

## mHealth for Maternal, Neonatal and Child Health in India – A Boon or Bane?

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Digital technology is significantly impacting the way health is being managed worldwide. It is revolutionizing the management of health data, diagnostics, health care delivery, and research. Digital health is the “application of information and communications technologies and the data they generate to support informed decision-making and engagement by individuals, health providers, and health systems to increase demand, access, coverage, quality, and affordability of health and wellness for all”<sup>(1)</sup>. Digital health “incorporates the subdomains of eHealth, medical informatics, health informatics, telemedicine, telehealth and mHealth, as well as data analytics, big data, and artificial intelligence”<sup>(2)</sup>. The use of mobile phones in the health sector is commonly denoted as mHealth, and its use is now ubiquitous with the exponential rise of smartphone ownership in India. The current subscriber base in India is 1.2 billion; the second-largest globally and two-thirds of the population access internet using mobile phones<sup>(2)</sup>. The mobile phone is used not just as an interpersonal communication device but as a mHealth device. It is additionally used for vital registrations, data collection and reporting, electronic health records, decision support, client education, point of care diagnostics, provider to provider communication, provider training and education, provider work planning and scheduling, human resource management, supply chain management, and financial services.

### mHealth initiatives in India

A scoping study of mHealth initiatives implemented from 1997 to 2016 was conducted by the George

Institute for Global Health. They presented a landscape of mHealth initiatives published in peer-reviewed journals, available as smartphone Applications (Apps), and implemented as organizational initiatives. They reviewed 189 journal articles with mHealth initiatives, 557 Apps for features and functionalities, and 16 organizational activities on Google search. Of those published, 59% were used by community health workers, 28 % by the community or patient groups, and 13% of the user information was ambiguous. The technology was primarily used for health care delivery (73%). Nearly 50% of the papers described the use of this technology for non-communicable diseases (NCDs), 14% for communicable diseases, and only 7% for reproductive, maternal, neonatal, and child health (RMNCH). Most were feasibility studies and targeted around the building of health care delivery systems to strengthen human resources. Telemedicine application using mHealth had limited use. 1254 Apps were reviewed on Google and Apple play store, the majority of which were for NCDs. The majority (60%) of them were patient-centric (client awareness, metabolic risk tracking), 34% targeted for health professionals (clinical tools), and 6% were for both patients and providers. There were no Apps for RMNCH delivery<sup>(3,4)</sup>.

### Examples of mHealth initiatives in RMNCH in India

There have been several examples of effective mHealth interventions that have been implemented in Gujarat, Uttar Pradesh, Madhya Pradesh, Bihar, and Maharashtra by Non- Governmental Organizations

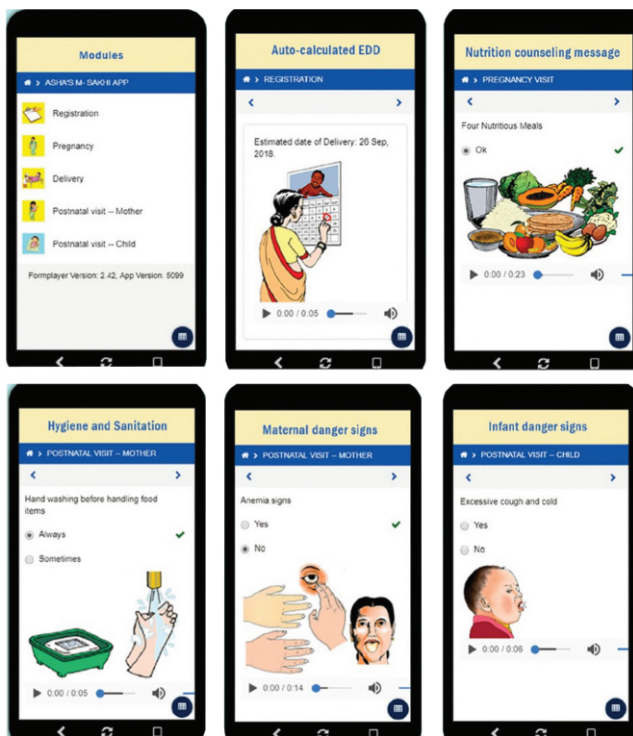
engaged in health research in collaboration with international foundations and the public health systems. They have enabled community health workers (CHWs) and their beneficiaries to reduce barriers to information and help improve health behaviors<sup>(5-9)</sup>. “Mobile Solutions Aiding Knowledge for Health Improvement”- M-SAKHI was one of the most comprehensive intervention that extended through the continuum of care from pregnancy to infancy and engaged not just the CHWs or ASHA (Accredited Social Health Activists) workers and their beneficiaries but also linked up primary care providers such as the Auxiliary Nurse Midwives(ANM) and ANM tele-counselors. The description of the intervention and the methodology to evaluate its effectiveness in reducing

the prevalence of stunting in children was recently published<sup>(5)</sup> and are provided below.

