



THE Jivita JOURNAL

Mobile Technology for Health in Rural Bangladesh

Connecting women to care and compressing response time to crises.

Globally, ~3.6 million newborns die every year, with a vast majority of these deaths occurring in low-resource settings such as rural South Asia where most births still occur at home and trained newborn care is rarely provided.¹ Reaching mother and baby at delivery enables preterm and low in birth weight babies to be identified and provided emergency care and referral. A timely visit at birth allows health workers opportunities to clean the umbilical cord²⁻³, deliver to the newborn a vitamin A supplement⁴⁻⁶, and advise mothers about proper newborn care, such as initiating breastfeeding within the first hour after birth, avoiding prelacteal feeds³, delaying bathing, and keeping the baby warm (thermal control), all of which can reduce risk of infant mortality. The need for such newborn care is urgent. In rural Bangladesh, for example, despite achieving major reductions in maternal and child mortality, neonatal mortality (in the 1st 28 days) remains at 45-65 deaths per 1000 live births. Innovative solutions are needed to save lives through routine preventive care, especially during pregnancy, at birth and in the neonatal period.

Recent studies have shown that community health workers, embedded in villages where they understand local context and culture, can, through timely communication and action, provide effective curative services and timely referral to reduce mortality.⁷ However, rural health workers, to date, rarely have rapid access to client information and are ill

equipped to utilize health information data that can improve delivery of services. Matching referred emergencies to clinical expertise in low resource settings is also a critical linkage that can be improved by faster, more timely communications. The new way to effectively link demand to care in ways never before possible will be through the use of mobile phone technology and systems.

Cellular networks continue to expand rapidly in resource-limited settings, accompanied by increased affordability of technologies and services. Bangladesh is a typical example of this rapid growth in wireless technology, achieving reported 100% coverage in 2011.⁸ Penetration, the actual individual ownership of phones, however, remains somewhat lower, at between 40 and 60%. Recent data from the International Telecommunications Union (ITU) suggests that Bangladesh, with a population of over 156 million, has 76.3 mobile phone subscriptions for each fixed line connection – in sharp contrast to the US 2:1 ratio. The estimate of phone



subscriptions per 100 residents in 2010 was approximately 46.17, according to the ITU.⁹

New strategies emerge:

Since 2001, JiVitA has enrolled and followed ~120,000 pregnant women, in large randomized controlled nutrition intervention trials to improve materno-fetal-infant health and survival. We have examined in great detail the causes of infant and maternal mortality, uncovering novel potential strategies to interrupt the trajectories to death. In this population we have also explored mobile phone ownership and use by pregnant women in the absence of a formal “mhealth” program.¹⁰ Measuring access to and use of mobile phones is critical to understand the potential of mobile health initiatives targeting antenatal and infant health.

We recently analyzed and reported use of mobile phones during 611 intrapartum obstetric crises, “near miss” events that were resolved successfully and did not result in death, that occurred between 2007 and 2010. During this period, household ownership of mobile phones in our study population increased from 20.4% to 42.5%, but was starkly different by socioeconomic status (Figure 1).¹¹ Never-the-less, mirrored growth in phone availability in these two strata was observed with near-parallel

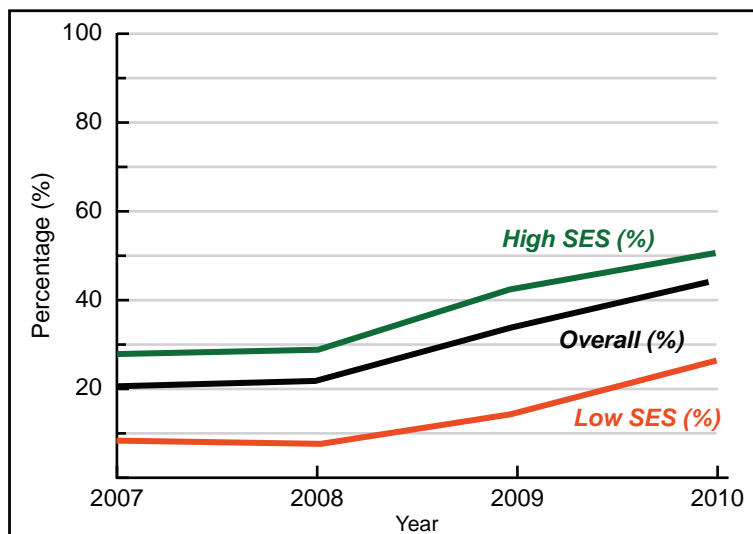


Figure 1. Increase in reported household-level phone ownership in rural Gaibandha 2007-2010, stratified by socioeconomic status.

slopes, suggesting that though a constant equity gap existed during the study period between the strata in this community we do continue to see increases at about the same rate in phone ownership at the household level.

