



# LEVERAGING MOBILE TECHNOLOGIES TO PROMOTE MATERNAL & NEWBORN HEALTH:

THE CURRENT LANDSCAPE & OPPORTUNITIES FOR  
ADVANCEMENT IN LOW-RESOURCE SETTINGS

THE CENTER FOR INNOVATION & TECHNOLOGY IN PUBLIC HEALTH  
PUBLIC HEALTH INSTITUTE | OAKLAND, CALIFORNIA







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## ACKNOWLEDGEMENTS

The authors would like to extend the deepest appreciation and regards to the many resources who have helped inform the preparation and writing of this report. Many thanks go to Neal Lesh (Dimagi), Eric Blantz (Inveneo), Brendan Smith (Vital Wave Consulting, Inc.), Pamela Riley (Abt Associates), Erin Sines (MacArthur Foundation), Sandhya Rao (USAID, Office of Health, Infectious Diseases and Nutrition at USAID), James Bon Tempo (Jhpiego), Catharine Taylor (PATH), Kiersten Israel-Ballard (PATH), Anton Luchitsky (PATH), Peggy D'Adamo (USAID, Office of Population and Reproductive Health), Rose Reis and Trevor Lewis (Center for Health Market Innovations), Heather Vahdat and Kelly L'Engle (FHI 360), Patricia Mechaël (mHealth Alliance, UN Foundation), Jaspal Sandhu (Gobee Group), Kelly Kiesling (The mHealth Working Group), Stan Kachnowski (Mailman School of Public Health at Columbia University), Katherine de Tolly (Cell-Life), Trina DasGupta (GSMA), Craig Friedrichs (GSMA), Kyla Reid (GSMA), Alice Newton (Government Digital Service), Mojca Cargo (GSMA), Toni Eliaz (World Bank), Jody Ranck (Consultant at IntraHealth International), Kate Cummings (Ushahidi), Rafael Anta (Inter-American Development Bank), Bas Hoefman (Text to Change), Richard Bartlett (International Partnership for Innovative Healthcare Delivery), Michael Syson (Ateneo de Manila University in Philippines), Juan Rodriguez (Voxiva), Patricia J. Garcia (Universidad Peruana Cayetano Heredia in Peru), Walter Curioso (Universidad Peruana Cayetano Heredia in Peru), and Rodrigo Saucedo Martínez (Instituto Carlos Slim de la Salud of Mexico). We have drawn heavily from the practices, experiences, and contributions of these individuals and their organizations to characterize the scale and scope of mHealth activity in maternal and newborn health. This report would not have been possible without their sharing best practices, recommendations, and learned lessons in relation to mHealth intervention design, implementation, and evaluation, and the potential opportunities and levers for successfully advancing mHealth interventions at scale and on a sustained basis. Our many thanks also go to Ada Kwan, Cathryn Meurn, Jennifer Potts, Francis Gonzales, and Madhura Bhat for their help and support in the production of this report.

Most importantly, we would like to express our appreciation to the mHealth Alliance, hosted by the UN Foundation. Without their leadership, support, and its commitment to advancing the role of mobile technology in global health and investment in supporting mHealth practices in maternal and newborn health, this report would not have been possible. It is our utmost desire that the product of our efforts will go forward to inform the strategic use and implementation of mHealth to improve access to care for pregnant women, mothers, and newborns so that reductions in maternal and newborn mortality – achievable with existing technologies of today – can happen without further delay.

## EXECUTIVE SUMMARY

Every year, approximately 350,000 women die worldwide as a direct result of pregnancy and childbirth, and for each woman who dies, approximately 20 others suffer from pregnancy-related consequences.<sup>1</sup> Additionally, three million babies die every year before they are a month old, and a similar number are stillborn.<sup>2,3</sup> When stillbirths are included, about half of all 7.5 million deaths in children under age five occur before the end of the neonatal period, or the first 28 days of life, and without a reduction in the number of neonatal deaths, a dent cannot be made in under-five mortality rates.<sup>4</sup> With over six billion mobile phone subscriptions spread across a world population of over seven billion, mobile technologies are rapidly penetrating even the most remote corners of the world.<sup>5</sup> For women and newborns in many low- and middle-income countries (LMICs), the rapid expansion of mobile technology infrastructure presents an unprecedented opportunity to increase access to health care and save lives that are lost from preventable and avoidable conditions.

### OBJECTIVE

The objective of this report is twofold:

- (1) to describe the current state of mHealth intervention design, implementation, and evaluation that can be leveraged to improve maternal and newborn health globally and
- (2) to identify ways to strategically advance mHealth in maternal and newborn care, as well as strategies for scaling up interventions.

### METHODOLOGY

This report prioritized information from 13 LMICs in Asia, Latin America, and Africa: Bangladesh, India, the Philippines, Brazil, Mexico, Peru, Ghana, Kenya, Liberia, the Republic of South Africa, Rwanda, Tanzania, and Uganda. A total of 70 projects related to maternal and newborn health (MNH) and 160 projects in other health areas were identified. Key informant interviews were conducted with experts in health, technology, and public policy, as well as those involved in the development and implementation of mHealth programs worldwide. Additionally, this report was informed by a review of published information and by contacting sponsoring organizations.

### FINDINGS

In MNH, combining mobile technologies with existing health system resources offers significant potential to provide women and newborns with adequate and appropriate care through interventions that stimulate demand for available services, promote improved access, and lead to efficiencies in care delivery and management practices. As with other application areas of mHealth, MNH interventions face significant barriers at technical, social, and economic levels.

### CONCLUSIONS

The ability to conduct rigorous evaluation and provide evidence of demonstrable impact is the crucial catalyst that will advance policy and investment in the field and lead to the successful scaling and sustainability of mHealth interventions. As evidence accrues, policy makers will be able to push forward supportive national policy for information and communications technologies in health care, which will promote an enabling environment where the potential of mHealth can best be realized.



A woman with dark hair tied back, wearing a black and white striped cardigan over a black top, is holding a newborn baby in a pink patterned sling. The baby is wearing a matching pink hat and is sleeping. The background is a solid yellow color. A text box is overlaid on the upper right portion of the image.

TO ACHIEVE THE MDGS AND TO  
MAINTAIN BETTER MNH BEYOND  
2015, **WE MUST CRITICALLY  
EXAMINE** NEW WAYS OF USING  
EXISTING RESOURCES

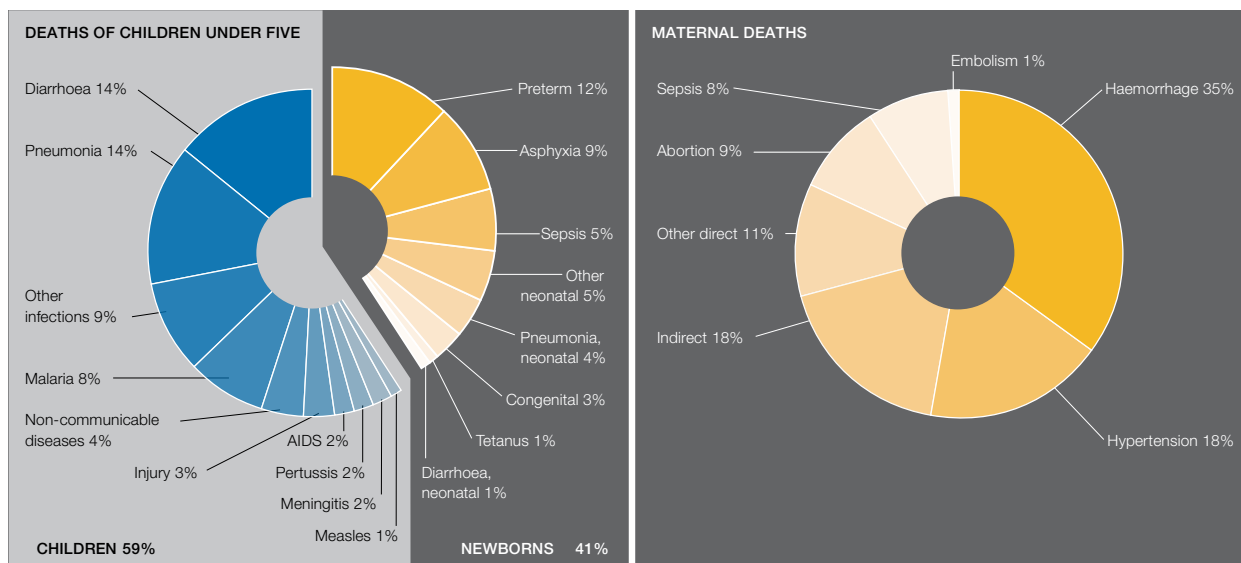
## INTRODUCTION

Every year, approximately 350,000 women die worldwide as a direct result of pregnancy and childbirth, and for each woman who dies, approximately 20 others suffer from pregnancy-related consequences.<sup>1</sup> Additionally, three million babies die every year before they are a month old, and a similar number are stillborn.<sup>2, 3</sup> When stillbirths are included, about half of all 7.5 million deaths in children under age five occur before the end of the neonatal period, or the first 28 days of life, and without a reduction in the number of neonatal deaths, a dent cannot be made in under-five mortality rates.<sup>4</sup>

Although the majority of these deaths and debilitating illnesses and injuries are preventable and avoidable (See **Figure 1**), reducing the under-five mortality rate and the maternal mortality ratio has seen slow progress.<sup>6</sup> Placed on the global agenda as Millennium Development Goals (MDGs) 4 and 5, respectively, the global health community has determined **WHAT** is effective at reducing the number of deaths, and now must focus on **HOW**

to deliver these already proven interventions at scale to reach the mothers and newborns **WHO** need them most.

