. In the four months since the introduction of this system, CHW performance increased dramatically. On average, there was a 522-percent increase in the number of monthly registrations comparing paper- and mobile-based registrations, and a 15-fold increase in the number of follow-up visits, comparing the average number of follow-up visits with the paper system to those conducted in February 2015.

Lessons Learned

- Pay for performance, focusing on counseling and follow-up, can be an effective strategy to increase CHW performance while adhering to the Tiahrt Amendment. Using the mobile system offers real-time tracking of pay-for-performance targets for CHWs and the project team to increase transparency of the system.
- Training CHW champions to support trainings and mentor newly trained CHWs in the field is an efficient and scalable model, allowing implementation teams to roll out high-quality mHealth programs at scale.
- Communicating with CHWs on a regular basis is very important as it provides a venue for both feedback and support and allows the program to identify and act on issues in the field.
- Data quality has improved after introduction of the mobile application. The system automatically flags suspicious data entry for follow-up.

Conclusion

This program demonstrates that mobile tools can effectively be used to improve the quality of community-based family planning services and increase CHW performance. With the use of pay-for-performance and CHW champions, this model has the potential to be implemented at scale. The next phase of the program will focus on training an additional 123 CHWs and the development of supervisory tools to further transfer monitoring and management of the project to the local government. ■

Geographic Coverage: Five Districts in Shinyanga Region, Tanzania

Implementation Partners: Pathfinder International, D-tree International

Donors: USAID Tanzania, David & Lucile Packard Foundation

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Julia Ruben, D-tree International

The ePartogram is a key component of a health systems approach to improving labor management practices and clinical care for laboring women and newborns.

ePARTOGRAM

IMPLEMENTATION DATE: January to June 2015

Improving the management of labor and deliveries to reduce maternal and perinatal mortality in Tanzania

Maternal mortality is a major public health challenge in developing countries, particularly in sub-Saharan Africa. Most maternal and newborn mortality occurs around the time of delivery, and hence can be prevented with simple measures, including appropriate training, supplies, and equipment. One important tool for a safe delivery is the paper-based partogram, a graphical depiction of labor that supports decision-making during the management of labor to prevent and detect complications. Endorsed by the World Health Organization (WHO) for over 30 years, appropriate use of the partogram can decrease maternal and perinatal mortality by reducing prolonged or obstructed labor, sepsis, and unnecessary operative interventions.[1,2]

Despite these clear benefits, use of the paper partogram in developing countries is low and inconsistent.[3,4] Challenges to consistent use are related to learning and remembering how to fill it in appropriately, and—once filled in—knowing how to interpret the clinical implications of the observations. Birth attendants may find it cumbersome, time-consuming, and simply fail to see its clinical value. To address the key challenges in partogram use and appropriate management of labor and delivery, Jhpiego, in collaboration with D-tree International, has developed an electronic, tablet-based tool which aims to be easier to use and provides the feedback missing from the paper version, through reminders and alarms. The tool stores data both locally and on a server, which allows supervisors, referral facilities, and experts real-time access to patient care information.

About ePartogram

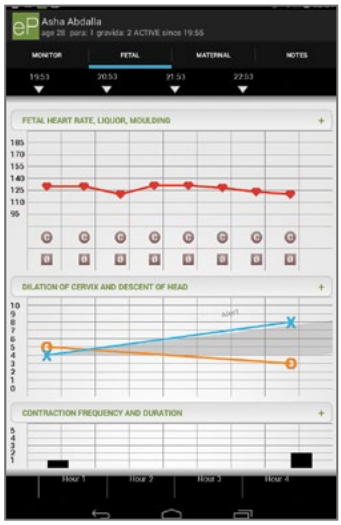
The innovation of the ePartogram is two-fold: the tablet-based application uses validated clinical algorithms based on WHO guidelines to alert providers when critical observations need to be made and if they are abnormal, and

it also strengthens the referral pathway between peripheral and referral facilities by enabling electronic transmission of data between facilities and connecting providers for remote consultation. The ePartogram is a key component of a health systems approach to improving labor management practices and clinical care for laboring women and newborns. It has the following features:

- Efficiency in entering and plotting observations as the software automatically graphs the data
- Prompts providers when critical observations need to be made
- Provides alerts and decision-making support if complications occur
- Syncs data within a facility and automatically prioritizes laboring clients based on clinical algorithms, helping supervisors allocate staffing appropriately
- Aggregates client data and clinical outcomes in a web-based reporting dashboard

Evaluation and Results

The ePartogram received seed funding in Round 1 of the Saving Lives at Birth: Grand Challenge for Development to define the functionality and software features for the device, assess the form, function, and acceptability of ePartogram in the Bondo District of Kenya, and develop a second-generation prototype. Recognizing that transformational innovation requires iterative validation of the clinical, public health, technology, business, and health systems value of a product, Jhpiego has since worked with service providers, ministries of health in Zanzibar and Kenya, independent researchers, and Dalberg Impact Group to address stakeholder needs throughout the development of the ePartogram. Since 2014, Jhpiego and D-tree International have developed the third generation of the ePartogram prototype and D-tree conducted an iterative three-month field refinement of the software at two facilities in Zanzibar. Providers there found that the



ePartogram saved time in entering and interpreting clinical measurements and provided useful reminders for taking measurements. They also appreciated the alerts and combination alerts that help to ensure that action was taken when needed.

Next, Jhpiego will conduct a feasibility study of ePartogram use in three facilities in Zanzibar to assess acceptability by skilled birth attendants (SBAs) and ease of use when managing multiple clients, characterize how SBAs use and care for the tablets, and confirm findings from the field refinement related to data entry, screen flow, and technology performance. From there, a validation study is envisioned before pilot and scale-up.

Lessons Learned

- Even relatively educated health workers are often not comfortable immediately with touch screen technology (in this case tablets). Training should allow ample time to learn and practice basic functionalities.
- Both global standards and local realities need to be recognized and accounted for in application development and field refinement.
- The double burden of paper and electronic entry should be remembered and minimized during field refinement and piloting. It is best to pick facilities that are not too busy.
- There should be an educational and training component, as well as opportunities for end-users to provide feedback, which can be applied to ongoing application optimization.
- Close collaboration with various stakeholders and engagement with the government from the early stages of product development is critical.

Conclusion

The ePartogram provides the potential to increase consistent use of the partogram for labor management and even increase its efficacy and safety by providing feedback to the providers that the paper form lacks. The tool has been developed, tested, and refined in two facilities in Zanzibar, Tanzania, and a rigorous feasibility assessment is underway. The vision is for the ePartogram to be further refined, piloted, and scaled up, including possible integration with other mHealth applications. ■

Geographic Coverage: Unguja, Zanzibar

Implementation Partners: Jhpiego, D-tree International, Zanzibar Ministry of Health

Donors: GE Foundation, USAID

Contact Information: Brinnon Mandel, Director of Innovations, Jhpiego, brinnon.mandel@jhpiego.org

Leah McManus, IntraHealth International

The mHero platform allows health workers, government authorities, and other key stakeholders to engage in real-time, targeted communication via mobile phone two-way short message service (SMS), interactive voice response, and direct calls.

mHERO

IMPLEMENTATION DATE: August 2014 to Present

Connecting and empowering health workers through mobile phones in Liberia

Severe shortages of qualified health workers and poor communication and coordination among those on the front lines have exacerbated the Ebola virus disease (EVD) outbreak in West Africa. These challenges were hindering the delivery of quality health services in the region even before the outbreak.[1] Harnessing mobile technology and using it to improve existing health information systems (HIS) makes it possible to rapidly strengthen communication among health authorities, the health workforce, and local communities, in order to save lives.