Despite this gap in access to mobile phones at the household-level, during obstetric emergencies, 55.2% (n=337) of all respondents reporting a near-miss used a mobile phone. More than half of those that used a mobile phone (57.0%, n=193) reported using it to receive medical advice; 71.7% (n=241) used one to call a health care provider, 32.6% (n=110) to arrange for transportation, and 20.9% (n=70) to ask for financial support. These categories not exclusive, as shown in Figure 2.¹¹

Demonstrated successes:

From 2004-2007, we conducted a large randomized trial where we provided a dose of vitamin A to newborns, thus, reaching the neonate shortly after birth was critical to the intervention and was achieved at about 15 hours from birth, on average, in over 16,000

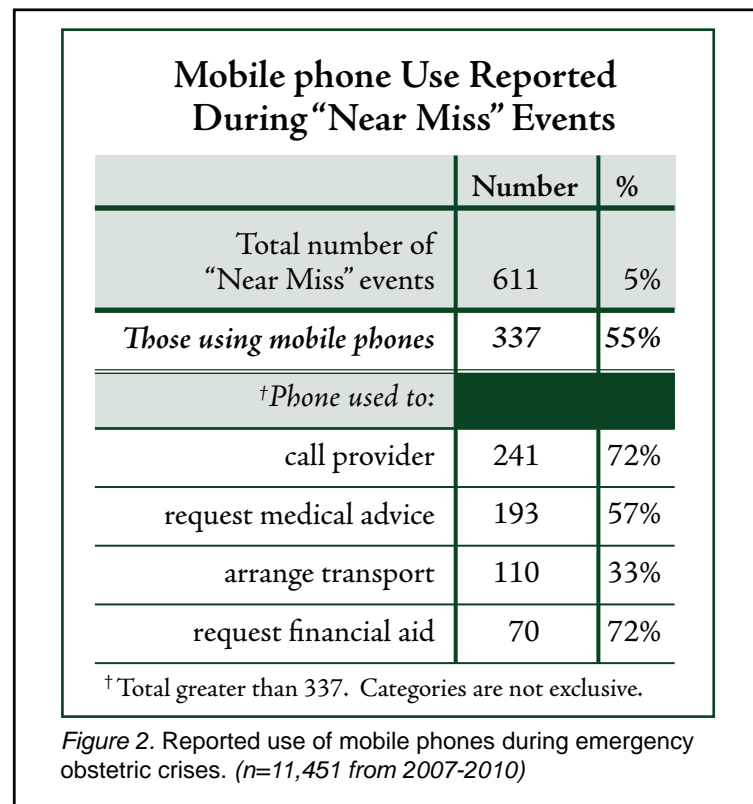


Figure 2. Reported use of mobile phones during emergency obstetric crises. (n=11,451 from 2007-2010)

births. The study spanned the period of time during which mobile phone coverage was introduced in the area. We explored whether household ownership of a mobile phone affected the rate of birth notification and found that in the 23% of households reporting mobile phone ownership, the median time was not statistically different from those without phones. This is partially explained by the fact that access to mobile technology is relatively cheap through local tea-stalls or shops providing fee-for-service mobile phone access.

In a nested study of ~500 pregnancies, we piloted a mobile-phone based labor notification system, to ensure the presence of nurses at birth to collect placentas and cord blood. In 89% of deliveries, a mobile phone was used and the team of nurses sent to attend birth, and in 68% of these cases, the team arrived prior to placental expulsion. Although this performance is less than ideal, it demonstrates that getting care to where obstetric crises might occur is possible, even in remote, rural settings at whatever time of day or night they occur.¹²

These findings have multiple implications for both maternal and neonatal support during a window of time that represents the highest risk for mortality and severe morbidity. The ability of a skilled birth attendant to provide added motivation to seek immediate care when an obstetric emergency occurs is potentially critical in saving lives at birth. Furthermore, the dispatched worker can assist the family in arranging appropriate referrals,

that is, to the level of care and facility capable of handling the specific crisis.

Access to mobile phones for pregnant women and their families, especially during the late and intrapartum period, presents a new opportunity to reduce life-threatening maternal complications.