A closer look at global maternal and newborn mortality trends shows that half of maternal deaths occur in sub-Saharan Africa and a third occur in South Asia with India contributing to 22 percent of deaths with similar patterns existing for neonatal mortality.<sup>1,7</sup> Challenges in getting effective solutions to mothers and newborns who are most at-risk can be overcome by delivering proven interventions with better coverage and quality particularly in Africa and South Asia. Factors that hinder adequate health care from reaching the women and newborns who are most at risk include distance to resources, severe shortages of trained health professionals, and lack of investment in public health. To achieve the MDGs and to maintain better MNH beyond 2015, we must critically examine new ways of using existing resources in regions where improvements need to be made.



**Figure 1.** Causes of deaths in children under five years of age and maternal deaths (Source: Global Campaign for the Health Millennium Development Goals, 2011).

With over six billion mobile phone subscriptions spread across a world population of over seven billion, mobile technologies are rapidly penetrating even the most remote corners of the world.<sup>5</sup> For women and newborns in many low- and middle-income countries (LMICs), the rapid expansion of mobile technology infrastructure presents an unprecedented opportunity to increase access to health care and save lives, but how exactly can we leverage the power of mobile technology to save the lives of women and newborns?

Through mobile health (mHealth), or the use of wireless information and communication devices (e.g. mobile phones and smartphones) and mobile phone networks for health, not only can frontline health workers carry tools loaded with protocols, but captured data can also flow through a health system in real-time and deliver critical information to support women's and providers' needs in a timely and efficient manner. Additionally, combining mobile technologies with existing health system resources offers opportunities in stimulating demand for available services and expanding access to effective and already existing programs through growing mobile phone networks, both of which can lead to higher levels of efficiency in service delivery, supervision, and management practices.

In particular, for MNH, mHealth can support and strengthen existing efforts along the continuum of care, as well as offer innovative solutions, such as providing women with MNH-related information services by phone, in addition to providing community-based health workers and health

facilities with point-of-care decision support tools to maintain existing standards and augment existing protocols that have been proven to be effective in case management.

At this time, mHealth applications in the MNH field are in the formative stage, and existing evidence for effectiveness and impact is new, but rapidly evolving. This report aims (1) to describe the current state of mHealth intervention design, implementation, and evaluation that can be leveraged to improve MNH globally, and (2) to identify ways to strategically advance and scale up mHealth in maternal and newborn care so that opportunities afforded by mobile phones and networks can reach their full potential. This report will first provide frameworks currently used in the field of MNH, which will help provide a structure for general mHealth strategies and those that have been particularly implemented to improve MNH outcomes. Detail is then provided on how mHealth can stimulate demand for services among pregnant women and new mothers, strengthen human resource capacity, and transform health system capacity. The report then summarizes the opportunities that mHealth can leverage to reduce mortality rates, as well as suggestions for strategically advancing the space. To build from the accrued knowledge of global MNH, a quick review of existing frameworks will help facilitate the integration of mHealth. This section will describe two frameworks used in the field of MNH: the maternal-newborn continuum of care and the Three Delays Model.

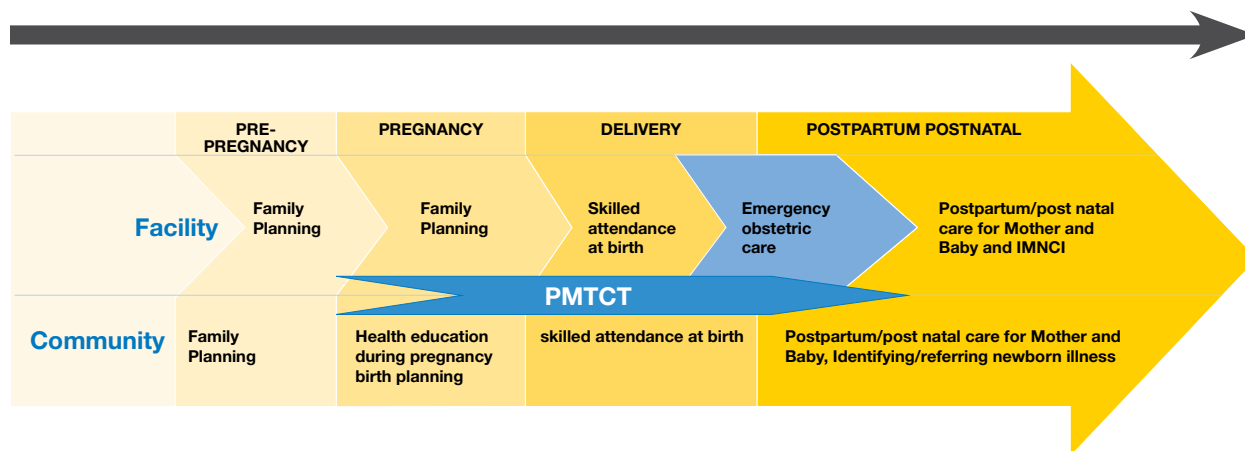


## MATERNAL AND NEWBORN HEALTH FRAMEWORKS

First, the *maternal-newborn continuum of care* ranges from pre-pregnancy and extends into pregnancy, labor and delivery, and postpartum or postnatal care, and it naturally includes child health; however, this report will focus primarily on the MNH section of the continuum. The purpose of the continuum of care is to map the specific moments along the continuum where proven interventions ought to be delivered (See **Figure 2**). An analysis of 'coverage gap' measures, which represents the percentage of a target population not receiving critical services, indicated that the greatest inequities in services fall into the categories of maternal and newborn care and family planning.

In reality, along the continuum of care, significant variation persists in the levels of coverage, and because mHealth can provide solutions to improve access and extend reach of health efforts, it will be important to acknowledge these relations when selecting and integrating appropriate strategies.

**Figure 3** highlights the status in 2010 of coverage estimates of evidence-based interventions related to maternal, newborn, and child health in 68 MDG countdown countries.<sup>8</sup> The high rate of maternal and newborn mortality in many low-resource settings also reflects inequities in access to medical services because of the geographic and economic imbalances that exist between rural and urban populations and the rich and poor. Poor women and their infants living in rural areas have a higher risk of poor pregnancy outcomes as a result of barriers to accessing timely and adequate care and limited preventive measures and treatments. For example, only one in three rural women in developing countries receive the recommended care during pregnancy.<sup>9</sup>