This intervention was developed by reviewing the literature to understand the gaps in the existing public system to improve maternal and child health indicators in rural Maharashtra. These gaps could be addressed using the mHealth intervention, M-SAKHI. A series of pilot studies were then conducted to assess the extent of mobile phone use in the community and the acceptance of mHealth interventions such as text and voice messages by women during the antenatal and postnatal period. We assessed the feasibility, ability, acceptance, and skills of ASHAs in using a CommCare based App on android smartphones by ASHA workers that displayed audio-visual messages to the beneficiaries for

**Table 1: Intervention and the methodology to evaluate its effectiveness in reducing the prevalence of stunting in children**

Component	Provider	Recipient	Medium of the intervention providers	Schedule and frequency
Data collection in real - time and face - to - face counseling	ASHA	Participant	Using CommCare ASHA app with embedded counseling messages and health videos	Monthly home visits starting from enrolment until 12 months of infant age
Delivery of pushed text messages	Server delivered and programmed	Participant	Automated and programmed through data entered in ASHA app	Thrice a week, starting from enrolment until 12 months of infant age
Delivery of pushed voice messages	Server delivered and programmed	Participant	Automated and programmed through data entered in ASHA app	Once a week, starting from enrolment until 12 months of infant age
Delivery of alert (text) messages	Server delivered and programmed	Participant, ASHA, and study ANM counselor	Automated and programmed through ASHA app	Conditional, based on any danger signs recorded in ASHA app, starting from enrolment until 12 months of infant age
Mobile phone to mobile phone counseling	Study ANM counselor	Participant and her family	Using CommCare ANM app with auto generated dates for scheduled calls and recording call details	Every fortnightly, starting from enrolment until 12 months of infant age
Field supervisory app	Field supervisor	ASHAs	Using CommCare field supervisor app for real - time monitoring of ASHAs	During monthly meeting of project managers, starting from enrolment of participant until 12 months of implementation



**Figure 1: Illustration of user interface of ASHA App**

promoting healthy behavior change and was a platform to collect real-time data in a standardized manner<sup>(10)</sup>. The M-SAKHI intervention was evaluated using a community-based cRCT by Lata Medical Research Foundation (LMRF), Nagpur, India, collaborating with the University of Sydney. It was implemented in 40 Primary Health Centers (20 intervention, 20 control) of Nagpur and Bhandara districts. It recruited 150 ASHA workers and 2500 beneficiaries in their ante-natal period who were followed up through delivery till their infants were 18 months old. The outcomes data was collected independently and is being analyzed.

The 'Reducing Maternal and Newborn Deaths (ReMiND)<sup>(7)</sup>' was also developed with Dimagi Inc. as the technology innovator. This mHealth intervention was used only by ASHAs to provide customized counseling messages to pregnant women using an economical Java-based mobile phone. The App had tailored content with locally relevant audio and visual prompts to support client assessment, counseling, early identification, treatment, and rapid referral of pregnancy, postpartum and newborn complications. Data entered about the services utilized by pregnant women were pooled on a common server and then used to provide timely reminders to ASHAs for the

subsequent due counseling, besides serving as a tool for monitoring ASHA activities by supervisors. This intervention was evaluated using a pre-and post-quasi-experimental design conducted in two community blocks of district Kaushambi, UP, with two matched blocks as control. The Annual Health Survey conducted by the Ministry of Health and Family Welfare in 2011 served as preintervention data, whereas a household survey in four blocks of Kaushambi district in 2015 provided post-intervention coverage of key services. Three of eight targeted services showed significant improvement<sup>(11)</sup>.

Using a qualitative study, the mHealth intervention, Common Application Software(CAS)<sup>(9)</sup>, was evaluated for its feasibility and acceptance among CHWs and Bihar and Madhya Pradesh beneficiaries. CAS was an open-source mobile platform comprising three components: i) job aid for Anganwadi workers (AWW) to track beneficiaries, maintain records of their daily activities, and provide prompts for scheduling visits and services. It also had behavior change communication (BCC) videos on family planning, birth preparedness, complementary feeding, and sanitation; ii) supervisory App for lady supervisor to monitor the AWW and iii) dashboard for real-time monitoring and tracking nutrition and growth indicators for pregnant and lactating mothers that enables data-driven decision making. The mHealth intervention was acceptable to the CHWs who felt that CAS improved their status in the communities where they worked. Beneficiaries' views were a mix of positive and negative perceptions<sup>(12)</sup>.

Innovative Mobile-phone Technology for Community Health Operations (ImTeCHO) was a job aid for the ASHAs and the Primary Health Center (PHC) staff to improve coverage of RMNCH in rural tribal communities of Bharuch and Narmada district, Gujarat. The ImTeCHO mobile-phone-and web-based application included scheduling home visits, screening for complications, counseling during home visits, and supportive supervision by PHC staff. It was evaluated in 11 intervention and 11 control PHCs using a cRCT. They found that coverage and quality of most of the RMNCH services were significantly higher among

PHCs that were served by ASHAs who used mHealth as a job aid compared to those who did not<sup>(6)</sup>.