In August 2014, the mHero Partnership, led by IntraHealth International, the US Agency for International Development (USAID), UN Children's Fund (UNICEF), and a team of international stakeholders, created mHero.[2] The mHero platform allows health workers, government authorities, and other key stakeholders to engage in real-time, targeted communication via two-way short message service (SMS), interactive voice response, and direct calls. mHero communications, which are flexible and scalable, and can be triggered both centrally and locally, go far beyond the traditional "message blasts" offered by many technology vendors, enabling stakeholders to rapidly respond to health workers' needs.

About mHero

mHero unites globally recognized technologies—RapidPro, the iHRIS open source health workforce information system, and District Health Information Software (DHIS2)—using Open Health Information Exchange interoperability architecture.[3,4,5] Drawing on information about health workers and facilities in iHRIS and DHIS2 and harnessing RapidPro's platform, mHero permits communication via basic mobile phone. Through country ownership, open technologies/standards, and a collaborative partnership, the mHero approach exemplifies the nine principles for digital development.[6] The platform also allows for continual development of extra modules and features for Ebola-related services and those for maternal, neonatal, and child health.

Since 2014, mHero has operated at pilot scale in Liberia, where a Ministry of Health and Social Welfare (MOHSW)-appointed team designed, deployed, and guided the country's

approach. With help from Liberia's mobile network operators, the team set up easy-to-remember phone numbers (short codes) for free SMSs and calls within mHero's network. The health ministry provided direction to configure high-priority use cases and readied them for launch within weeks. Priority messages included: verifying active health workers; identifying inactive workers to re-engage them and restore essential services; and determining health facility status through SMS exchange with officers-in-charge. Full mHero rollout in Liberia is scheduled for mid-2015. Implementation is also being initiated in Guinea and the health ministries in Sierra Leone and Senegal have expressed interest. The platform can be used to quickly disseminate critical information; rapidly collect data on key health services delivery indicators and health workforce management areas; support continuing professional development; identify and monitor health worker attitudes and needs related to the work environment; and provide a technical resource for frontline health workers.

Evaluation and Results

The Liberia pilot marked mHero's launch and tested its technical capabilities. At the outset, the mHero team and ministry leaders discussed post-Ebola sustainability, county-level decentralization, and integration of mHero activities with existing systems. Working with technology experts from UNICEF and IntraHealth, the MOHSW adapted, tested, and enhanced the platform. The initial stages of the Ebola crisis greatly disrupted Liberia's health workforce, with some health workers moving to community care centers and Ebola treatment units and others abandoning their posts due to fear or uncertainty. It became clear that existing data in iHRIS needed validation to ensure accurate personnel records for planning, management, and communication. mHero's staff validation use case enabled the MOHSW to update iHRIS records in real time, including verifying critical health worker contact information.

During the pilot, mHero sent SMSs to 482 health workers in four counties (Bomi, Grand Cape Mount, Grand Gedeh, and Margibi) to validate health workers' phone numbers, location, job title, supervisor, and facility. In addition, this use case sought to provide information about the proportion of health workers submitting bank account information (critical for timely payments) and use of facility attendance logs. At the time, only 60 percent (n=289) of the 482 health workers were reached due to ongoing negotiation of mobile network operator contracts. Promisingly, of the 289 health workers reached, 57 percent (n=165) responded to the first mHero message. About three-fourths (72 percent or n=119) of those who responded to the first message completed all 15 questions in the workflow. Most (92 percent) were frontline health workers; the rest were administrative and support staff. Nearly all 119 respondents confirmed that the name in iHRIS was correct (95 percent), reported submitting account information to their human resources officer (90 percent), and reported completing daily attendance sheets at their health facility (97 percent).

Lessons Learned

- **Health workers were receptive** to the mHero messages, wanting to share information and actively participate in the system.
- **Several different planning, implementation, and monitoring tools** created by the MOHSW contributed to mHero's strong, efficient, and effective operations. These tools continue to be adapted and updated.
- **The initial mHero use case increased the MOHSW's understanding** of the value of effective and efficient communication with health workers, as they had not had access to such a rapid communication method prior to mHero.
- **The pilot experience provided important lessons** for enhancing the mHero approach on a global level, particularly with regard to the engagement strategy, tools, and technologies.

Conclusion

IntraHealth and UNICEF continue to engage with global partners to harness the interoperability of mHero with HIS and further develop the software. mHero implementation will continue in West Africa and beyond to strengthen communication between health ministries and health workers. In Liberia, the mHero team is scaling up mHero in line with MOHSW priorities. Crucial next steps include: planning mHero sustainability beyond the Ebola response; rolling out mHero with administrators at the county level; expanding monitoring and evaluation efforts; and establishing a strong governance system within the ministry to ensure effective and efficient implementation of mHero. In Guinea, initial mHero use cases will be developed to support health workers providing maternal, newborn, and child health care. ■

Geographic Coverage: West Africa

Implementation Partners: IntraHealth International, UNICEF, Jembi Health Systems, Thoughtworks, HISP, mPowering Frontline Health Workers

Donors: UNICEF, USAID, Johnson & Johnson

Contact Information: Amanda Puckett, Technical Advisor, IntraHealth International, apuckett@intrahealth.org

Collins Otwane

This project aims to reduce perinatal transmission rates of HIV through the enhancement of information management, and to fortify the knowledge base and foster information acquisition and sharing among clinicians, patients, and the community.

MOBILE APP for Management of HIV in Pregnancy

IMPLEMENTATION DATE: March 2015 - Present

Reducing perinatal transmission of HIV by improving information management

Highly active antiretroviral therapy (HAART) taken by a woman during the peripartum period can virtually eliminate perinatal transmission of HIV.[1] Access and adherence to medication; a skilled, knowledgeable workforce; and patient retention, tracking, and monitoring are essential. However, much of the world suffers severe health care staffing and information deficits. Mobile, electronic health technologies can compensate for these deficits by providing access to patient records, access to up-to-date management guidelines, facilitating clinician and patient communication, retaining patients in care, and enabling extensive data mining and analysis.[2] A mobile technology-enhanced, combined electronic medical record and clinical decision support-system aimed at the co-management of HIV and pregnancy has been developed and will be studied for usability and effects on management processes.

About Mobile App for Management of HIV in Pregnancy

This project seeks to reduce perinatal transmission rates of HIV by utilizing wireless broadband technology, mobile telecommunications technology, and electronic information systems to create a combined electronic medical record and clinical decision-support system (EMR/CDSS) to support the clinic, clinician, and patient in the delivery of care. This system is accessible via wireless broadband services on Chromebooks, which are low-cost, fast laptops. The wireless broadband accessibility and self-powered nature of the devices ensure that the system has utility in care environments that lack power and grounded Internet connections and when facilities lose power services.