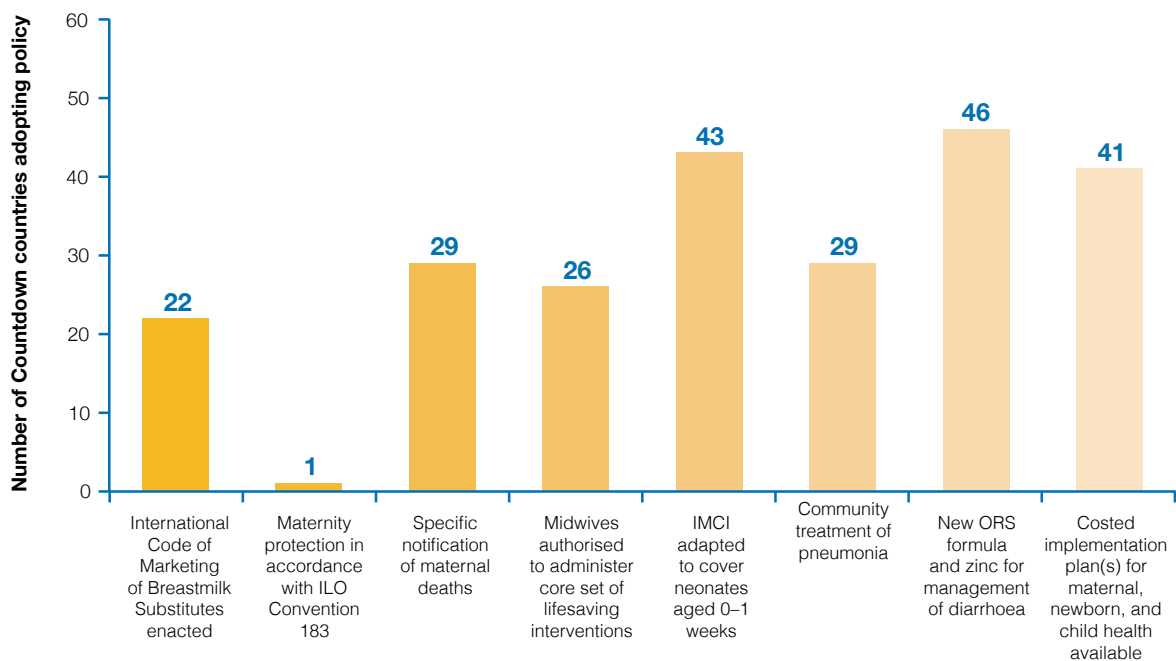


**Figure 2.** Maternal-newborn continuum of care (Source: mHealth Alliance<sup>a</sup>, Credit: UNICEF)

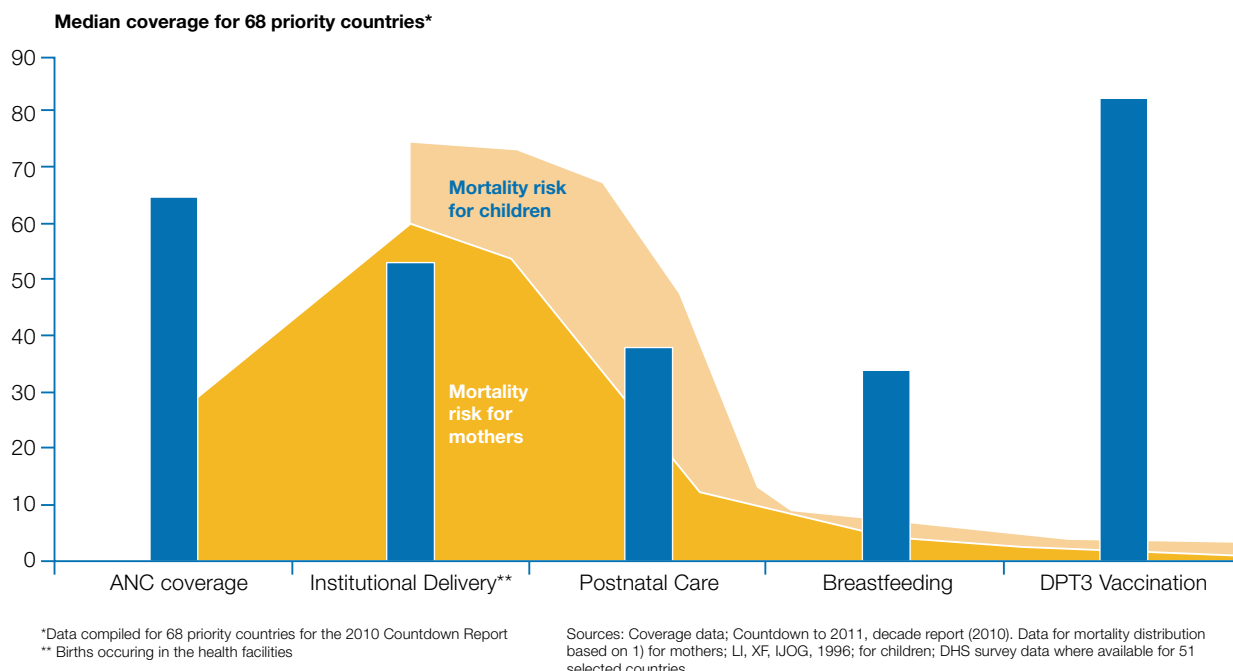
a. Maternal-Newborn mHealth Initiative. Retrieved on March 25, 2012 previously available on the web page:

[mhealthalliance.org/content/maternal-newborn-mhealth-initiative-mmii](http://mhealthalliance.org/content/maternal-newborn-mhealth-initiative-mmii)

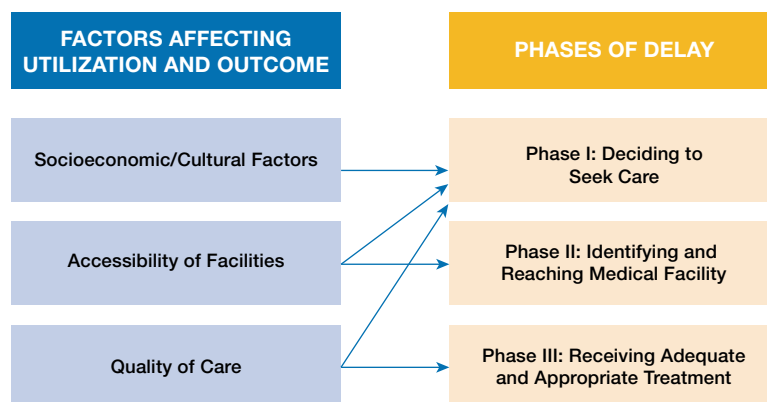
b. 2015 Millennium Development Goals: Retrieved on March 25, 2012 from: <http://www.un.org/millenniumgoals/>



**Figure 3.** Coverage estimates from 2010 for evidence-based policies related to maternal, newborn, and child health in 68 countdown countries. ILO=International Labour Organisation; IMCI=Integrated Management of Childhood Illness; ORS=oral rehydration solution. (Source: Bhutta et al., 2010).



**Figure 4.** Mortality Risk for Mothers and Children Along the Continuum of Care (Source: Global Campaign for the Health Millennium Development Goals, 2011).




**Figure 5.** Three Delays Model for maternal mortality (Source: Thaddeus and Maine, 1994).<sup>9</sup>

Notably, the onset of labor marks the beginning of another high-risk period that continues through the immediate 48 hours after birth. **Figure 4** highlights the mortality risk for mothers and children along the continuum of care. Expanding access to prenatal care, family planning resources, proper nutrition options, and postnatal care is important; however, around the onset of labor, 150,000 maternal deaths, 1.6 million neonatal deaths, and 1.2 million stillbirths occur each year.<sup>9</sup> Almost all of the deaths occurring during this high-risk period take place in LMICs. In sub-Saharan Africa and South Asia, which together accounted for 87 percent of global maternal deaths in 2008, less than half the women deliver in hospitals. Optimizing birth outcomes in these countries requires strengthening human resource and health system capacities during this acute high-risk period, and encouraging women to deliver in well-equipped and staffed institutional care settings, while addressing

the need to have effective emergency responses. One model that frames the challenges of improving maternal mortality is the Three Delays Model, which proposes that pregnancy-related mortality is overwhelmingly due to delays in the decision to seek care, access to the appropriate level of care, and receipt of the appropriate treatment and professional care upon arrival at the health facility (See **Figure 5**). The maternal-newborn continuum of care provides a general overview of what health systems can do to assure that appropriate services are available to mothers and newborns, but when designing effective interventions, it is equally important to keep in mind factors on the population side that may prevent the usage of services, regardless of whether they are delivered with high quality or not. In this report, ways mHealth can be integrated to reduce these delays are described using this framework.

c. Saving Lives at Birth: A Grand Challenge for Development (<http://www.savinglivesatbirth.net>)



A photograph of two pregnant women standing side-by-side. The woman on the left is wearing a pink and white striped short-sleeved shirt and a yellow and red patterned wrap. The woman on the right is wearing a colorful, multi-colored patterned wrap. Both women are looking towards the camera. A semi-transparent grey box with text is overlaid on the image.

EXPANDING MOBILE PHONE  
PENETRATION **AND NETWORK  
COVERAGE CAN** REMOVE  
TRADITIONAL GEOGRAPHIC  
AND ECONOMIC BARRIERS  
TO HEALTH CARE

## MOBILE HEALTH IN MATERNAL AND NEWBORN HEALTH

The rise in mHealth solutions to improve health outcomes is largely attributable to the ubiquity of mobile phones as well as the convenience, user friendliness, and relatively low cost of mHealth applications. Expanding mobile phone penetration and network coverage can remove traditional geographic and economic barriers to health care, particularly in emergency situations that can be life threatening, as is often the case for MNH. To provide the context to discuss the existing and potential role of mHealth in MNH, a review of mHealth across <sup>13</sup> LMICs was conducted. Lessons learned were drawn not only in MNH but from all mHealth efforts.

mHealth is fairly new with a rapidly developing evidence base that suggests encouraging progress. In general, mHealth interventions fall primarily into two categories: **(1)** those directed toward improving the provision of health services where the predominant focus is at the health system level, and **(2)** those directed toward the recipients of health services where client-focused services can involve sending health information or reminders to improve treatment compliance or attend appointments.<sup>10</sup> In the former, target applications make use of mobile phone features for real-time or actionable information for data collection, surveillance, supply chain management, and point-of-care support applications. In the latter, client-focused services emphasize the promotion or reinforcement of positive health behaviors and the use of recommended health services, and mobile finance services that facilitate savings toward the cost of recommended health products and services. With regard to the type of mobile phone features utilized, recent evaluations of mHealth programs indicate a potential to broadly support patient self-management through text-message-based cues, reminders, and prompts to schedule or confirm an appointment; notifications for laboratory results

or health status reports; requests for self-reported data, encouragement or motivation to sustain a positive behavior (and the reverse, to reduce a negative one); and education and information resources to improve self-efficacy. A systematic review of the literature on behavior change and clinical outcomes from disease management and prevention services delivered through text messaging found significant results in eight of nine studies that support text messaging as a tool for behavior change.<sup>11</sup> However, this review, much like the other published evidence to date, reflects small-scale projects in high-income countries, and thus limits their relevance to many LMIC settings.

