Opportunities to Improve Maternal, Neonatal and Child Health in India through Smartphones and 3G Connectivity Solutions

CONTENTS

EXECUTIVE SUMMARY

Frontline health workers are often the first and only link to health care and preventative health services for millions of families in low- and middle-income countries. However, there is a severe shortage of trained, frontline health workers to provide quality and timely health care services, particularly to pregnant women and newborns. The shortage as well as lack of capacity of existing front line health workers are key barriers to achieving the United Nations' Millennium Development Goals 4 and 5, which are to Reduce Child Mortality and Improve Maternal Health, respectively.

The lack of quality maternal, infant and child care has a staggering impact. Globally, 47 million babies were delivered without skilled care in 2011.[1] Half of pregnant women in developing regions receive the recommended minimum of four antenatal care visits.[2] Complications during pregnancy or childbirth are one of the leading causes of death for adolescent girls.[3]

Most maternal deaths in developing countries are preventable through adequate nutrition, proper health care, the presence of a skilled birth attendant during delivery and emergency obstetric care.[4]

Advanced wireless technologies offer a revolutionary opportunity to strengthen the capacity of frontline health workers, expand coverage and improve the quality and timeliness of delivery of critical maternal and child health interventions such as antenatal services, birth preparedness planning, prevention of mother-to-child transmission of HIV, essential newborn care, immunization and community case management of childhood diseases.

Mobile broadband can help lower health-related costs, facilitate remote care and increase efficiencies. It allows communities unparalleled opportunities to track health data from anywhere, at any time, providing public health policymakers with timely information about the needs of their communities in order to improve performance of health workers as well as tweak intervention strategies. These benefits make mobile health (mHealth) an essential tool in extending health care resources to underserved communities.

This paper examines the current environment for mobile content and mobile tools that are supporting frontline health workers in India to improve maternal, neonatal and child health outcomes in low-resource settings; identifies challenges and opportunities for mHealth solutions; and suggests areas where mHealth solutions can support the Government of India's plans to strengthen its cadres of frontline health workers and improve their performance in regard to maternal, neonatal and child health.

MATERNAL, NEONATAL AND CHILD HEALTH IN INDIA

Since 1990, India has made large investments to improve its maternal mortality ratio from 600 per 100,000 live births to just over 200 in 2010.[5] More than 53 percent of pregnant women now deliver with a skilled birth attendant, therefore reducing the risk of mortality from complications and unsafe birthing practices. Despite this progress, India still accounts for nearly 20 percent of all maternal deaths globally.[6]

Many neonatal and child health indicators from birth to under the age of 5 still lag in India. Nearly 30 percent of all global newborn births occur in India, with 53 percent of all under-five deaths occurring in the first 28 days of life. Forty-eight percent of children under age 5 are stunted, and 44 percent are underweight.[7]

SEGMENTS OF FRONTLINE HEALTH WORKERS IN INDIA

Frontline health workers in India are referred to as community health workers (CHWs). The three primary groups include Accredited Social Health Activists (ASHAs), Auxiliary Nurse Midwives (ANMs) and Anganwadi Workers (AWWs). The scope of their work may vary across states, depending on community needs and priorities of the various state governments of India. However their roles are deeply intertwined at the community level.

Accredited Social Health Activists

There are approximately 890,000 ASHAs across India, primarily making home visits to pregnant women and women who recently delivered. These home visits are designed mainly for health promotion and preventive care on topics such as nutrition, basic sanitation, birth preparedness, safe delivery and breast-feeding and essential newborn care. They reach approximately 70 percent of the population in rural areas. ASHAs do not receive a salary but are financially incentivized to ensure pregnant women receive antenatal care. They also receive financial incentives for encouraging institutional deliveries and for supporting healthy behaviors by pregnant women. ASHAs are encouraged to maintain records of their activities to improve their efficiency. To receive their incentives, they must track the services they deliver to families. The cadre of ASHAs was established under the National Rural Health Mission of the Government of India's Ministry of Health and Family Welfare.

Auxiliary Nurse Midwives

ANMs are full-time government employees who manage the operations and service delivery at primary health centers or sub-centers.[8] They lead home visits when required. There were approximately 208,000 ANMs working in these centers across the country as of March 2011.[9] To reduce the rates of maternal and neonatal mortality by increasing the number of skilled providers supporting institutional deliveries, efforts are being made to train ANMs to become "certified" Skilled Birth Attendants.[10] Like the ASHAs they supervise, ANMs are managed by the Ministry of Health and Family Welfare.