The system utilizes the open source OpenMRS medical record software and the widely recognized CIEL-MVP dictionary, assuring interoperability with other OpenMRS-based systems and concept definition coherence with internationally recognized nomenclature systems. This system also provides the highest levels of security and standards for patient confidentiality.

The system provides access to individual patient electronic medical records. The record itself guides the clinician through both pregnancy and HIV management. Current, evidence-based management guidelines specific to pregnancy and HIV infection have been incorporated at relevant points

throughout the record and are accessible by clicking on an information icon. These guidelines address antepartum, intrapartum, postpartum, breastfeeding, and infant antiretroviral algorithms as well as opportunistic infection management, including malaria and tuberculosis, preventative services (immunization, malaria prophylaxis, deworming, and micronutrient supplementation), breastfeeding recommendations, contraceptive planning, and other pregnancy- and laboratory-related issues—at all points taking into consideration pregnancy and HIV status.

These guidelines are derived from the World Health Organization, Centers for Disease Control and Prevention, the National Institutes of Health, Kenya's National AIDS and Sexually Transmitted Infection Control Program, and National Institute for Health and Care Excellence sources, and are updated in the EMR/CDSS when they are updated at the source. System-based, interactive graphics allow clinicians and patients to review danger signs during pregnancy as well as cover routine educational elements during visits. Patients may choose to be reminded of upcoming appointments and recalls to the clinic via SMS. Recall and clinic notification of missed appointments can be generated at the discretion of the clinic team. Clinical and administrative flags are generated on both patient-specific and clinic population-specific bases for missed appointments, concerning laboratory analysis values, and missing information. Flags appear both when an individual record is opened and reports are also generated daily for all flags in the clinic system.

As the EMR/CDSS is coded to concepts, reports may be generated at any interval requested, incorporating virtually any parameter that is part of the record. This function will assist with quality assurance and data reporting. Further, as the OpenMRS system is used in many locations worldwide and the concept dictionary is used widely, data from this project may be incorporated with data from other locations.[3] The potential applications of this level of data mining are limitless.

Evaluation and Results

The research study associated with this project will take place at Kakamega County General Hospital in western Kenya. The EMR/CDSS will be used by clinicians at the point of care in the antenatal clinic for women living with HIV. A Chromebook loaded with the technology will be in the labor and birth suite and the medical director and HIV specialist physician will have a Chromebook loaded with the EMR/CDSS to consult when clinical staff in the antenatal or labor and delivery unit require consultation. The launch date was March 6, 2015.

The research design utilizes qualitative and quantitative approaches. The qualitative element will evaluate user experiences of the system and focuses on changes to information access, workflow, patient interaction, management decision-making, consultation and referral capabilities, and ease of use.

Quantitative analysis will employ a post-interventional study group and a pre-interventional control group. Comparisons will be made between the two groups with respect to usage of continuous HAART versus no therapy or episodic therapy, treatment with HAART for longer than 12 weeks, and changes in the types of antiretroviral agents used. A sample size of 100 in each group will mean that a difference of 20 percent in treatment between the groups will be able to be detected with 80 percent power (using $\alpha = 0.05$).

Lessons Learned

- Unfamiliarty with using laptop computers and track pads required extra time for training of staff.
- Extreme weather events caused widespread power outages in Kakamega and caused extensive damage to the cell tower that the project is utilizing. Paper-based records have been printed to continue with data collection in case of these events in the future.
- Programming and debugging the record took longer than expected. This should be prepared for in future projects.
- The Kakamega-based project coordinator has been an essential element of the project.

Conclusion

This project aims to reduce perinatal transmission rates of HIV through the enhancement of information management, and to fortify the knowledge base and foster information acquisition and sharing among clinicians, patients, and the community. It seeks to maximize the utility of clinicians and facilities, extend geographic access and patient volume capacities of clinicians, improve diagnosis and treatment, and enhance data management and analysis in both centralized and decentralized care environments. The study will add to the evidence base regarding the use of mHealth and eHealth systems. All stakeholders are looking forward to the data collection phase of the project. ■

Geographic Coverage: Kakamega County General Hospital, Kakamega Kenya

Implementation Partners: Curtin University, Bentley, Western Australia; Moi University Teaching and Referral Hospital, Eldoret, Kenya; Uamuzi Bora

Donors: Curtin University; Curtin University Postgraduate Student Association Grant; Neel Arant Bandy

Contact Information: Neel Arant Bandy, Curtin University, Bently, Western Australia, neelarant@gmail.com

Ronald Dangana, MCHIP

The use of phone calls to defaulters is a cheaper and more convenient alternative to the home visit approach. Also, the use of phone contacts to track defaulters contributes to improved retention of immunization clients in intervention facilities.

MATERNAL AND CHILD HEALTH INTEGRATED PROGRAM, KENYA

IMPLEMENTATION DATE: May 2013 to March 2014

Using cellular phones to increase return rates for immunization services in Kenya

Immunization is a proven strategy for the prevention of childhood disease and mortality, yet undervaccination remains a challenge in parts of sub-Saharan Africa. In Kenya, failure to complete the immunization schedule is an obstacle to ensuring full childhood immunization. Traditional home visits to track defaulting children have not successfully reduced drop-out rates due primarily to their costliness and the time-consuming task of tracking defaulters. The assumption is that caregivers do not remember the appointment date led to development and use of short message service (SMS) reminders. These reminders, however, do not clarify the reasons behind failure to honor appointments. Widespread mobile phone penetration (over 65 percent) in Kenya presents an opportunity to use phones to trace defaulters and minimize dropout, as well as understand the reasons contributing to dropout. The US Agency for International Development Global Health Bureau's flagship program, Maternal and Child Health Integrated Program (MCHIP), determined to test the use of phone contacts as an alternative approach for tracking immunization defaulters in four districts in western Kenya. For nine months, children accessing immunization services (pentavalent 1) in 12 facilities were followed.

About MCHIP/Kenya Operations Research

The objective of this research was to test the feasibility of phone call reminders to track immunization defaulters. Specific objectives included: 1) calculating defaulter rate; 2) determining the cost and time of phone calls; 3) elucidating reasons for defaulting; and 4) determining mobile phone ownership among caregivers.

Twelve facilities with the highest drop-out rates, from four districts, were selected to participate in the study. Children who received the first dose of pentavalent (DTP-HepB-Hib) vaccine were registered in an immunization diary and followed throughout the study. Caregivers provided a reliable phone number. The child's name was entered on the date of the next visit. Children were considered defaulters if they

missed the appointment by at least 14 days, when the health worker called the caregivers to remind them of the missed appointment. The health worker recorded the number of times each caregiver was called and the estimated duration of the call before the children were either brought back or their immunization status was established. The duration and the cost of the calls were confirmed from the monthly phone bills. During the call, reasons for missing appointments were sought from the caregivers.

Dropout was defined as the difference between children getting the first dose of pentavalent (penta1) and those who received the third dose pentavalent (penta 3). The dropout rate for the study period was compared to the dropout rate for the same period for two preceding years. The numbers of children successfully tracked using the phone contacts and those tracked by health workers during the study period were compared.