**Figure 6** provides an overview of mHealth services for MNH in LMICs organized by three categories reflecting responses to each of the delays in the Three Delays Model: stimulating demand among pregnant women and mothers, strengthening human resource capacity, and transforming health system capacity. These three categories are further explored in more detail below.



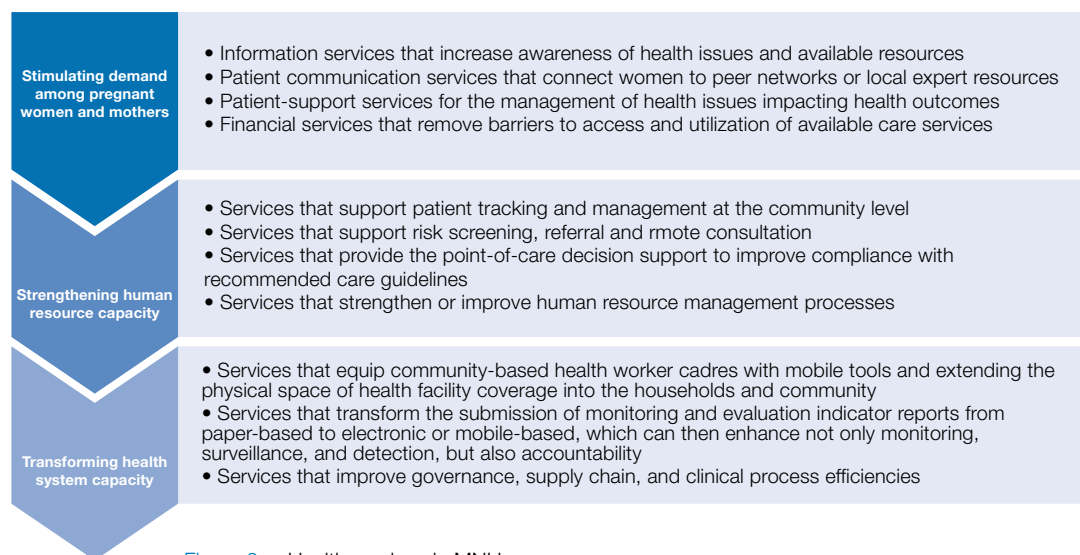


Figure 6. mHealth services in MNH.

## STIMULATING DEMAND AMONG PREGNANT WOMEN AND NEW MOTHERS

Reasons that may delay a woman's decision to seek care are many and the result of a confluence of factors. These include a lack of knowledge about health services and complications during pregnancy and how these complications are managed, as well as geographic, economic, and socio-cultural barriers. In certain societies, the lower status of women is a barrier to their ability to make independent decisions regarding their own care. Other barriers include the lack of financial resources to pay for hospital services and to purchase medications; beliefs and practices surrounding childbirth and delivery, nutrition, and education; and a lack of trust in health systems.

mHealth solutions that have been designed to influence a woman's decision to seek care can address the problem from several perspectives.

**Table 1** summarizes mHealth strategies for supporting pregnant women and encouraging them to seek medical care. In this regard, strategies have been standalone or integrated and aim to:

increase women's awareness of MNH issues and promote behavior change in their utilization of related care services; directly connect women to expert resources such as skilled birth attendants at health clinics; provide complementary patient support services for the prevention and treatment of health issues contributing to maternal and newborn mortality; and/or offer mobile financial services which either remove financial barriers to care or directly encourage women to save toward delivery and post-natal care.

Because pregnant women can also be reached through extended caretakers in their communities, mHealth interventions in this category also target family members of pregnant women, such as a spouse or mother, or influential community members. Targeting these individuals can facilitate the knowledge transfer of appropriate care, as well as encourage expectant mothers to seek services. mHealth can also create peer networks of pregnant women or partner first-time mothers with experienced mothers for support.




**Table 1.** mHealth interventions and strategies to stimulate the demand for MNH services among pregnant women <sup>d</sup>

MHEALTH INTERVENTION	PROGRAM Main Affiliated Organizations	STRATEGY
Information services that increase women's awareness of health issues and encourage women to use available health resources	<b>BabySMS</b> World of Avatar, MTN South Africa	South Africa – Subscription-based services that require participants to provide their expected delivery date (or date of infant's birth) to time content delivery for optimal impact on users' health knowledge and behaviors.
	<b>SMS Appointment Reminder System</b> University of Philippines Medical Informatics Unit	Philippines – Standalone services that send appointment reminders to women who have registered at local health centers 2-3 days in advance of a scheduled follow-up appointment.
	<b>mCheck</b> World Health Organization PSP/CPO	India – Targeted services that assist women and family members in the identification of crucial risk factors in mothers and newborns during the immediate week-long, high-risk period following delivery and in seeking appropriate care.
	<b>Interactive Maternal Health Mapping Tool</b> eSAC Project; Phi Research Group, University of Toronto; PAHO	Mexico – Interactive mapping services that mash up health system and geographic information system data to provide detailed information about the quality and types of maternal health services offered in local locations.
	<b>Mobile Alliance for Maternal Action (MAMA)</b> USAID, Johnson & Johnson, babycenter	Bangladesh, India, South Africa – For no charge to expecting and new mothers, MAMA offers health information in the form of text messages adapted to different contexts. Messages are developed with the help of BabyCenter, which has reached 25 million pregnant women and new mothers in 20 countries around the world. Locally adapted messages will be available on an online library for other projects to encourage sharing learned lessons.

d. For a more comprehensive list of mHealth interventions and strategies, visit the database on the Health Unbound website <http://www.healthunbound.org/>

MHEALTH INTERVENTION	PROGRAM Main Affiliated Organizations	STRATEGY
Patient communication services that directly connect women to peer networks or expert resources in the community such as skilled birth attendants	<b>Wired Mothers</b> University of Copenhagen; Ministry of Health and Social Welfare, Zanzibar, Tanzania; Health Sector Programme Support Zanzibar; Danida Health Sector Programme Support	Tanzania – Services that strengthen communication between pregnant women and primary health care units through use of mobile phones to ask questions and seek advice in cases of acute or non-acute problems and potentially avoid unnecessary visits.
	<b>Project Kopano</b> The SHM Foundation, Yale School of Medicine, University of Pretoria	South Africa – Services that allow HIV-positive mothers to communicate directly with each other via SMS about issues affecting their lives during their pregnancy.
	<b>mMitra</b> UCSF Bixby Center, ARMAAN	India – Services delivered to elected, trained, trusted female leaders from villages' local consultation groups to ensure that the few eligible women without phones also have access to the educational messages on preventive and emergency care.
Complementary patient-support services addressing the management of health issues that contribute to maternal and newborn mortality	<b>Mobile for Reproductive Health (m4RH)</b> FHI 360, USAID, PROGRESS	Tanzania, Kenya – Reproductive health services that use text-based messages to deliver evidence-based information on family planning methods. Services are designed to target both men and women with information on family planning.
	<b>Cellphones4HIV</b> Cell-Life, Vodacom, USAID, PEPFAR, The Raith Foundation, Johns Hopkins Health and Education South Africa, Right to Care	South Africa – Programs to prevent the mother-to-child transmission of HIV/AIDS that use text messaging to send educational messages and reminders for scheduled appointments, testing and treatment.
Mobile financial services that remove financial barriers to care by allowing women to save toward delivery and post-natal care	<b>Changamka</b> Changamka MicroHealth Ltd.	Kenya – Services that enable women to save money over an extended period of time to gain access to primary health care services by facilitating payment at the point of care using a medical smart card combined with mobile money transfer service systems.
	<b>m-Money For Women with Fistula</b> Fistula Care, Freedom from Fistula Foundation, USAID, Vodafone Group	Kenya – Services that combine mobile financial services, educational information, and the provision of free treatment in order to cover transport costs for women and facilitate their access to fistula repair services.



MHEALTH CAN ALSO CREATE  
**PEER NETWORKS OF PREGNANT  
WOMEN** OR PARTNER  
FIRST-TIME MOTHERS WITH  
EXPERIENCED MOTHERS FOR  
SUPPORT



mHealth services targeting new and expectant mothers involve a broad range of private and public partnerships in the planning for promotion and outreach, content and format, and pricing of mHealth services with the shared goal of increasing a woman's awareness of health issues and encouraging her to use health services. These include the use of the government health workforce (SMS Advice for Pregnant Women in Bangladesh); facility-based posters, palm cards, and flyers (Mobile for Reproductive Health in Kenya and Tanzania); and more traditional uses of national media campaigns (Wazazi Nipendeni in Tanzania).