Anganwadi Workers

The AWWs manage nutrition and early child development programs in their communities. They also manage centers that function both as non-formal preschools for children between 3-6 years of age and as distribution points for rations for pregnant women, lactating mothers and families with adolescent girls and children under 6 years of age.[11] As part of their role, AWWs weigh each child under the age of 5 at least once a month, record the results during either a home visit or at the center, conduct health check-ups and identify children that require a referral to a primary health center or sub-center for immediate medical attention. As of September 30, 2012, there were 1.3 million AWWs, more than 35,700 AWW supervisors and 1.2 million AWW helpers in position.[12] AWWs work closely with ASHAs and ANMs. The team of AWWs is managed by the Ministry of Women and Child Development.

THE VALUE OF MOBILE BROADBAND

A recent report suggests that by the end of 2014 there will be more mobile phone subscriptions than people in the world.[13] Currently, total cellular connections are estimated at 7 billion and are expected to grow to approximately 8.7 billion by the end of 2018.[14] Mobile phone penetration rates stand at 96 percent globally (128 percent in developed countries and 89 percent in developing countries). India is an important part of this market, with one of the largest telecommunications networks in the world as of March 2010.[15] In terms of subscribers, India had 807 million active mobile users as of August 2014.[16]

The global mobile health market, including devices, software and services, is projected to grow eight-fold, from $5.1 billion in 2013 to $41.8 billion in 2023.[17]

While the majority of mobile services offered in India are based on 2G technologies, 3G adoption has accelerated in recent months. In the next six years, mobile broadband user base in India is expected to grow four times.[18] Investing in advanced wireless infrastructure for the future is critical to solving health problems and adding value at scale.

The Government of India recognizes the value of CHWs owning mobile phones to support the value of CHWs, and some states are purchasing mobile phones for these workers.[19] The Government of Madhya Pradesh distributed SIM cards to nearly 80,000 ASHAs and ANMs.[20] Similarly the Government of Uttar Pradesh distributed a basic mobile phone with SIM card to all ASHAs and ANMs in its state.[21, 22]

GOVERNMENT OF INDIA HEALTH INITIATIVES

The Government of India leads several key policy and program initiatives to improve maternal and child health outcomes. These initiatives provide insight into how mHealth could be integrated into the broader health system.

National Health Mission:

The National Health Mission has two Sub-missions: the National Rural Health Mission (NRHM) and the National Urban Health Mission (NUHM). The Union Ministry of Health and Family Welfare launched the NRHM in 2005 to provide accessible, affordable and quality health care to the rural population, especially the vulnerable groups. NUHM's launch was approved in 2013 to meet health care needs of the urban population, with a focus on the urban poor. The National Health Mission's overall success is measured, in part, by reductions in the maternal mortality rate, infant mortality rate and total fertility rate. India's group of ASHAs was born of this initiative, as were incentive programs to encourage institutional deliveries.

Integrated Child Development Scheme:

Implemented by the Ministry of Women and Child Development within the Government of India, this is one of the world's largest schemes for pregnant women and early childhood development. It aims to provide preschool education to children and reduce malnutrition, morbidity and mortality. These objectives are achieved through a package of services including infant feeding, supplementary nutrition, immunizations, health check-ups, referral services, preschool non-formal education, and nutrition and health education.[23] AWWs spearhead this program and are expected to work closely with ASHAs and ANMs.

Mother and Child Tracking System (MCTS):

The MCTS is an ambitious plan to register all pregnant women and children under the age of 2 and track the health services that are provided to them. This system also operates as a feedback system for ASHAs, ANMs and other health care providers to improve health services for pregnant women and children. Health workers record their services on paper-based forms, which then go to data entry operators who enter the data into the system at the block level (an administrative unit below the district where a normally public health center normally exists), after which the data is then uploaded to the central-server. This data is used to develop work plans and home visit schedules which are sent back to the ASHAs and ANMs via SMS.

The National Informatics Center, which is the IT division of the Government of India, has introduced a call center that conducts random calls to pregnant mothers to verify that the data captured reflected the services received.[24]

The MCTS is a powerful tool to strengthen maternal, neonatal and child health outcomes by using data to monitor and identify gaps and priorities and close the feedback loop between CHWs and the Government of India.

The Ministry of Health and Family Welfare is keen to explore how mHealth solutions can be used to support real-time data entry by ANMs and ASHAs to improve data entry speed and data quality. Some states are testing mHealth solutions for updating the MCTS across both feature phones and smartphones.