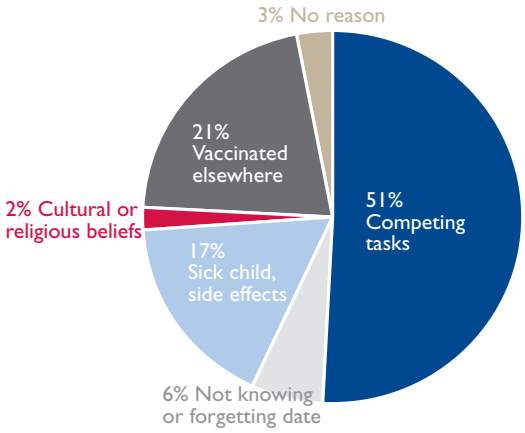
Evaluation and Results

The design of this study was longitudinal with both qualitative and quantitative arms. Sampling was purposive, based on reported high dropout rates and a rural-urban mix.

A total of 5,908 children were enrolled during the nine-month duration of the study, 57 percent of them by three facilities. A total of 785 defaulters were tracked using the phone compared to 141 tracked through home visits. Dropout rates varied between facilities. All facilities except one reported significant declines in dropout rates compared to same period in the preceding two years. On average 1.5 calls lasting two minutes were made before the child's status was established. The average cost of the phone calls was $0.14/child.

Competing tasks, a sick child and vaccine-related effects were the most common reasons for missing appointments. Forgetting the appointment date and traditional or religious beliefs were mentioned less frequently.

Figure 1. Reasons for defaulting



Ownership of cell phones by immediate caregivers was above 65 percent with minimal rural/urban difference. Only nine percent of the caregivers did not provide any phone number, and alternative efforts were made to link them to health workers for tracking.

Lessons Learned

- Calling the caregiver directly enables health workers to establish personal relationships with them, to understand reasons for default, and to negotiate an appropriate time to vaccinate the child. Although perceived as expensive, this follow-up approach is cheaper than home visits.
- A major limitation of this study was its inability to pick health worker-related causes of dropouts, such as long wait times and poor attitudes of the health workers, which have been cited in other literature.
- Caregivers who provided phone contacts of their male spouses were more likely to respond to calls favorably and have their children vaccinated. Although this finding needs further analysis, it is important to note that none of the children were brought to the clinic by their fathers or females who were accompanied by their spouses.

Conclusion

Use of phone call reminders significantly reduced dropout time at all facilities. Alternative approaches to reduce dropout have failed for three main reasons that this study attempted to address: low motivation among health workers, competing priorities for public health technicians, and poor/no funding for defaulter tracking. The use of phone calls to defaulters is a cheaper and more convenient alternative to the home visit approach. Also, the use of phone contacts to track defaulters contributes to improved retention of immunization clients in intervention facilities. Considering the high ownership rates of phones in Kenya and low costs of calling clients, the use of phone contacts is a cost-effective alternative to other defaulter tracking mechanisms. ■

Geographic Coverage: Western Kenya

Implementation Partners: John Snow, Inc., Kisumu County Health and Immunization Offices

Donor: USAID

Contact Information: Lora Shimp, Senior Technical Officer, John Snow, Inc., lshimp@jsi.com

Lauren Galvin

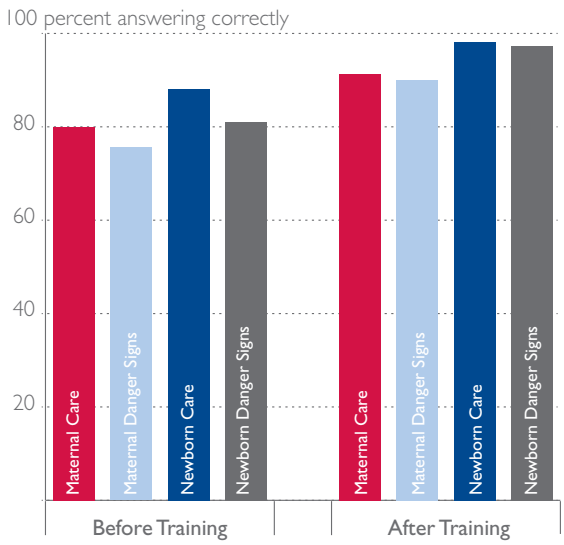


Figure 1. Intervention Group Pre- and Post-Training Assessment Correct Responses

ASHA-LINKS

IMPLEMENTATION DATE: May 2014 to September 2014

Using mobile phones to address postpartum needs of mothers and newborns

The health and development indicators of mothers and children in Uttar Pradesh, India, continue to be among the worst in the world with significantly higher rates among rural populations. The women in the rural Moradabad District face overwhelming barriers to essential maternal and newborn health care, including limited mobility due to social restrictions, limited availability of trained health providers in primary health centers (PHCs), poorly equipped and supplied PHCs, and lack of timely referral and skilled care at the community level. Because approximately 45 percent of postpartum maternal deaths and 25 to 45 percent of newborn deaths occur within 24 hours of birth, the World Health Organization recommends that all mothers and newborns receive a postpartum visit within this critical time frame.

Initiated in 2011 as part of a broader government-run health scheme targeting rural populations throughout India, accredited social health activists are being training home-based newborn care (HBNC) with the expectation that they will conduct six postpartum home visits but not within the first 24 hours for facility-based deliveries. Most ASHAs in Moradabad have yet to receive this training, and ASHA performance is compromised by lack of skills and motivation, minimal incentives, and few opportunities for career progression. ASHA-LINKS to Postpartum Maternal and Newborn Health was designed by Project Concern International (PCI) in response to the critical need to address maternal and newborn morbidity and mortality in the rural areas of Moradabad in northern India, and because well-trained ASHAs play an invaluable role in assuring that rural mothers and their families are educated on healthy postpartum practices and supported through the identification of danger signs and the swift referral of life-threatening complications.

About ASHA-LINKS

The objective of the ASHA pilot study was to develop and potentially scale up a project utilizing mobile technology as a means to improve maternal and newborn postpartum outcomes. PCI aimed to test the hypothesis that

the introduction of the mobile postpartum health assessment increased the frequency, timeliness, and quality of 24-hour postpartum assessments; the capacity of ASHAs to provide 24-hour postpartum assessments; and the ability to make referrals of serious complications to appropriate health facilities. The mobile application included a decision tree to guide ASHAs through assessments and a combination of text prompts, audio recordings, and images to assist in identifying, managing, and referring complications. PCI also tested the uptake of an improved referral network to link ASHAs with auxiliary nurse midwives and health facilities to improve the continuum of care that mothers or newborns with complications receive. Ten intervention and 10 control group ASHAs underwent a two-day training on home-based life-saving skills for mothers and newborns; the intervention group received additional training on use of the mobile application.