#### **Preliminary evidence indicates:**

- Improved compliance in scheduled follow-up appointments (SMS Appointment Reminder System in Philippines)
- Higher rates of service utilization (Mobile eHealth Safe Motherhood Project in Philippines)
- Higher levels of trust (Mobile for Reproductive Health in Kenya and Tanzania)
- Improved user satisfaction with services (CycleTel in India)
- Higher rates of delivery in the presence of skilled birth attendants in the intervention arm than the skilled birth attendant rate at delivery in Tanzania was 43 percent in 2004-2005<sup>7</sup> (Wired Mothers in Tanzania)

Results indicate the potential benefit of these measures in preventing loss of mothers to follow-up (Cellphones4HIV in South Africa). A randomized controlled trial (RCT) in South Africa assessed the effectiveness of reminding HIV-positive mothers to keep appointments, bring their infants for HIV testing, and if needed, treatment. In the trial of 738 mothers, more than 90% of the 323 who received messages brought infants for testing, compared with 78% of those who didn't receive messages. The service comprises a ten-week intervention that provides educational information and reminders to keep scheduled appointments and bring infants for HIV testing and also further

treatment for those who need it. Mothers receive the messages free of charge and the project bears the cost of approximately US\$1.50 per mother to send messages. The intervention is still being evaluated as to whether they return for test results. Exit interviews indicated that participants received a strong psychological benefit from participation. A similar program among HIV-positive mothers is currently conducting an RCT to evaluate the mental health benefit from the use of mobile phones to complement standard treatment programs and the role of peer mentors who provide participants with mental health support in managing their conditions (Project Masihambisane in South Africa).

In low-resource settings, a financial hurdle often confronts proper and adequate health service delivery. This is now being addressed by transaction-based mobile financial services, which are particularly valuable for individuals who do not have bank accounts. Mobile technology solutions that allow users to save money for future payment for goods and services have proven particularly effective among expectant mothers as a sustainable financing mechanism. For example, participants can save for their antenatal, delivery, and postnatal services at participating health facilities. In Kenya, Changamka has distributed more than 10,000 smart cards to low-income pregnant women through health facilities. The service is being deployed more broadly through other health facilities nationwide. One example of success is the m-Money for Women with Fistula program, which has noted a sharp increase in caseload following the launch of a broad-based outreach and promotion campaign that offers women a free hotline, transportation, and treatment service. The program transfers money via M-PESA to those who cannot afford transport to a fistula unit. During the six months prior to the campaign, the average caseload of fistula patients at one facility called the Jamaa Mission Hospital (JMH) was 15 per month. In the month following the campaign, JMH saw an increase in the demand for services as it supported a patient caseload of 40 fistula patients.

## STRENGTHENING HUMAN RESOURCE CAPACITY

Delays in accessing the appropriate level of care are primarily due to shortages of qualified health professionals, most often in difficult-to-reach rural and remote areas. The labor shortage is compounded by (1) the lack of transportation, particularly important in emergency situations involving complications during a pregnancy, and (2) the lack of systems that could support the ability of community health workers to monitor and track at-risk patients and to refer those in need to specialized care in a timely manner.

As found in **Table 2**, mHealth programs strengthen human resource capacity in three main ways:

(1) point-of-care decision support solutions that

facilitate the ability of frontline health workers to transmit data and receive expert feedback on urgent care cases; (2) direct communication with different levels of the health system, such as in the case of emergency transportation of pregnant women with complications; and (3) tools offering improved efficiencies in remote diagnosis, treatment, and case management of patients across the maternal and newborn continuum of care. These efforts often direct information and data from the community level to health facilities and from the district level to the Ministry of Health. Such existing programs have demonstrated their feasibility; however, success in scaling up to the national level requires the strategic alignment of the intervention with the prioritization of MNH on national health agendas, in addition to strong public-private partnerships.

**Table 2.** mHealth interventions and strategies to strengthen human resource capacity for health<sup>e</sup>

MHEALTH INTERVENTION	PROGRAMS Main Affiliated Organizations	STRATEGY
Services that support patient tracking and management at the community level	<b>ASHA (Accredited Social Health Activist) Project</b> CommCare	India – Services that provide registration forms, checklists, care protocols, and educational materials to support community health workers in tracking pregnancies during home visits, supporting maternal, neonatal and early child health, and providing referrals for at-risk individuals.
	<b>Mobile Technology for Community Health (MoTECH)</b> Grameen Foundation, Columbia University's Mailman School of Public Health, Ghana Health Service	Ghana – Services that integrate community-based electronic records of care with the delivery of SMS or pre-recorded voice educational messages to pregnant women and their families to remind women and newborns that they are due for or are non-adherent with scheduled care.
	<b>ChildCount+</b> Millennium Villages Project	Ghana, Kenya, Rwanda, Tanzania, Uganda – Services that allow community health extension workers to use text-based messages to register new births, monitor community health events in pregnant women, receive feedback on recommended treatment, and track and manage their care.

e. For a more comprehensive list of mHealth interventions and strategies, visit the database on the Health Unbound website <http://www.healthunbound.org/>

MHEALTH INTERVENTION	PROGRAMS Main Affiliated Organizations	STRATEGY
Services that support risk screening, referral, and remote consultation	<b>Sajida Bandhu</b> Sajida Foundation, ACCESS Health International	Bangladesh – Services that support the ability of clinicians in central facilities to monitor data that has been collected and transmitted by phone during home visits and to provide medical advice in real-time.
	<b>Mi Bebé</b> Instituto Carlos Slim, Qualcomm	Mexico – Mobile health monitoring services that allow health professional and community health workers to continuously and remotely monitor women with high-risk pregnancies to provide early warning of abnormalities and to connect women to specialized clinics in a timely manner.
	<b>Using Cell Phones for Obstetric Emergencies</b> Ifakara Health Institute, Maternal Health Task Force	Tanzania – District-level referral services for emergency obstetric care for pregnant women that connect health workers in peripheral facilities with senior medical staff at district headquarters for immediate consultation and emergency clinical support.
Services that provide electronic versions of care protocols for community health workers and facility-based staff	<b>e-IMCI (Integrated Management of Childhood Illness)</b> D-Tree International, Dimagi	Tanzania – Services that provide electronic protocols on mobile devices to guide health workers step-by-step through the assessment, classification and treatment of a condition to improve their adherence to standard care protocols as well as to ensure favorable patient outcomes.
	<b>Mobiles for Quality Improvement</b> Marie Stopes International, USAID	Uganda – Education and training services that use text messages to deliver daily instructions, tips, and quizzes to health workers that reinforce clinical content learned during training and adherence to standards and guidelines.
	<b>Clinical Patient Administration Kit (CliniPAK)</b> Vecna Cares Charitable Trust, Click Health	Kenya – Services that employ portable devices with embedded workflow processes that guide skilled professionals or less skilled health workers through primary care and specialized clinical protocols and that support improved data capture, longitudinal patient care and reporting, and patient outreach.
Services that strengthen or improve human resource management processes	<b>Capacity Project</b> IntraHealth International, USAID	Kenya – Services that support effective communication with health workers deployed to remote areas to improve monitoring and supervision, and produce time and cost efficiencies in reporting administrative data and in responding to personnel concerns.



In particular for frontline health workers, mHealth can not only improve MNH care delivery but also increase work motivation, autonomy, and supervision in a number of ways. To improve delivery, mobile phones offer options to better collect routine patient data during home and clinic visits; screen for risk factors during pregnancy; transmit any data for remote review and interpretation by clinicians, which allows remote monitoring of high-risk pregnancies; and deliver protocol-driven care and treatment. Mobile-mediated solutions can facilitate postnatal home visits in the period immediately following discharge from a facility, as well as provide critical linkages and referrals to further remote monitoring or consultation.

With regard to increasing work motivation, autonomy, and supervision of health workers, mHealth solutions facilitate workloads and automate challenging aspects of the duties placed

on health workers. In rural areas where paper-based data collection and submission to district-level reporting systems requires hand delivery, traditional techniques are being streamlined by electronic opportunities of transmission, effectively resulting in both money and time savings. Furthermore, data collected on mobile phones can be directed for immediate feedback by experts to frontline health workers on follow-up actions, such as diagnosis, referrals, or treatment. Additionally, administrators have the ability to track health indicators at the community level, monitor health worker performance, provide learning resources to community- or facility-based health workers to reinforce previous training or prioritize community-level actions and resource allocation. Additionally, well-equipped health facilities and on-time payment of salaries or per diems are as important to the workforce morale as are financial incentives that reward performance.



## TRANSFORMING HEALTH SYSTEM CAPACITY

The third category of mHealth efforts is aimed at making improvements in inadequate levels of resources and poor infrastructure that limit health system capacity and performance for delivering MNH services. Aforementioned examples in the previous section regarding how mHealth strengthens human resource capacity are applicable here as well. For example, services that equip community-based health worker cadres with mobile tools can extend the physical space of health facilities, which can then augment

coverage of effective services at the household and community levels, places where delays can be reduced. Additionally, services that turn existing systems for monitoring and evaluation reporting from paper-based into electronic or mobile-based cannot only speed up monitoring, surveillance, and detection from weeks or months to real-time, but can also enhance accountability for health system strengthening. Since these have been described earlier, this section will detail existing mHealth efforts that can improve the governance and introduce supply chain and clinical process efficiencies, as shown in [Table 3](#).