The Alliance for Saving Mothers and Newborns (ASMAN) program is a mHealth intervention with a digital tablet platform and an intrapartum and immediate postpartum decision support tool for staff nurses. It is undergoing evaluation across 81 public health facilities in Rajasthan and Madhya Pradesh to investigate contextual factors influencing its implementation. The nurses will use this platform to enter real-time data on digitized maternity case sheets that also include a Safe Childbirth Checklist along with provision for vital digital recording, alerts, and notifications to inform staff about high-risk cases. It has a live dashboard to help health workers and managers to monitor all cases in real-time, identify and manage high-risk cases, refer cases to higher centers, and make urgent decisions if necessary<sup>(8)</sup>.

### **Advantages of mHealth and its future use**

The above examples of using mHealth for health care delivery unanimously showed that there is improvement in the efficiency of health care delivery indicators by utilizing the technology for vital registration, data collection and reporting, electronic health records (EHR), electronic decision support, provider-to-provider communication, provider work planning and scheduling, provider training and education, human resource management, supply chain management, and financial transactions and incentives<sup>(13)</sup>. Even in hard-to-reach populations, the SARS-CoV2 pandemic has used mHealth tools as health sensors, point-of-care diagnostics, and video call consultations. Real-time data collection can provide real-time and prompt data-driven health solutions, including linking up with ambulance services, hospitals, health insurance, and payments. Artificial Intelligence (AI) is now being used to provide digital health solutions for patient outreach, remote patient monitoring, patient engagement, and education using AI-enabled virtual assistant (AVA)<sup>(14)</sup>. Electronic health records created using mHealth solutions can be linked to one integrated digital health platform to understand the health demand for efficient supply chain

management by the government and other non-governmental or private health providers. Anonymized health data is then available for research to improve health care solutions and prevent or keep epidemics in check. On 27th September, on completion of three years of the Pradhan Mantri Jan Arogya Yojna (PM-JAY), which enable health services to those identified by the government to be marginalized and poor, the Prime Minister of India launched the Pradhan Mantri Digital Health Mission (PM-DHM). It is being implemented in a pilot phase in six Union Territories. It is based on the foundations PM Jan Dhan (cash transfer -direct, conditional, employment-based), Aadhaar and Mobile or mHealth (JAM) trinity, and other government digital initiatives. The PM - DHM will create a seamless online platform by providing a wide range of data, information, and infrastructure services, duly leveraging open, interoperable, standards-based digital systems while ensuring the security, confidentiality, and privacy of health-related personal information. It is envisioned that such mHealth enabled digital platforms will enable storage of patients' medical records, information on hospitals and providers, methods of payments, etc. It can be seamlessly accessible to provide prompt quality care<sup>(15)</sup>.

### **Drawbacks of mHealth**

Some studies have reported that implementing RMNCH mHealth in rural or adolescent communities can be a mixed bag of boons and bane. The socio-cultural barriers, the uncertainty of availability of women on home visits, gender and power dynamics of a household, the dependence of husband's phone or poor functionality of their own phone, limited digital literacy, time constraints, weak linkages with the providers, concerns regarding privacy and confidentiality cannot be solved with technology alone<sup>(12,16)</sup>.

Although most of the studies show improvement in health care delivery system indicators, they may not necessarily translate to a reduction in clinical outcomes such as morbidity and mortality due to many other constraints and socio-cultural barriers. Another offshoot of the use of mobile phones is its psychosocial



implications on mother-infant relationships, which can be compromised as mothers may prioritize their time on the phone and its social media over the infant. Conditions such as “emptying out,” i.e., other social interactions taking priority over that of the infant or “absent presence,” can impact the early language, cognitive, emotional competencies of the infant<sup>(17)</sup>. Similarly, mobile phones may not always improve provider mother interactions as they may be considered impersonal compared to face-to-face interactions, which may be preferred, particularly when there are technological challenges. The flip side is that mHealth may increase mothers' dependency on healthcare providers, reducing their self-efficacy and confidence in providing care to her newborn. Other macro-level significant challenges are the economic costs of digital platforms, mobile infrastructure, network connectivity, good quality phones for the providers, training costs, and technological literacy of provider and beneficiary. There are also concerns regarding environmental pollution, radio-frequency electromagnetic emissions from cell phone towers that may impact health in general.

### Conclusion

Mobile phone use and the mHealth revolution is gaining global momentum that has been further accelerated during the COVID pandemic. It is achieving popularity for health care delivery in RMNCH in low- and middle-income countries (e.g., India, Kenya, Peru, South Africa, Tanzania). It has been found to improve access to medical service, promote health behavior, adherence to required medical visits by the beneficiaries, enabled monitoring of activities of the provider and beneficiary. Therefore, it is presumed that this technology will enable meeting the Sustainable Development Goals for the mother and child.

However, mHealth interventions need rigorous evaluations and understanding of the socio-cultural context where implemented. These evaluations need to assess if health objectives are achieved cost-effectively and inform guidelines to further improve the quality of mHealth interventions. The benefits have to be weighed

against the harmful psychosocial, economic, cultural, environmental, and physical consequences of mHealth, as it can be a bag of mixed blessings.

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