GLOBAL HEALTH INITIATIVES IN INDIA WITH MOBILE COMPONENTS

Some important global initiatives focusing on frontline health workers as a priority area—and India as a target country for implementation—recognize the importance of using mobile technology.

Child Survival Call to Action

The Governments of India, Ethiopia and the United States together with UNICEF launched the Call to Action for Child Survival and Development in 2012 to focus on accelerating the achievement of Millennium Development Goals 4, 5, 6 (Combat HIV/AIDS, Malaria and Other Diseases) and 7 (Environmental Sustainability) in 200 underperforming districts in India. Use of mobile technology is a key priority within the Call to Action's innovation vertical.

A Promise Renewed

In June 2012, more than 175 countries and over 400 civil society and faith organizations signed a pledge in support of the Child Survival Call to Action. This global commitment became known as A Promise Renewed (APR). Recently, the global community came together at the World Health Assembly to endorse a global newborn action plan and set a target to reduce preventable newborn deaths to a global average of 7 deaths per 1,000 live births, and a national target of fewer than 10 deaths per 1,000 live births, both by 2035. Progress is underway for a related measure and benchmark for family planning. In a recent report released by USAID to track progress from 1990 to 2012, India has reduced the under-five mortality rate by 55 percent and the maternal mortality ratio by 65 percent.[25]

United Nations Special Envoy's Office

The three, health-related Millennium Development Goals provide the vision for work at the UN Special Envoy's Office. Efforts focus on reducing child mortality (MDG 4), improving maternal health (MDG 5) and lessening the burden of HIV/AIDS, tuberculosis and malaria (MDG 6). Focusing on child mortality, Special Envoy's Office studies have shown that reaching mothers and families with simple messages about the importance of early and exclusive breastfeeding, keeping the baby warm and dry, recognizing the danger signs of a sick newborn and avoiding practices that are harmful to newborns can halve the rate of newborn deaths. The Special Envoy's Office estimates that essential newborn care behavior change and outreach targeted to the greatest concentrations of mothers most at risk of losing a newborn can close up to 20 percent of the MDG 4 achievement gap in 2015.

MDG Health Alliance

The MDG Health Alliance is an initiative of the UN Special Envoy for Financing the Health Millennium Development Goals and for Malaria. The Alliance operates in support of Every Woman Every Child, an unprecedented global movement spearheaded by the UN Secretary-General to mobilize and intensify global action to improve the health of women and children.

Within this Alliance, the CHWs and Frontline Delivery team focuses on strengthening frontline health worker programs to better deliver life-saving commodities to vulnerable populations living at the last mile. The team does this by harmonizing approaches, improving access to financing, sparking innovation and accelerating dialogue on core challenges. Working side-by-side with governments, UNICEF, the One Million Community Health Worker campaign, the Frontline Health Workers Coalition, mPowering Frontline Health Workers, and other key partners and implementers, the MDG Health Alliance develops innovative and accelerative efforts to drive global progress towards achieving the health MDGs.

United Nations Commission on Life Saving Commodities for Women and Children

A part of Every Woman Every Child, this Commission was established to promote the availability, affordability, accessibility and rational use of essential commodities for the health of women and children. One of the Commission's 10 recommended actions to deliver on the promise of saving millions of women's and children's lives focuses on exploring how mobile technology can be used to improve frontline health worker performance and accountability.

OPPORTUNITIES FOR mHEALTH IN INDIA

CHWs in India face numerous challenges in delivering quality and timely health care: inadequate training and continuous skills development, weak persuasive counseling skills, lack of supportive supervision, inability to make accurate and timely diagnoses, weak performance incentives, inefficient data for decision-making and performance improvement, and an inability to access and provide timely and relevant health information.

mHealth has a significant contribution to make in tackling some of these challenges. Already, mHealth solutions have rolled out in parts of India to support CHWs in five verticals of (i) Self-learning/Refresher Training, (ii) Patient Registration and Monitoring (iii) Scheduling and Task Management (iv) Awareness and Counseling and (v) Clinical Decision and Assessment Support. Developed across a variety of technologies, such as Interactive Voice Response Service (IVRS), text SMS, rich media SMS, multimedia-enabled applications on smartphones, 2G/3G video and others, many programs exist in which CHWs are using mobile devices to improve outcomes for mothers and children. Below are some examples in each of the above mentioned verticals.