**Table 3.** mHealth programs and strategies that strengthen health system capacity.<sup>f</sup>

MHEALTH INTERVENTION	PROGRAMS AND STRATEGIES
Supply Chain Management	<ul style="list-style-type: none"> <li>• <b>SMS for Life</b> (Ministry of Health and Social Welfare National Malaria Control Programme, Novartis, Medicine for Malaria Venture, Swiss Agency for Development, Vodacom, PSI Tanzania, Vodafone, IBM, Roll Back Malaria Partnership Secretariat; <i>Tanzania</i>) employs mobile phone, short message service, and electronic mapping technologies to accurately track and support review of reported weekly stock levels of artemisinin combination therapy and quinine injectables. This information helps eliminate stock-outs and improves access to essential medicines by allowing district-level medical officers to allocate malaria treatments to where they are most needed, as well as coordinate emergency deliveries to health facilities if necessary. Results of a pilot in three districts of rural Tanzania, involving 128 health facilities and covering a population of 1.2 million, reported a decline in the stock-out rate from 26 percent of health facilities to 0.8 percent over a 21-week period. Following a request from the Tanzanian Ministry of Health, SMS for Life has been extended to all 5,099 health facilities in Tanzania. The program is a partnership with Novartis, Vodafone Solutions and the Roll Back Malaria initiative.</li> <li>• <b>mTrac</b> (Uganda Ministry of Health, UNICEF, FIND; <i>Uganda</i>) employs text-based messaging to track disease outbreaks and medication supplies. Community health workers at district health centers submit weekly data reports that are sent to district-level and national stakeholders who follow up on the outcomes; this creates a clear line of performance accountability. The initial pilot reported a response rate of approximately 90 percent from the 170 health facilities in two districts of Uganda. The program was transferred from the initial pilot partners FIND (Foundation for Innovative New Diagnostics) and the Millennium Villages Project to the Ugandan government in 2011, which is now in the process of rolling out the program nationwide through 5,000 health facilities and 8,000 community-based drug dispensaries. A key factor contributing to its success was the incorporation of sustainability and scalability factors into the initial design and development.</li> </ul>
Clinical Diagnostic Results Reporting	<ul style="list-style-type: none"> <li>• <b>SMS Printers to Accelerate Return of Test Results for early infant diagnosis of HIV/AIDS, SMART</b>, (Clinton Health Access Initiative, Federal Ministry of Health of Nigeria; <i>Nigeria</i>) employs SMS-driven printers that connect referral laboratories to community clinics via Global Service for Mobile Communications (GSM) mobile networks and a simple database application to reduce the turnaround time in laboratories returning results of critical blood tests for HIV-exposed infants to clinics. The only consumable required is the thermal print paper. A pilot in Nigeria that reduced the turnaround time from 33 to 14 days led to plans for the national scale-up of the project. The government is committing financial resources to the expansion of the service. Future plans for expansion include automating and analyzing results and adding tests for other conditions to the system. The estimated cost for the printers is between \$300 and \$500 depending on suppliers.</li> </ul>

f. For a more comprehensive list of mHealth programs and strategies, visit the database on the Health Unbound website <http://www.healthunbound.org/>

**MHEALTH  
INTERVENTION****PROGRAMS AND STRATEGIES****e-Governance**

- **e-MAMTA** (Health and Family Welfare Department, Government of Gujarat; National Rural Health System; *India*) consists of an online registration system combined with a call center to track pregnant women, infants, and children attending government-run health centers in the state of Gujarat to improve the reliability and accuracy of state-reported data related to maternal and child health services and outcomes. The program ensures receipt of proper medical services and vaccinations, and supports the identification of every pregnant mother who visits a government health facility, and monitoring from conception through 42 days after delivery. The call center officials frequently call the pregnant mother to ensure that she is receiving proper medical attention. Children are monitored for a period of five years to ensure receipt of immunizations. The Indian government has adopted the system for replication in other states.
- **mUbuguzima** (Rwanda Ministry of Health, Phones for Health, USAID; *Rwanda*) is a system using interactive voice response through cell phones to enable community health workers to provide in real time monthly data related to community health indicators, such as the number of women who delivered at home or in a health facility in a given month, case management of sick children, and nutritional and vaccination status. These data are immediately processed, and health actors at all levels of the health system can access data updates and plan appropriate interventions aimed at reducing maternal and child mortality and reaching other health policy goals. The data are also used to supervise community health workers and to provide small incentive payments based on their performance. The Ministry of Health was able to negotiate deep discounts, which reduced the costs of airtime by 82 percent, for SMS and voice messaging with the mobile phone operators. In the future, it is envisioned that the system will provide decision support directly to community health workers to enhance the delivery of maternal and child health services. mUbuguzima has been developed in collaboration with the Ministry of Health and supported by the Phones for Health, a public-private partnership.

**Professional  
Knowledge  
Networks**

- **MDNetwork** (Vodafone, MTN; *Ghana and Liberia*) is a free mobile phone network for professional doctor-to-doctor communications as a result of a partnership between MDNet, now Switchboard, and the local telecom operator, Vodafone. The service addresses a need to share best practices and provide physicians in rural areas with expert knowledge through peer-to-peer knowledge transfer. The launch of the service in Ghana in 2008 created the first countrywide mobile doctor network in Africa. The program has allowed the Ghana Medical Association to easily send bulk text messages to all physicians in Ghana, improving countrywide emergency response capabilities and communication. Since its inception, more than 1,900 physicians in Ghana have registered for the MDNet program and have logged more than three million calls. In Ghana, MDNet has generated nearly \$1,300,000 in revenue for the local telecom operator Vodafone since 2008. The service was also launched in Liberia in August 2008 and has networked 100 percent of physicians working in Liberia, and is being introduced in Tanzania.





LITERACY AND INEQUITIES  
IN WOMEN'S ACCESS TO  
MOBILE PHONES REMAIN  
**KEY ISSUES IN THE DESIGN  
AND IMPLEMENTATION OF**  
mHEALTH SERVICES

## OPPORTUNITIES FOR MHEALTH IN MATERNAL AND NEWBORN HEALTH

The opportunities offered through mobile technologies in addressing unmet needs and in removing traditional geographic and economic barriers to care are great. Existing mHealth interventions focus primarily on acute, life-threatening situations;<sup>12</sup> however, mHealth can yield a larger impact on MNH outcomes in LMICs if further leveraged at multiple points along the continuum of care, such as when addressing family planning or the period between labor and the immediate 49 hours after giving birth.<sup>d</sup>

With this focus on the continuum of care, mHealth opportunities for MNH include approaches that address family planning and increase contraceptive prevalence, incentivize women to attend centers providing skilled care during and after childbirth. Other mHealth interventions with potential include remote monitoring of high-risk pregnant women with wireless fetal monitors and empowering frontline health workers with case management and clinical decision support tools to provide integrated, evidence-based care management. In LMICs, mobile technology can help meet MDG targets by supporting the delivery of complementary patient-support information-based services. These could include information services that support the prevention of mother-to-child transmission of HIV/AIDS services, along with other services related to communicable diseases, such as tuberculosis and malaria, known to contribute to maternal and newborn mortality.

Even though mHealth projects identified in this brief are currently in the design and test phase or early stages of implementation and have not been in operation long enough to be evaluated for impact on health outcomes, there are many lessons learned that should be considered when integrating a mobile-mediated project. The

lessons that have emerged across mHealth interventions in MNH and that highlight what has been learned by the global community are described below.

- **Technology design should address user needs.** For example, when compared to text messages, voice-based solutions are often more effective in optimizing the reach and impact of mHealth services particularly in an environment where illiteracy levels are high. Additionally, it is important to contextualize content of the information being transmitted, while taking into consideration local cultures when designing interventions.
- **Solutions should leverage available resources to maximize impact.** Mobile technology solutions should be consistent with local technology and health policy environments to have optimal impact on augmenting established care practices. This improves the likelihood that mHealth solutions will better contribute to health priorities and complement existing practices while minimizing the potential for disruption. In the future, it is probable that advances achieved through mHealth interventions will drive developments in public policy and health practices.
- **Technology is one element of the whole solution.** In addition to the technology itself, social factors, market-based incentives, and regulatory frameworks must be considered. Incorporating these will ultimately influence successful user interaction with technology, the benefits to be derived, the rate of adoption and diffusion, and the degree of impact on health outcomes. Failure to achieve adequate attention in the planning phase may lead to mobile solutions falling short of their potential.
- **Open solutions minimize the technical and economic risks in design.** Open-source software solutions, standardized user and system requirements, and the sharing of resources based on experiences with technology can facilitate

greater interoperability among information systems. They can also support the development of cost-effective and low-risk approaches to design and development, and increase the prospect for local ownership, adaptation, and management in the implementation of mHealth solutions.

