BABY MONITOR

Preventing maternal and newborn deaths through mobile phone-based screening

Despite significant global progress in reducing maternal and infant mortality rates, nearly 300,000 maternal deaths and an estimated 5 million infant deaths occur each year. Prenatal care and a series of proven interventions delivered by a skilled attendant could prevent nearly 80% of maternal deaths and 66% of newborn deaths. However, many women and infants are never assessed and connected to healthcare. Baby Monitor, a new mHealth platform that takes clinical screening directly to pregnant women, aims to change this.

The goal of Baby Monitor is to save lives, improve health outcomes, and optimize the use of community health workers (CHWs) in rural and remote regions where access to health systems is limited and clinical assessment often occurs too late or not at all. With seed funding from the Saving Lives at Birth Grand Challenge, Population Council and its partners developed and tested a beta version of Baby Monitor, a mobile-phone based screening, referral and patient management service that targets hard-to-reach pregnant women as end-users. The formative study was conducted in a periurban catchment area in Nairobi, Kenya in 2012. Baby Monitor is currently being further refined and tested in a second study in Bungoma East District, Kenya.

Implementation date: October 2011

About Baby Monitor

Baby Monitor is an open source mobile phone application that uses interactive voice response (IVR) technology to offer free mobile screenings to pregnant women and new mothers. When it is time for a prenatal or postnatal exam, a registered user receives a text message with a code that can be redeemed by "flashing" the Baby Monitor phone number to trigger a free call back. The woman selects her preferred language, listens to recorded audio prompts asking her how she and her baby are feeling, and presses keys on her phone's number pad to respond. All of her responses are logged in an electronic medical record. The analysis engine determines whether the woman is likely to need referral to a medical facility or more immediate assistance.

When fully operational, Baby Monitor will include an "action" component that uses screening results to trigger automated referrals and emergency dispatch.

Baby Monitor uses Verboice, a free IVR platform, installed on an Amazon Elastic Compute Cloud (EC2) server connected to a Voice over IP (VOIP) provider in Kenya. Each call costs Baby Monitor USD $0.04 per minute, which could be reduced through bulk pricing.

Evaluation and Results

The initial study conducted in Nairobi in 2012 allowed Baby Monitor developers to:

1. evaluate the feasibility and acceptability of Baby Monitor through interviews and focus group discussions with study participants and consultations with our clinical partner and
2. assess reliability and accuracy of the mobile screening protocols by comparing results from mobile screenings to follow-up, in-person clinical assessments.

Four health screening protocols were developed for different stages of the birth continuum. The antenatal protocol included screening questions about maternal physical and mental health. The postnatal protocol, used one and three days after delivery, assessed maternal and infant physical health (but not mental health or infant development). The postnatal protocol, used seven days after delivery, assessed maternal physical health, perinatal depression and infant physical health, and the postnatal screenings, delivered at 6, 10 and 14 weeks, assessed maternal physical health, perinatal depression, infant physical health and infant development.

Ninety-five (95) women in their second trimester were enrolled for the study. Women completed automated screenings and, one day later, completed the same screening with a nurse.

In the prenatal period, Baby Monitor correctly identified 88.5% of positive cases—those classified by the nurse as having "any problems". The screening tool was less successful in the postnatal period, only correctly

identifying 23.8% of positive cases. The tool demonstrated high specificity, positive predictive value and negative predictive value in both periods.

Overall, the screening tool proved to be a valid assessment of medical need. It also had acceptable initial measures of reliability, meaning that the women largely provided the same responses to the automated service as they did to the live nurse. Reliability can be improved as the system moves to production by increasing the stability of the platform and enhancing the audio quality of the phone connection.

Lessons Learned

- The Baby Monitor system is feasible to implement and acceptable to users.
- Automated screening can be used as a tool to identify women and infants with medical needs.

Conclusion

For many women in rural and remote settings, a mobile phone signal is more likely to reach their home than a community health worker. The formative study of Baby Monitor demonstrates the potential of using an automated IVR screening on mobile phones to identify women and infants with medical needs. Through integration with existing electronic medical records systems, the developers of Baby Monitor will be able to build an interoperable service that encourages women to seek healthcare, optimizes the use of health system resources, tracks outcomes and offers women a more personalized health experience.

Geographic Coverage: Kenya (initial study in Nairobi, current study in Bungoma East District)

Implementation Partners: Population Council, in partnership with InSTEDD, Jacaranda Health and Moi University

Funder: Saving Lives at Birth Grand Challenge partners, including USAID, the Government of Norway, the Bill & Melinda Gates Foundation, Grand Challenges Canada, and the World Bank

Contact Information:
Population Council: Eric Green, Principal Investigator, Population Council (+1919-666-7111, eric.green@duke.edu)

References:

1. Green, Bellows, di Tada and Pearson (2013). "Baby Monitor: Developing and testing a mHealth screening service for pregnant women and new mothers in Kenya." Preliminary Working Draft.
2. Baby Monitor Slide Deck, Tech'n'Talk session, Women Deliver 2013.
3. http://www.babymonitor.co