Evaluation and Results

ASHA knowledge, skills-based capacity, and overall performance were evaluated both qualitatively and quantitatively during pre- and post-training assessments, from data retrieved from the mobile phones during postpartum assessments, during home visit observations using a checklist, and through feedback from both ASHAs and the new mothers they visited. Researchers determined enablers and barriers for ASHAs in using the mHealth application to determine the potential for scale-up. The assessments found the following:

- Families were more receptive to ASHAs using the mHealth application, and ASHAs felt more respected by families and other health workers, likely because mobile phones carry symbolic authority. Quality of visits improved.
- The intervention group had more structured and complete assessments but the application had little impact on timeliness of assessments within and between the two groups. This finding is likely the result of deeply ingrained structural and behavioral challenges within the health care system.
- The intervention group covered twice as much information during visits than the control group, but ASHAs tended to rely on the phone at the expense of interpersonal communication.
- Phone data entry was more reliable than paper recording, but troubleshooting caused some delays in data analysis. This miscommunication became a barrier to case follow-up.
- The referral network from ASHA to facility within both groups was a challenge due to poor communication, lack of authority, absence of a formal referral system, and mistrust in public health care facilities. The intervention group recorded more referrals, but the accuracy of both groups' referrals could not be verified due to lack of records.

Table 1. Percentage of ASHAs answering questions correctly pre- and post-training for intervention and control groups

Assessment Questions	Intervention		Control	
	Pre-	Post-	Pre-	Post-
Newborn Care				
Assessing breathing problems	80.0%	100%	66.7%	88.9%
Proper cleaning of cord	100%	100%	55.6%	100%
Head positioning during KMC	90.0%	100%	55.6%	100%
Breastfeeding positioning	90.0%	100%	66.7%	77.8%
Newborn Danger Signs				
Fever	80.0%	100%	33.3%	77.8%
Chills	70.0%	80.0%	33.3%	55.6%
Eye infection	30.0%	80.0%	11.1%	44.5%
Jaundice	70.0%	100%	11.1%	66.7%

Lessons Learned

- Continuous, on-the-ground technical support should be provided to ASHAs in case the mHealth app encounters technical errors. This will ensure the data are forwarded to the server correctly.
- Some images used to help ASHAs recognize danger signs needed clarification as ASHAs had trouble understanding them.
- ASHAs felt that they should receive additional compensation from the government for the increased workload accrued through performing postpartum assessments.
- ASHAs lack training in record-keeping and counseling, limiting the reliability of data, expecially in the control group.

Conclusion

A decision-support phone application can be an effective job aid if training is adequate. It does not take the place of the ASHA's assessment and decision-making capabilities but rather contributes to assessment completeness and quality. Well-functioning referral and health care systems need to be in place to support the ASHAs and to provide proper assessment, referrals, and responsive treatment. Scale-up would require extended training for the ASHAs on home-based life-saving skills and mHealth technical skills, on-the-ground technical assistance for mHealth app troubleshooting, clearly defined and monitored government standards for ASHAs, and continuous supervision and support. ■

Geographic Coverage: Moradabad District, Uttar Pradesh, India

Implementation Partners: Project Concern International (PCI), Dimagi, Inc.

Donor: Dimagi, Inc., through CORE Group

Contact Information: Carolyn Kruger, PhD., Sr. Technical Advisor for RMNCH, Project Concern International (PCI). Email: ckruger@pciglobal.org

Dimagi, Inc

Partnership with the government resulted in a sense of ownership within the state health team, as their inputs on the application content were solicited and they were given a certificate for work performed in Chandil.

COMMCARE Mobile Job Aid for Sahiyas

IMPLEMENTATION DATE: August 2014 to Present

Strengthening maternal and newborn health in India

Despite renewed efforts to improve maternal health outcomes, maternal mortality rates remain high in India. India recorded around 57,000 maternal deaths in 2010, and the country's maternal mortality rate is nearly double its Millennium Development Goal of 109 deaths per 100,000 live births. The global health community has identified proven interventions for every stage of maternal care. Properly trained, motivated, and supervised community health workers (CHWs) have been shown to reduce neonatal mortality by up to 50 percent, making them a critical component in optimizing primary health care service delivery to the most remote and under-resourced locales.

mHealth interventions have demonstrated the effectiveness and relevance of mobile job aids in advancing the technical capacity and reporting of CHWs, as well as the quality of their behavior change communication services. These tools have been shown to increase worker motivation, and they provide a powerful set of tools for monitoring, supervising, and supporting community health programs. In this context, Dimagi developed mobile job aids for government CHWs in India, called Sahiyas, in partnership with the National Health Mission of Jharkhand; the US Agency for International Development Global Health Bureau's flagship program, Maternal and Child Health Integrated Program (MCHIP); and the UN Children's Fund (UNICEF), through its flagship mHealth platform, CommCare. CommCare supports Sahiyas in the tracking of pregnant mothers and newborn children through the continuum of care, focusing on integrating comprehensive decision-support, extensive multimedia for low-literate users, and offline capabilities to work in low-resource settings.

About CommCare Mobile Job Aid for Sahiyas

CommCare, Dimagi's open source mobile health platform, facilitates the work of Sahiyas by enabling easy electronic data collection, remote monitoring and supervision, decision-support, and counseling messages. It supports capabilities to gather high-quality data while incorporating features not available via conventional paper-based tools, including multi-

ple languages, interactive multimedia, branching logic, global positioning system integration, and photo capture tools. It aims to help Sahiyas more accurately track and support the registration, follow-up, and completion of care for pregnant women, postpartum mothers, and children up to the age of two years. It is built on a complex decision- and logic-processing platform that can support these CHWs to deliver timely services supported across the continuum of care, as well as provide critical data-quality checks at the point of service. It submits data collected from remote locations to a cloud server to be accessed by supervisors at various levels to support real-time, data-driven decision-making and worker supervision. Given Jharkhand's predominantly rural and forest-covered terrain, CommCare is a valuable tool for Sahiyas and enables better access, quality, and experience of care to beneficiaries.

The content of the application was designed to integrate India's National Health Mission guidelines in conjunction with rigorous field testing to incorporate feedback on the tool's usability and accessibility for Sahiyas and beneficiaries. The application incorporates extensive multimedia support, including local-language audio prompts and behavior change counseling video content provided by UNICEF, to facilitate more engaging interactions between Sahiyas and their beneficiaries.

Evaluation and Results

Since August 2014, Dimagi worked with the National Health Mission (NHM) of Jharkhand to design and pilot a mobile job aid for Sahiyas in the high priority district of Seraikela-Kharsawan, deploying CommCare for 220 Sahiyas in 1 block. A core objective of the mobile job aid for Sahiyas is to increase the awareness and delivery of care on key NHM priority areas. In order to assess the impacts of CommCare on knowledge retention on critical areas of care, Dimagi carried out a baseline knowledge assessment survey and aims to conduct midline and endline surveys to assess the impact of the mobile job aid introduction into standard care practices.