- **Strong partnerships across sectors breed success for sustaining development efforts.**

Partnerships that engage a broad range of stakeholders across the health system and other sectors are more likely to ensure successful outcomes and the incorporation of a rigorous evaluation framework. For a more conducive policy environment and to assure that projects are consistent with health system priorities and resources, involving the government is particularly important. Success also depends on the development of in-country program capacity in technology development, project management, and monitoring and evaluation.

## ADVANCING MOBILE HEALTH IN MATERNAL AND NEWBORN HEALTH


Advancing mHealth in the MNH context requires addressing challenges related not only to tailoring the technology to human, social, and cultural factors, but also to market mechanisms and regulatory and legal policy frameworks that can ultimately determine the successful user interaction with the technology, the benefits perceived, the rate of market adoption and diffusion across the population, as well as the degree of impact on health outcomes that can be realized.

Currently, the mHealth global landscape contains a large number of pilot projects that report largely favorable and positive outcomes on usability but fail to offer comprehensive project assessment reports that provide definitive evidence of the impact on health outcomes. Furthermore, there is a lack of evidence regarding the kinds of interventions

and approaches that can work at scale and how to translate success into reproducible but context-specific strategies. Because of this, key recommendations for building a sustainable and scalable mHealth program are comprised of a combination of policies, strategies, and guidelines that align health system needs and priorities with technology's capabilities and user preferences. In particular, the recognition of mobile technology's potential to improve MNH, along with solid evidence of mHealth's broader impacts on health, is critical for advancing policy and investment in the field. Increased investment and supportive policy are not likely until the evidence base is strengthened and strategies for successfully sustaining interventions at scale are outlined.

The programs of recent recipients of catalytic funding grants from the mHealth Alliance highlight the various approaches to scale up. For example, the SMART program has proposed the design and deployment of a centralized computing infrastructure that will help expedite sharing and follow up of laboratory test results, in addition to real-time tracking of program data. Dimagi is currently planning to accelerate, scale up, and amplify the impact of its CommCare-ASHA case management mobile-mediated solution that enrolls, supports, and tracks the clients and activities of community health workers. The Grameen Foundation has indicated that it will introduce a fee-for-service model for its MoTeCH project in urban areas, which will subsidize services for the poor living in rural areas.



A photograph showing a woman in a white shirt holding a newborn baby wrapped in a white cloth. The baby has a red string tied around its wrist. In the background, a healthcare worker is seated at a green table with several blue UNICEF folders and papers. The worker's hands are visible, one holding a pen. The scene is set in a clinical or community health center environment.

COMBINING MOBILE  
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TO PROVIDE **WOMEN AND  
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AND APPROPRIATE CARE**



## TECHNOLOGY, DESIGN, AND IMPLEMENTATION

The first category of advancing mHealth in MNH emphasizes the technology, design, and implementation of programs. In many LMICs, the majority of mHealth applications rely on basic wireless, cellular telephony as a technically efficient and culturally responsive means to support the supply and demand sides of health services. However, the penetration of mobile broadband still remains low and outside the economic and technological reach of many.

Basic text and voice functionality and real-time communication capacity of mobile devices offer the broadest range of potential benefits in many countries. Literacy and inequities in women's access to mobile phones remain key issues in the design and implementation of mHealth services, and for the former, voice-based messages or interactive response are the better alternatives to communicate information to end users who may be illiterate. Innovation also needs to be seen as an iterative, non-linear process and the more successful interventions are likely to be those that can remain flexible and adaptable to the quickly-evolving nature of technology. Finally, mHealth interventions need to be designed as an extension and augmentation of existing information and communication technology capabilities to produce the greatest systemic benefits.

When designing mHealth for MNH, it is important to avoid interventions that have too narrow a focus and are not designed in the context of a larger health system and as part of an eHealth information system. A consequence of the detached, standalone nature of mHealth interventions is that many have been evaluated only as single deployments rather than as parts of integrated, comprehensive systems of broader eHealth deployment. The fragmented nature of mHealth interventions is seen as a major rate-limiting step in the advancement and scaling of the field since

each “siloe” application lacks the standardization and integration to support interoperability and information sharing along the continuum of care. mHealth should also be designed and implemented in a way that it can begin to move beyond the vertical orientation and single-solution focus adopted by many interventions to date. Focus should shift toward integration solutions within broader health system and technological contexts. Intervention examples would include the prevention of malaria to reduce mortality in pregnant women in developing countries, as well as health promotion and disease prevention in the management of chronic conditions that play a role in maternal health outcomes in higher income countries. In programs that integrate mHealth solutions with other mobile initiatives in other sectors, such as banking and agriculture, the value of services can be enhanced if services were bundled for the end users. This could aid in scaling up services or programs.

The current evidence reflects user preferences and less on work efficiency, cost-effectiveness, systems-level impact, and clinical outcomes. In order to develop this evidence base, RCTs on mHealth programs are necessary, as well as the development of more agile research study designs and methodologies. These need to be tailored toward the rapidly evolving technology and overcome the delays inherent in the gold standard RCT. The development of methods to analyze streaming, tagged, complex, and layered data generated from mHealth interventions will be necessary. Donors should also transfer the responsibility for evaluation from program managers to independent evaluation specialists.

## SCALING AND SUSTAINING

With regard to the particular barriers to scale and sustainability and gaps in knowledge encountered by mHealth programs, there is accruing evidence, but there is also emerging evidence on characteristics that have helped some mHealth programs become successful. Capitalizing on what others have learned from implementation to date and building from this rapidly developing field will be crucial in realizing the full potential of mHealth.

Factors that have been critical in extending a project's lifetime past the duration of a pilot project include planning for long-term sustainability through business models during the design phase, strong strategic partnerships, a clear understanding of each stakeholder's role and incentive for participation, and the ability to conduct rigorous evaluation to provide evidence of demonstrable impact on health outcomes. Monitoring and evaluation requires the development of more agile research study designs and methodologies that recognize the rapidly evolving technology.

Although most programs are provided at minimal or no cost to the user, bringing a program to national scale on a sustained basis in low-resource settings will require innovative financing models, and governments will have a critical role to play as key stakeholders. The financing models will need to remove barriers to use, particularly affordability of mobile phones for women and the cost of services. The programs will also need to engage private partners to ensure basic operational costs are covered. Approaches to engagement that are under consideration include bundling mHealth with other "mServices," placement of product marketing in messages, direct sponsorship, and tiered user pricing, such as the Mobiles for Health initiative in Bangladesh. Meanwhile, governmental support can strengthen the potential of mHealth through public health policy and development of standards and architectures that guide the creation of eHealth frameworks for mHealth systems to interact with

health systems seamlessly. This will align health information systems and other technology-based initiatives to maximize effectiveness. The scale-up of mHealth within national health agendas should also be broadly supported across all relevant government ministries and agencies, as well as by all departments within the Ministry of Health.<sup>13</sup>

## PUBLIC POLICY

Government leadership and national eHealth policies can offer a solid foundation for mHealth deployment, particularly in creating and supporting eHealth architectures and standards for data interoperability, as well as standardizing measures that are used in evaluation techniques for assessing mHealth impact. National governments can also be influential by building in-country technology planning and management capacities to support the introduction of technology into health services at scale, and through promoting initiatives that remove barriers to women's use of mobile technology, particularly their ability to afford phones and pay for services.

As key stakeholders, governments play a critical role in the integration and advancement of mHealth in MNH. With public-private partnerships, government involvement can provide critical support to programs, ensure the strategic alignment of mHealth solutions with health system priorities, and balance risk and benefits for all stakeholders. The policy infrastructure to support investment and create a market environment conducive to the broad-scale adoption of mHealth into MNH services remains presently underdeveloped.<sup>14</sup> One component of mHealth which can be catalyzed by governments is encouraging rigorous evaluation of mobile interventions.

The scale and scope of mHealth activity is unevenly distributed and represented across LMICs, making meaningful comparison difficult. The fact that countries as diverse as Rwanda and Bangladesh lead in mHealth activity while Liberia and Brazil lag behind cannot be explained on the basis of


health, development, and technology indicators alone. Differences can emerge for any number of reasons, but government leadership and national eHealth policies play key roles in explaining differences among countries. Governments need to become more involved in building in-country technology planning and management capacity. As access to health data on a systems level improves policymakers' ability to use it for program management, planning and evaluation to drive improvements in women and child health, governments may become more aware of the strategic importance of mHealth in national health systems planning. A multi-sectoral response to the design of systems-level solutions is likely to produce sustainable health benefits, particularly in light of the impact of low socio-economic status on access to health care.