Self-learning/Refresher Training

Self-learning and refresher training mHealth solutions offer frontline health workers the ability to "learn while they earn" by adapting training modules into mobile-friendly, digital or audio content followed by assessment tools such as digital or audio quizzes and exams.

BBC Media Action has developed a training course, called Mobile Academy,[26] to expand and refresh CHWs' knowledge of ten life-saving health behaviors and to enhance their communication skills. The audio course is delivered via IVRS – a technology that can be accessed from any mobile handset. Mobile Academy enables CHWs to complete the course anywhere, any time at a fraction of the cost of face-to-face training.

> "We learned that ASHAs tend to listen to the modules after lunch or after dinner and felt that self-learning fit better into their schedule versus interrupting their schedule for offsite government training."
>
> — Sara Chamberlain, Country Head, BBC Media Action India

IntraHealth International has built *mSakhi*,[27] a solution among others to support self-learning and refresher training for ASHAs. *mSakhi* has been developed as an interactive tutorial offering ASHAs key health messages for maternal and newborn care. It uses a combination of audio and video, all contextualized with localized illustrations, to encourage its use among the community health workers. Initially built for keypad-based mobile phones, the system shifted to Android smartphones in the second phase of a pilot program. This shift was based on feedback from beneficiaries at the pilot site who preferred multimedia-enabled applications. A study comparing the recall ability of ASHAs who trained on the mobile phones with those who trained using paper-based tools found that 76 percent of ASHAs using the mobile phones were able to recall at least six critical newborn conditions that warranted referral, versus 58 percent of ASHAs using paper-based tools.[28] Additionally the study revealed that 46 ASHAs in the experimental group accessed the messages on the application 57,222 times in nine months, totaling 1,048 hours.

Operations research studies tested the feasibility and effectiveness of *mSakhi* as a self-learning and counseling tool as well as an integrated tool (self-learning, beneficiary registration, counseling, decision-support, and real-time monitoring) specifically for the postnatal period. Additional evidence supporting the effectiveness of the *mSakhi* application can be read at: http://www.intrahealth.org/page/msakhi-an-interactive-mobile-phone-based-job-aid-for-accredited-social-health-activists.

Patient Registration and Monitoring

CHWs use mobile phones to register pregnant women, newborns and other beneficiaries by either collecting basic information and issuing a unique identification number or using an existing "Know Your Customer" document such as the Aadhaar or National Population Register number. This record is then used to monitor services delivered as well as data on vitals, conditions and complications. Monitoring data can also be related to disease surveillance or CHW performance, such as absenteeism.

Patient registration and monitoring is a very common category of mHealth solutions for community health workers across SMS, IVR, Java and smartphone applications. This indicates that improving data collection and reporting is a key priority for government ministries and NGOs. The concentration of mHealth solutions in this category is driven by the realization among the health community in India that paper-based reporting creates a backlog of information that cannot be used in time to identify and solve gaps in delivering essential medical interventions.

For example, the study of the ***mSakhi*** program[29] (discussed further in the Awareness and Counseling section below) showed almost 100 percent registration of the estimated number of pregnant women in the experimental group which used mobile phones compared to only 78 percent of the control group which did not use mobile phones, demonstrating the efficacy of mobile phone-based registration methods.

Awareness and Counseling

Existing, paper-based job aids for community health workers range from text-heavy reference materials and bulky counseling flipbooks to complex newborn-care checklists which have been found to be difficult to use and adopt. The weighty and difficult nature of using these tools can render them less effective as aids for convincing pregnant women and families to adopt new health behaviors.

In addition to Mobile Academy, BBC Media Action has also developed a multimedia service to enhance the impact of CHWs counselling to families. Called Mobile Kunji (which means 'guide' or 'key' in Hindi), it brings together an IVR-based mobile service and a printed deck of cards on a ring. The Kunji cards have been designed to look like a mobile phone, with illustrations, supporting arguments and key messages about maternal and child health. Each card has a unique mobile shortcode printed on it, which corresponds to a specific audio health message. When a health worker dials the number, they can play the health message – voiced by a character called Dr. Anita, an engaging but authoritative female doctor – to the family via their mobile phone.

Similarly, regarding the *mSakhi* application of IntraHealth mentioned earlier in the paragraph "Self-learning/Refresher Training," an IntraHealth study revealed that monthly usage of the counseling messages between the beginning of the project and the end increased from 52 minutes to 121 minutes.[30]

Across mHealth projects, researchers have found that mobile solutions have elevated the confidence and status of frontline health workers in the community, almost granting them "overnight credibility."[31] This increase in confidence and self-efficacy has resulted in the delivery of timely, higher-quality messages and services to community households.