Dimagi constantly examines how CommCare impacts the four key areas of care: access, quality, experience, and accountability. 1) Access: An RCT showed that reminders from CommCare led to 85% more timely home-visits. Another study found that ASHA's using CommCare on average make visits that are 1.8 times longer and about twice as likely to include key decision-makers (client's husband, mother-in-law) compared to counselling sessions without CommCare. 2) Quality: One study in India demonstrated that after four months of use, ASHA's had increased knowledge retention of at least three danger signs from 48% at baseline to 70%. Another study, found 24% improvement in ASHAs' knowledge of high-impact MNCH interventions within five months. 3) Experience: The literature indicates that multimedia usage in CommCare increases client engagement. These findings corroborate with earlier work that shows that videos played by CHW's on phones helped engage beneficiaries. 4) Accountability: CommCare improves monitoring and communication. In one project in Madhya Pradesh (MP), the introduction of CommCare improved data completeness from 67% to 84%. It also reduced the average time it took to submit data to a program coordinator from 45 days to 8 hours.

Lessons Learned

- Through Dimagi's projects globally, an immense importance in effective supportive supervision for the successful adoption and continued use of CommCare as a mobile job aid for health workers has been seen. In the context of government health workers, this project has showed how important effective supervision is and the challenges of engaging supervisors in a system where little incentives exist for quality supervision. Learning how to integrate supervisors into a program from the onset can be as integral to the success of a mobile intervention as getting buy-in from end-users, especially for sustainability in the government context.
- Engaging with the government comes with its own challenges, and most often a top-down approach can be most effective in decision-making and facilitating buy-in at all levels. When implementing a project on the ground, buy-in from local officials is key to ensuring success of an implementation, but often buy-in from senior government officials can ease accessing and getting support from local officials in the field.

Conclusion

While Dimagi has contributed to successful interventions through mobile job aids for health workers with several partners in several locations across the world, this was the first time Dimagi partnered directly with the government. This partnership resulted in a sense of ownership within the state health team, as their inputs on the application content were solicited and they were given a certificate for work performed in Chandil. Relationships were also forged with the health workers and the officials on the ground. Dimagi will continue exploring different methods of supportive supervision in conjunction with government officials to assess the most effective methods of ensuring program sustainability. ■

Geographic Coverage: Chandil block, Seraikela District, Jharkhand, India

Implementation Partners: Dimagi, Inc.

Donor: World Bank Development Marketplace

Contact Information: Rushika Shekhar, Senior Field Manager, Dimagi, rshekhar@dimagi.com

Gabriel Anthony

The combination of decision support, SMS reminders and linking of health records has the potential to improve continuum of care for mothers and babies and improve quality of service delivery.

MOBYAPP

IMPLEMENTATION DATE: July 2013 to December 2016

Strengthening maternal and newborn health in Tanzania

Access to and uptake of comprehensive, quality maternal, newborn, and child health (MNCH) services are a prerequisite to reaching Millennium Development Goals 4 and 5. Unfortunately health indicators in Tanzania show that MNCH service utilization remains low. While 96 percent of pregnant women attend at least one antenatal care (ANC) visit and immunization coverage among children is high, there is a lack of continuity with the uptake of institutional deliveries at 50 percent and postnatal care (PNC) services within two days after birth as low as 31 percent.[1, 2] Because these services are not provided with a continuum of care approach, there are missed opportunities to provide essential MNCH interventions to mothers and their infants.

One gap in current service provision at reproductive and child health (RCH) clinics is the lack of patient records, which would allow health workers to monitor and follow up mothers and their infants along a continuum, beginning with the initial ANC visit. The Elizabeth Glaser Pediatric AIDS Foundation (EGPAF) and its partner, D-tree International, have developed a decision-support application and electronic patient record system, which can track uptake of MNCH services along the continuum of care. This application is being implemented in 25 health facilities in six districts of the Tabora region.

About MobyApp

EGPAF supports the Ministry of Health and Social Welfare (MOHSW) with integrated RCH and prevention of mother-to-child transmission of HIV (PMTCT) services in over 1,400 health facilities. EGPAF and D-tree's Moby App, designed on an Android platform for use with smart phones, provides decision-support for health workers, links to mother and baby records, and tracks mother-baby pairs across MNCH/HIV services.

The application supports health workers to provide MNCH services in line with national guidelines. Each pregnant woman starting ANC, regardless of HIV status, is registered into a phone-based electronic record. This phone-based app is

then used to prompt the nurse to provide (and record) a step-by-step assessment of the mother and record all findings in the mother's health record. Similarly, the tool provides support to the nursing staff for postpartum visits for the mother and newborn. The system also registers, tracks, and provides decision support for PMTCT prophylaxis for the newborn and HIV testing after six weeks to determine infant HIV status. The Moby App sends automated short message service (SMS) reminders to clients, reminding them of upcoming appointments, missed appointments, and approaching delivery dates so women can prepare to deliver in a health facility. The next stage of development will involve experimenting with the use of unique IDs to allow tracking of clients across facilities.

To date, staff from 25 health facilities across six districts in the Tabora region have been trained in the use of the Moby App; eight facilities have started implementation, while the remaining sites are still practicing its use for future rollout.

Evaluation and Results

In the first full quarter of Moby App implementation, 91 percent of pregnant women registering for ANC were entered into the Moby App (n=1606). This performance decreased substantially to only 34 percent in the second quarter due to technological, logistical, and motivation challenges. Key inputs required to address this drop in coverage were: (1) re-installing or updating the application at sites where it seemed corrupted; (2) managing airtime through bundles to enable continuous connectivity; and (3) personal feedback and support to motivate health workers to use the application.

As of March 2015, a total of 3,790 were registered, of which 83 percent were ANC clients, 6 percent postnatal care mothers, and 11 percent neonatal clients.

Providers have given both positive and negative feedback on the application. Most find the tool useful to ensure that the full standard of care is provided, and many have reported that they feel proud to have been reminded and supported in providing the "care they were trained to provide." However, as the tool is not yet fully implemented and not all clients are registered in it, providers still also maintain usual paper-based tools and thus some perceive the new tools as additional workload.

While still early, initial data in some sites are promising; in the original eight pilot sites a combination of interventions to improve continuum of care, including the implementation of the tool, the percentage of mother/baby pairs attending HIV services each month increased from 68 percent in January 2014 to 96 percent by December 2014.

Lessons Learned

- **Using mobile technology provides useful support** to health workers to standardize services provision.
- **Health care workers appreciate the support** the phone-based tool provides, which has increased their knowledge and capacity to provide quality services to pregnant and lactating women.
- **Shortage of reagents and equipment failure** affects health worker ability to provide services according to the national guidelines, thus it was necessary to update the Moby App to allow providers to record the reasons for clients not receiving tests.
- **Stable and secure mobile services coverage** affects success of this application, thus rollout is limited to areas with network coverage. Innovative technologies to expand mobile services to the most remote areas are needed.

Conclusion

Although the project is still in its infancy, using mobile technology in service delivery has been well perceived. The combination of decision support, SMS reminders, and linking the health records of mothers and infants has the potential to improve the adherence to provide a continuum of care and improve quality of service delivery.

In 2015-16, the Moby App will be expanded to an additional 17 sites in Tabora as part of an operations research study to evaluate the effectiveness of the SMS reminders on adherence to ANC and PNC visit schedules. This feature will also allow community health workers to automatically receive contact details of patients who have missed their appointments for follow-up.