Projects of the World Health Organization's Global Observatory for eHealth reflect a groundswell of activity in mHealth, the dominant form being small-scale pilot projects that address single issues in information sharing and access.<sup>15</sup> Limited, larger mHealth implementations tend to be supported by broad public-private partnerships. While it is anticipated that large-scale and complex mHealth programs will become more common as the field matures, strategies and policies that integrate eHealth and mHealth interoperability into health services are being advocated. Standards and interoperable technologies, ideally using open architectures, are critical. An international framework for evaluation, including meaningful and measurable indicators, would help data collection. The use of standardized information and communication

technologies would enhance efficiency and reduce cost. For now, mHealth only provides limited evidence balanced by optimism about the potential for broader impact. Evaluation will need to be incorporated into the project management life cycle to better ensure quality and address the need for evidence of efficiencies and effectiveness. Until that evidence base gets stronger it is not likely that policy or investment in the field will change dramatically.

The shortage of funding to reduce maternal and neonatal mortality is a significant challenge. The World Health Organization estimates that it will take an additional \$10 billion annually to ensure universal coverage of maternal, neonatal, and child health interventions to achieve MDGs 4 and 5,<sup>16</sup> and that the lack of leadership and political will to implement proven interventions at the country level is seen as a major impediment to success. Despite donors' interest in mobile technology's potential, they remain cautious about increasing funding for mHealth projects, and their skepticism and fatigue will persist until more rigorous evaluation, evidence of impact, and demonstration of scalable and sustainable models emerge. As a result, many developing countries will maintain a significant gap between minimum requirements and resources available unless alternative financing mechanisms are identified. Recommendations include using proceeds from the sale of portions of the mobile spectrum or taxes generated through mobile services. Similar initiatives that have already been proven in other areas of global health, such as the International Solidarity Levy on airline tickets for HIV/AIDS, have raised billions of dollars to date.<sup>17</sup>



A close-up photograph of a woman with dark skin, wearing a bright yellow lace-trimmed dress, looking down at a newborn baby. The baby is lying in a black plastic basket, wearing a yellow headband with a red dot and a yellow long-sleeved shirt. The baby is wrapped in a blue and white striped cloth with a colorful patterned border. The background is slightly blurred, showing other people and fabrics.

**TECHNOLOGIES** TO MAKE THIS  
HAPPEN EXIST TODAY, MAKING  
THE VISION OF ADVANCING  
PROGRESS IN MATERNAL  
AND NEONATAL HEALTH  
INDICATORS IN THE NEAR  
FUTURE HIGHLY ACHIEVABLE.



## CONCLUSION

In MNH, combining mobile technologies with existing health system resources offers significant potential to provide women and newborns with adequate and appropriate care through interventions that **(1)** stimulate demand for available services, **(2)** strengthen human resource capacity, and **(3)** transform health system capacity. These can then lead to greater efficiencies in care delivery and management practices as described throughout this report. In summary, interventions that are able to stimulate demand for available services include using mobile phone features to increase awareness of health issues and to offer patient-support services, as well as incentives that can remove financial-related barriers for either out-of-pocket expenses or transportation costs, which if reduced can increase both service access and utilization, respectively. For strengthening the capacity of human resources, there are new opportunities being offered from growing mobile telephony, such as patient tracking and management, as well as point-of-care decision support applications that make it easier for community-based health workers to follow existing guidelines. Lastly, from the examples provided, we have seen the ability of mobile phones to transform health system capacity in ways that can lead to more efficient delivery of care and management practices, particularly efforts that focus on tracking and mapping of diseases and drug stock levels through mobile networks, as well as mobile-phone-based monitoring and evaluation systems or education and training services for health workers. Also, because maternal and neonatal death events are hard to estimate and monitoring quality varies tremendously, mobile phones can fill the gaps in incomplete and unknown data, which can in turn be used to inform the selection of appropriate interventions to reduce maternal and newborn mortality in different contexts.

From such examples provided in this report, we have shown preliminary results that are promising for the field of MNH; however, if mHealth efforts continue to be integrated, they must be appropriately tailored to the country contexts and their epidemiological profiles, health system capabilities, and opportunities for strengthening existing technical, social, and economic barriers to MNH interventions. Additionally, as more and more evidence accrues, which it will quickly, it will become ever more important to learn rapidly from existing projects and put forth higher quality evidence so that the full potential of mobile technologies can be reached in the field of MNH. For now, existing mHealth efforts are supported by the recognition of the larger potential that mobile

technology offers, while solid evidence of the broader impact of mHealth on improving maternal and neonatal health outcomes is eagerly awaited to serve as a catalyst in advancing policy and investment in the field. The ability to conduct rigorous evaluation and provide evidence of demonstrable impact is the crucial catalyst that will advance policy and investment in the field and lead to the successful scaling and sustaining of mHealth interventions.

As addressed in this report, the lack of supportive national policy for information and communications technologies in health care can at times impede the alignment of health system needs and priorities with technology capabilities. This underscores the urgency for policymakers to advance policy frameworks appropriately and promote an environment that uses mobile technology for optimal impact on MNH outcomes. Governments can play a critical role through the formulation of public health policy and by developing standards and architectures that guide the development of eHealth frameworks for mHealth systems to interact with health systems seamlessly. By doing so, the technical elements of mHealth projects will be in alignment with eGovernment, health information systems, and other initiatives that seek to leverage information technology to improve the public's well being and health.

Mobile devices and networks hold strong potential to accelerate progress toward maternal and neonatal health outcomes worldwide, accelerating progress toward MDGs 4 and 5. Although strategic efforts and investments are necessary to deploy mHealth solutions properly to facilitate lessons learned from pilots to national scale, there are measurable gains that stand to be made in the coverage and quality of interventions already proven to be effective. The catalytic impact of these investments will likely translate into clear survival benefits for mothers and newborns at risk of dying from preventable and curable diseases each year. In addition to reducing the delays that prevent timely access and utilization of needed services for mothers and newborns, strategic integration of mHealth at the most appropriate delivery points along the maternal-newborn continuum of care will strengthen health systems and the capacity of frontline health workers who deliver life-saving interventions in the most remote, hard-to-reach populations globally. The knowledge, systems, and technologies to make this happen exist today, making the vision of advancing progress in maternal and neonatal health indicators in the near future highly achievable.

## REFERENCES

1. UNICEF. State of the World's Children 2009: Maternal and newborn health. New York, NY: UNICEF; 2009.
2. UNICEF. Levels & Trends in Child Mortality. Report 2011: Estimates developed by the UN Inter-agency Group for Child Mortality Estimation: United Nations Children's Fund; 2011.
3. Lawn JE, Cousens S, Zupan J, for the Lancet Neonatal Survival Steering Team. 4 million neonatal deaths: When? Where? Why? The Lancet. 2005; **365**: 891-900.
4. Global Campaign for the Health Millennium Development Goals. Innovating for every woman, every child. Oslo, Norway: Ministry of Foreign Affairs; 2011.
5. International Communications Union (ITU). The world in 2011: ICT facts and figures; 2011.
6. United Nations. The Millennium Development Goals Report 2011. New York: United Nations; 2011.
7. World Health Organization, UNICEF. Countdown to 2015 decade report (2000-2010): Taking stock of maternal, newborn and child survival. Geneva, Switzerland: World Health Organization; 2010.
8. Bhutta ZA, Chopra M, Axelson H, Berman P, Boerma T, Bryce J, et al. Countdown to 2015 decade report (2000–10): taking stock of maternal, newborn, and child survival. The Lancet. 2010; **375**: 2032-44.
9. Thaddeus S, Maine D. Too far to walk: Maternal mortality in context. Social Science & Medicine. 1994; **38**(8): 1091-110.
10. Mehl G, World Health Organization. Using mobile technologies to improve family planning, maternal health and newborn services in the developing world. SHOPS and mHealth Alliance Hold Online Conference. Online; 2010.
11. Cole-Lewis H, Kershaw T. Text messaging as a tool for behavior change in disease prevention and management. Epidemiol Rev. 2010; **32**: 56-69.
12. Noordam AC, Kuepper BM, Stekelenburg J, Milen A. Improvement of maternal health services through the use of mobile phones. Tropical Medicine and International Health. 2011; **16**(5): 622-6.
13. Lemaire J. Scaling up mobile health: Elements necessary for the successful scale up of mHealth in developing countries: Advanced Development for Africa; 2011.
14. Tamrat T, Kachnowski S. Special delivery: An analysis of mHealth in maternal and newborn health programs and their outcomes around the world. Matern Child Health J. 2011.
15. World Health Organization. mHealth: New horizons for health through mobile technologies. Geneva, Switzerland: World Health Organization,; 2011.
16. Bill and Melinda Gates Foundation. Maternal, Newborn, and Child Health Fact Sheet. 2012 [cited July 20, 2012]; Available from: <http://www.gatesfoundation.org/maternalnewbornandchildhealth/Pages/default.aspx>
17. Taskforce on Innovative International Financing for Health Systems. More money for health, and more health for the money: final report. Geneva, Switzerland: International Health Partnership; 2009.







*The mHealth Alliance champions the use of mobile technologies to improve health throughout the world. Working with diverse partners to integrate mHealth into multiple sectors, the Alliance serves as a convener for the mHealth community. The mHealth Alliance also hosts Health Unbound (HUB), a global online community for resource sharing and collaborative solution generation. For more information, visit [mHealthAlliance.org](http://mHealthAlliance.org).*