The horizon of possible program and policy implications

In rural Bangladesh we have demonstrated that mobile birth notification and labor notification systems CAN work, reaching >80% of births at home within 8 hours, and >60% of deliveries, in a pilot study, with trained nurses at home. Based on these successes, we are developing and testing strategies (mCARE Project, Figure 3) to improve antenatal and essential newborn care as well as targeting high-risk, preterm neonates for immediate attention; this prophylactic approach has never been tried, and could represent a novel strategy in fighting neonatal mortality, targeting the window of greatest vulnerability in early life, building on past successes and facilitating interventions of proven efficacy.^{13, 14, 15}

Once tested and demonstrated efficacious, this kind of innovative approach could be rapidly scaled to target prophylactic and special care services to the highest risk mothers and neonates, including providing emergency services in response to crisis situations. If the approach is shown to be effective in reducing early neonatal sepsis, preterm case-fatality, and intrapartum neonatal death, Government partners have already expressed interest and commitment to explore scale-up in Bangladesh and India. The technologies and skills required (mobile phone networks, call centers and clinically skilled medical/paramedical staff) are available and ubiquitous, and human resource demands are limited to

a small number of skilled Emergency, Neonatal and Obstetric Care teams with focused, centrally-located pregnancy tracking and “mHealth” support.

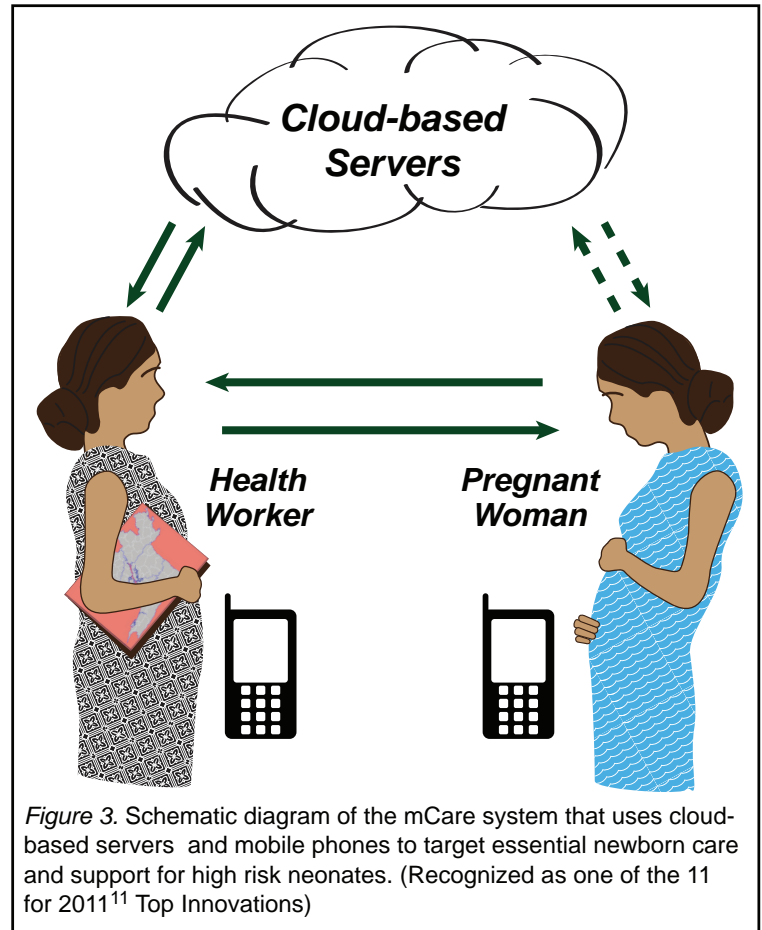


Figure 3. Schematic diagram of the mCare system that uses cloud-based servers and mobile phones to target essential newborn care and support for high risk neonates. (Recognized as one of the 11 for 2011¹¹ Top Innovations)

JiVitA is a project of the Center for Human Nutrition of Johns Hopkins University, spanning 19 unions of Gaibandha and Rangpur Districts in rural Northwestern Bangladesh. JiVitA has been conducting community trials, supported by epidemiologic, ethnographic, and laboratory research since 2000, to reveal the impact of public health interventions in order to guide nutrition and health programs and policies in Bangladesh and elsewhere in South Asia.

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Funding Agencies

- ✦ The Bill & Melinda Gates Foundation
- ✦ The United States Agency for International Development
- ✦ The United States Department of Agriculture
- ✦ The Canadian International Development Agency
- ✦ The Sight and Life Research Institute
- ✦ The Ministry of Health and Family Welfare,
The Government of the People's Republic of Bangladesh

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