Ulitmately, the project aims to create an electronic patient-level database feature. This new feature will generate the current data collected by the Moby App into a customized, user-friendly reporting system to provide health workers with data for individualized provision of care and monitoring of the uptake of services across the continuum of care for each mother and infant. The system will also offer districts easy access to real time data reports for program monitoring and decision-making. ■

Geographic Coverage: Tabora, Tanzania

Implementation Partners: Elizabeth Glaser Pediatric AIDS Foundation, D-Tree International

Donors: USAID, HealthEnabled

Contact Information: Roland van de Ven, Technical Director
Elizabeth Glaser Pediatric AIDS Foundation, Tanzania
roland@pedaids.org

Institute for Reproductive Health, Georgetown University

CYCLETEL Family Advice & CYCLETEL Humsafar

IMPLEMENTATION DATE: CycleTel Family Advice–March 2015 to Present; CycleTel Humsafar–2011 to Present

Bridging the gap between family planning knowledge and behavior

Does fertility awareness and family planning information impact attitudes and behaviors around family planning? Could knowledge increase the likelihood of family planning method uptake? Georgetown University's Institute for Reproductive Health (IRH) has developed a two-part service to answer this question. The first service, CycleTel Family Advice, is a series of 65 educational short message service (SMS) texts on fertility, family planning, couples communication, and related topics. Messages are written as conversational stories and targeted by age, sex, and marital status. CycleTel Family Advice users can also access the second service, CycleTel Humsafar, a family planning method directly on their phone. Based on the Standard Days Method® (SDM), CycleTel Humsafar helps a woman identify which days during her menstrual cycle she is most likely to become pregnant and alerts her on fertile days. IRH, in partnership with others, has followed a step-wise, systematic approach to CycleTel Humsafar development and pilot testing since 2010. Under the US Agency for International Development-funded FACT Project (2013-18), IRH and partners were able to design and develop the CycleTel Family Advice Service, and offer it at scale in India through a private sector partnership. Both services were made available to users starting in early 2015 and will be evaluated for behavioral outcomes.

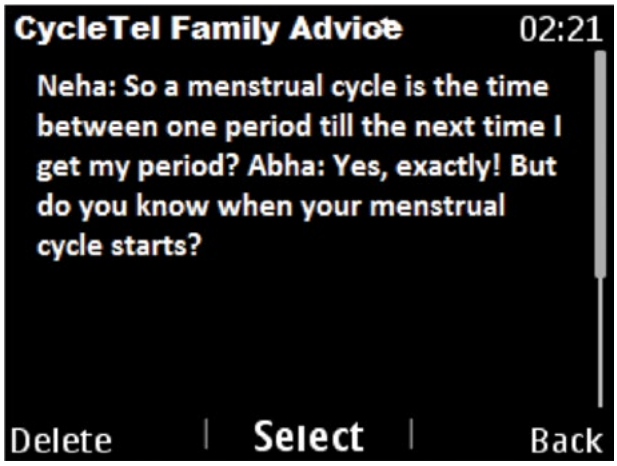
About CycleTel Family Advice and CycleTel Humsafar

IRH has partnered with Life Tools in India, a pre-installed application available on over 25 million phones in India. Integrating with the Life Tools application, CycleTel Family Advice Service and the CycleTel Humsafar services are now available in 12 local Indian languages and able to reach users at scale. CycleTel Family Advice will reach 350,000 users over 18 months and provide users with 15 weeks of content (users receive messages four times a week.) These messages will contain stories that illustrate common situations in family planning and provide information on fertility and family planning topics. These stories have been pretested to ensure that they are culturally appropriate and engaging.

Content is delivered entirely through the Life Tools platform and at no cost to users. Users are also given access to a CycleTel Helpline so that they can access additional information. For the CycleTel Humsafar service, over 11 million Life Tools users have the opportunity to enroll in the CycleTel Humsafar service. CycleTel Humsafar first determines if a woman is eligible to use SDM by asking a series of screening questions. If eligible, she enters the date of her last period and the service informs her of her fertile days during the cycle. She receives alerts on her "unsafe days" throughout the month. To continue using the service, the user must enter her period date every month and complete the billing process to pay 10 INR. Additionally, through the Helpline number, trained counselors are available for one-on-one consultation over the phone.

Evaluation and Results

CycleTel Family Advice was piloted with over 25,000 users in four languages in April 2014. Over 90 percent of users indicated that they learned something, and demographic questions indicated that over 50 percent of users were men, suggesting that this service is an effective way of engaging men in family planning. IRH has done extensive research on CycleTel Humsafar previously. Over 95 percent of users interviewed at exit reported that they received messages at an appropriate time and in an appropriate quantity, indicating that the technology worked as designed. When asked what they liked most about CycleTel, more than 80 percent of users reported appreciating its ease-of-use and the timely reminders. Nearly 90 percent of women and 80 percent of men interviewed said that they would recommend this service to others.



In 2015 and 2016, IRH will conduct extensive research on the two services at scale through phone surveys with new, continuing, and discontinued users and answer the following questions: Does CycleTel Family Advice improve knowledge and attitudes related to fertility awareness and family planning? Does it lead to adoption of family planning, including CycleTel Humsafar? How long do CycleTel Humsafar users continue SDM use? Do they use SDM correctly? Does it lead to uptake of other family planning methods? Answers to these questions and related system-generated data on conversion rates and continuation rates will drive product improvements in the future.

Lessons Learned

- Proof of concept testing, with low-cost technology solutions, is a critical first step to testing an mHealth concept.
- Creating an mHealth product is only the first step; reaching scale requires complementary outreach and educational efforts.
- Distribution partners with a broad market base and aligned goals and missions can facilitate scale and sustainability.

Conclusion

The complementary CycleTel services—CycleTel Family Advice and CycleTel Humsafar—are well positioned to increase access to both information on fertility and family planning and a direct-to-consumer family planning method. IRH's partnership with Life Tools and its consumer pay model will test sustainable expansion of the service in 12 Indian languages and offer lessons for the mHealth field. For an mHealth service to be taken to scale, continuous iteration, investment, and partnership development is required for a sustainable service and strong user base. ■

Geographic Coverage: India

Implementation Partners: Georgetown University's Institute for Reproductive Health leads a team that includes Thoughtworks, Inc., HCL Ltd., Indian Society of Healthcare Professionals, and Boring Brands

Donor: USAID

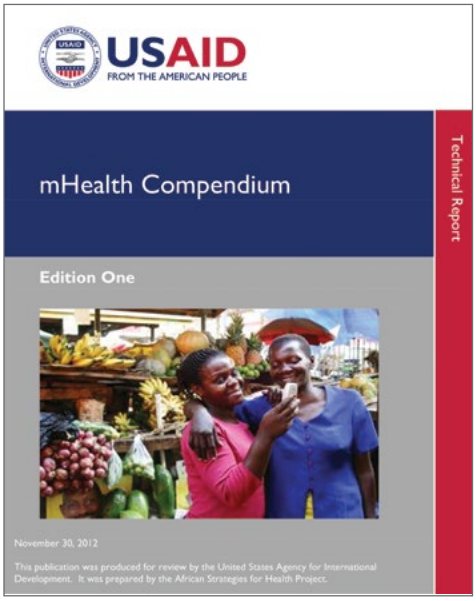
Contact Information: Victoria Jennings, Director, FACT: Fertility Awareness for Community Transformation project, Institute for Reproductive Health, Georgetown University, Victoria.jennings@georgetown.edu

Kara Cherniga

ANNEXES

Annex 1. Case Studies from Previous Volumes

VOLUME 1.