> "An ASHA was having a challenge convincing mothers to give birth at institutions. During the monthly meeting, they came up with the idea to videotape testimonials from women who had previously delivered in an institution, using the mobile phone. The ASHA would then show this recording to other moms during home visits to persuade them."
>
> — Madhuri Narayanan, Country Director, IntraHealth International

Scheduling and Task Management

Scheduling and task management solutions compute daily tasks for frontline health workers based on health needs drawn from patient registration data. A feature of more comprehensive mobile solutions, they can log tasks completed for supervisors to verify and to allow supervisors to stay informed.

For example, CARE India's Integrated Family Health Initiative application (continuum of care services – CCS) has integrated BBC Media Action's counseling and awareness tool, Mobile Kunji. The CCS application is designed to inform the ASHAs and AWWs which women to visit and which topics to cover during their visits, based on the status of each woman's pregnancy. The health worker conveys the counseling messages in a fun and engaging way. The system tracks the activity as it is completed and sends the data to both the health worker's supervisor and a central server.[32]

Clinical Decision and Assessment Support

Most mobile tools providing recommendations on patient diagnosis, treatment and referral are found within smartphone applications. This may illustrate a need for devices with more robust hardware in order to manage these often complex computing tasks.

The IntraHealth study found that ASHAs who used the step-by-step guide and decision-support module within the *mSakhi* smartphone application for the identification, management and referral of sick newborns achieved improved newborn assessment skills and a higher referral rate.[33]

HOW mHEALTH CAN SUPPORT THE GOVERNMENT OF INDIA

India still accounts for nearly one-fifth of all maternal deaths globally. This strongly suggests the need for continued investments in and evaluations of current health care systems to identify gaps and opportunities. Increasingly, accessible, mobile-driven solutions will help close the gaps and provide a foundation for improved health outcomes.

Two potential areas where mHealth solutions could support the Government of India's existing plans to strengthen its corps of community health workers and improve their performance to support maternal and child health are:

1. Improve the accuracy, completeness and timeliness of data captured to monitor and track pregnant women, mothers and children through services provided by community health workers.

2. Accelerate efforts to provide community health workers with refresher training and continuing education by establishing a pan-India platform that delivers accessible, relevant and high-quality mobile content for self-learning.

ABOUT THIS PAPER

This paper is a collaborative project between the mPowering Frontline Health Workers partnership, the United Nations Foundation and Qualcomm® Wireless Reach™.

mPowering Frontline Health Workers (mPowering) aims to accelerate the use of mobile technology to improve the skills and performance of frontline health workers, as part of a global effort to end preventable child and maternal deaths. A partnership of USAID and 15 other organizations from the public and private sectors, mPowering focuses on four key areas: global tools, country programs, research/global learning and advocacy. More than 80 organizations are directly contributing to mPowering activities. The Maternal and Child Survival Program, as mPowering's Secretariat, provides financial management, human resources, communications and administrative support to mPowering, as well as technical partnership. For more information, please visit www.mpoweringhealth.org

The United Nations Foundation builds public-private partnerships to address the world's most pressing problems, and broadens support for the United Nations through advocacy and public outreach. Through innovative campaigns and initiatives, the Foundation connects people, ideas, and resources to help the UN solve global problems. The Foundation was created in 1998 as a U.S. public charity by entrepreneur and philanthropist Ted Turner and now is supported by global corporations, foundations, governments, and individuals. The Foundation has long worked with the mHealth community and led mHealth initiatives designed to advance mHealth solutions for international development challenges. It served as the partnership secretariat for the mHealth Alliance for five years. It currently hosts the Mobile Alliance for Maternal Action (MAMA), as well as the ICT for Saving One Million Lives initiative in Nigeria, the Every Woman, Every Child Innovation Working Group Catalytic mHealth Grants program and this partnership with Qualcomm Wireless Reach and mPowering Frontline Health Workers designed to harness mobile technology to improve the capability and performance of frontline health workers in India. For more information, visit www.unfoundation.org.

Qualcomm believes access to advanced wireless technologies can improve people's lives. Qualcomm® Wireless Reach™ is a strategic initiative that brings wireless technology to underserved communities globally. Wireless Reach invests in projects that foster entrepreneurship, aid in public safety, enhance the delivery of health care, enrich teaching and learning and improve environmental sustainability. For more information, please visit www.qualcomm.com/wirelessreach.

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