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BEHAVIOR CHANGE COMMUNICATION

- Chakruok Interactive Radio Program
- CycleTel™
- iCycleBeads™ Smartphone Apps
- La Ligne Verte Family Planning Hotline
- Mobile 4 Reproductive Health (m4RH)
- SMS and IVR to Improve Family Planning Services
- Text Me! Flash Me! Call me!
- Workplace-based SMS Awareness Campaign

DATA COLLECTION

- Automating Data Collection for HIV Services
- Child Status Index (CSI) Mobile App
- EpiSurveyor/Magpi
- Integrated Health Systems Strengthening Project – IHSSP: RapidSMS
- JSI Early Warning System

FINANCE

- Changamka Maternal Health Smartcard
- Mobile Finance to Reimburse Sexual and Reproductive Vouchers

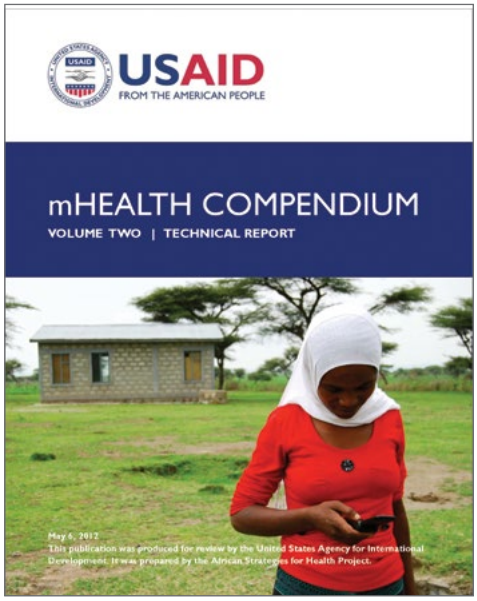
LOGISTICS

- cStock
- Delivery Team Topping Up System
- Integrated Logistic System – ILSGateway
- International Quality Short Message Services (IQSMS)
- Mobile Product Authentication MPA
- mTrac: Monitoring Essential Medicine Supply
- Tupange SMS Community Tracking System

SERVICE DELIVERY

- CommCare for Home-Based Care
- Community IMCI (cIMCI)
- eFamily Planning (e-FP)
- eNutrition
- Maternal Health (Antenatal and Postnatal Care)
- mHealth for Safe Deliveries in Zanzibar
- Mobiles for Quality Improvement (m4QI) – SHOPS Project
- MOTECH Suite
- Project Mwana – SMS for Early Infant Diagnosis of HIV
- SIMpill® Medication Adherences Solution
- Supportive Supervision (SS) for TB in Nigeria
- The Malawi K4Health Mobile Learning Pilot

VOLUME 2.



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BEHAVIOR CHANGE COMMUNICATION

- CommCare for Antenatal Care Services in Nigeria
- JustTested: SMS-Based Support and Information for HIV Testing and Counseling Clients
- MAMA Bangladesh
- MAMA South Africa
- Tobacco Kills: Say No & Save Lives
- Wazazi Nipendeni (Parents, Love Me): mHealth Initiative to Support Maternal Care in Tanzania

DATA COLLECTION

- Community-based Health Promotion for Safe Motherhood using mHealth
- DataWinners Platform
- iHRIS and Mobile Reference Dictionary
- iPhones for Malaria Indicator Survey
- The Last 10 Kilometers: What it Takes to Improve Health Outcomes in Rural Ethiopia
- Mobile Phone Microscopy for the diagnosis of Parasitic Worm Infections
- OpenHDS

FINANCE

- Heartfile Health Financing - an mHealth enabled innovation in health social protection
- Jamii Smart | KimMNCHip—referrals, mSavings and eVouchers
- Tanzania National eVoucher Scheme
- transportMYpatient: Facilitating access to treatment for obstetric fistulae

LOGISTICS

- Enat Messenger for Maternal Health in Ethiopia
- Mobile Phone Survey Software for End-Use
- mPedigree
- mTRAC Stop Malaria Program (SMP)

SERVICE DELIVERY

- AliveCor Heart Monitor - Mobile ECG
- FioNet: Mobile Diagnostics Integrated with Cloud Information Services
- GxAlert
- MarieTXT: A Mobile Powered Management Information System
- mCARE: Enhancing Neonatal Survival in Rural South Asia
- txtAlert for Patient Reminders

VOLUME 3.

BEHAVIOR CHANGE COMMUNICATION

- Heart Health Mobile
- Mobile Integrated Resources for Aurat-Women (MIRA) Channel
- NightWatch: Mobile
- Wired Mothers

DATA COLLECTION

- Child Profiling Survey
- Global Trachoma Mapping Project
- Malaria Control Program (MACEPA)
- Real-Time Biosurveillance Program
- ZiDi

FINANCE

- Interactive Alerts
- mHealth for Safe Delivered: Ezy Pesa mobile banking services
- Pona na Tigo Bima

LOGISTICS

- Fone Astra
- Project Optimize: Albania
- SMS for Life

SERVICE DELIVERY

- ACT of Birth, Uganda
- Baby Monitor
- eNUT
- Mobile Media Rich Interactive Guidelines
- MobiUS Ultrasound
- mSakhi
- Pre-eclampsia Integrated Estimate of Risk (PIERS) on the Move
- Sky Social Franchise Network
- SMART

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VOLUME 4.

BEHAVIOR CHANGE COMMUNICATION (BCC)

- Ananya
- Empowering and Mobilizing People Living with HIV/AIDS
- mCenas!
- Mobile Information for Maternal Health
- No-Yawa

DATA COLLECTION

- Community Led Total Sanitation Mobile Surveillance
- GIS Mapping of Health Facilities
- Ma Sante
- Mobile HIV & Malaria Diagnosis and Reporting System
- mSOS
- mSpray
- mWater
- Participatory Monitoring and Evaluation (PartMe)
- Reduction of Maternal Mortality Through ICT

FINANCE

- The Mobile Health Research Lab: Mobile Wallet

LOGISTICS

- The Liberian Agriculture Upgrading, Nutrition, and Child Health (LAUNCH) Project

SERVICE DELIVERY

- Better Health for Afghan Mothers and Children
- Chipatala cha pa Foni (Health Center by Phone)
- eCompliance
- Emergency Triage Assessment and Treatment (ETAT)
- Engage TB
- Grand Challenge Exploration Phase 1 Project
- inSCALE
- IVR mLearning Platform in Senegal
- Malaria Community Surveillance for Elimination
- Mobile-based Early Detection and Prevention of Oral Cancer (mEPOC)
- Mobile Phones for Improved Access to Safe Water (M4W)
- Mobilise!
- Peek Vision
- The Referral Exchange System (SIJARIEMAS)
- The Safe Delivery App

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