Effect of mHealth in improving antenatal care utilization and skilled birth attendance in low- and middle-income countries: a systematic review protocol

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Review question/objective: The objective of this review is to identify and synthesize the best available evidence on the effect of mobile health (mHealth) interventions in antenatal care utilization and skilled birth attendance in low- and middle-income countries. More specifically, the review questions are as follows:

- Is mHealth effective in improving antenatal care utilization compared with routine care received without the support of mHealth applications?
- Is mHealth effective in improving skilled birth attendance compared with routine care received without the support of mHealth applications?

Keywords Antenatal care; low- and middle-income countries; mHealth; mobile health; skilled birth attendant


Background

In 2015, globally, the maternal mortality ratio was estimated at 216 maternal deaths per 100,000 live births.1 This translates into approximately 830 women dying every single day due to the complications of pregnancy and childbirth. Almost all of these deaths occurred in low- and middle-income countries (LMIC).1,2

Providing all women with antenatal care, skilled care at birth and essential newborn care can dramatically improve prospects for safe pregnancy and child survival.3-7 Unfortunately, these areas are marked by extreme disparity – not only in access to care but also the quality of care.3 Worldwide, about one in four births (25%) take place without the assistance of a skilled birth attendant.8 In 2015 alone, this translated into more than 40 million unattended births in LMIC, about 90% of which were in South Asia and sub-Saharan Africa. Experts agree that the risk of stillbirth or death due to intrapartum-related complications can be reduced by about 20% with the presence of a skilled birth attendant.7,8

Regular contact with a doctor, nurse or midwife during pregnancy allows women to receive services vital to their health and that of their future children.9 The World Health Organization (WHO) recommends a minimum of four antenatal care visits for uncomplicated pregnancies, with the first visit starting before 16 weeks of gestation.10 Global estimates indicate that only about half of all pregnant women receive this recommended amount of care.8 The lowest coverage in at least four antenatal visits is observed in LMIC.2,8 Evidence shows that unequal access to quality care starts before birth and continues into the critical early years.3 Inadequate antenatal care is related to poor pregnancy outcomes such as pre-term delivery, having an infant small for his/her gestational age, and infant death.11 Women who seek antenatal care late with few visits are less likely to be assisted during delivery by a skilled attendant.12

The field of mobile health (mHealth) has been proposed as a potential solution to many of the
challenges that developing countries face, including workforce shortages, lack of health information, limited training for health workers and difficulty tracking patients.\textsuperscript{13,14} Mobile health is a medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs) and other wireless devices.\textsuperscript{13}

Mobile health interventions can be used to provide varying functions: educational information, support, reminders, emergency response and monitoring.\textsuperscript{14,15} Mobile health applications can also support the health sector to improve limited access to quality care, especially in rural and underserved communities, including the urban poor and women.\textsuperscript{16,17} Further, mHealth tools have been used to promote behavior change in health workers and/or patients. For example, text message reminders have been shown to increase care-seeking in some patients.\textsuperscript{18,19}

Most randomized trials of mHealth interventions have employed text message reminder systems. Two systematic reviews have described a vigorous evidence base for the use of text message reminders to improve attendance at healthcare appointments.\textsuperscript{20,21} Yet, none of the studies included in these reviews was conducted in LMIC.

The majority of mHealth implementation projects in LMIC have tended to be small-scale and donor-funded initiatives, which have taken place without the benefit of an adequate evidence base and have not themselves been configured with research in mind.\textsuperscript{22,23} However, there is a growing body of research indicating the potential of mHealth interventions for improving maternal and child health in LMIC.\textsuperscript{24-28}

While there is supportive evidence that mHealth applications may present an opportunity to increase the coverage and use of preventive maternal health services, such as antenatal care and/or skilled birth attendance in LMIC,\textsuperscript{29,30} there is no published systematic review on the current topic in the Cochrane Database of Systematic Reviews, the JBI Database of Systematic Reviews and Implementation Reports\textsuperscript{31} or the Campbell Library of Systematic Reviews. Therefore, this systematic review aims to determine the effect of mHealth interventions in improving antenatal care and/or skilled birth attendance in LMIC.

### Inclusion criteria

#### Types of participants

The current review will consider studies that evaluate mHealth interventions targeted at antenatal care utilization and/or skilled birth attendance in LMIC. Types of participants included in this review will be women in the antenatal and intra-natal period undergoing an intervention aimed at improving utilization of antenatal care (at least four visits) and skilled birth attendance.

**Antenatal care** is the care given by skilled health personnel for a woman during pregnancy.\textsuperscript{31}

**Intra-natal care** is the care given by skilled health personnel for a woman during or at the time of birth.\textsuperscript{31}

#### Types of intervention(s)

The review will consider studies of any intervention delivered using mobile technologies designed to improve antenatal care utilization and/or skilled birth attendance. Mobile technologies refer to portable, wireless digital device supported by networked mobile or satellite communications infrastructures, such as mobile phones or cell phones, smart phones, satellite phones, PDAs, tablet computers, portable media players, Radio Frequency Identification Device tags and Global Positioning System trackers.\textsuperscript{13} The review will include mHealth interventions such as educational messages, appointment reminders and communication platform between health providers and pregnant women. Within the scope of this review we will include all mobile technologies that encourage antenatal care utilization and/or skilled birth attendance. Mobile delivery modes in this review will include: text messaging via Short Message Service, voice calling, voice messaging, transfer or moving images via Multimedia Message Service, Multimedia downloads and live video.

#### Comparator

The comparator for this review will be routine care received without the support of mHealth applications.

#### Outcomes

The review will consider studies that include antenatal care utilization and/or skilled birth attendance as a primary outcome. Antenatal care will be
measured by the number of women who have received at least four antenatal care visits, whereas skilled birth attendance will be measured by the number of women who have given birth with assistance from a skilled birth attendant.

Types of studies
The current review will consider both experimental and quasi-experimental study designs, including randomized controlled trials, non-randomized controlled trials, and before and after studies. In addition, analytical observational studies, including prospective and retrospective cohort studies will be considered for inclusion.

Search strategy
The search strategy aims to find both published and unpublished studies. A three-step search strategy will be utilized in this review. An initial limited search of MEDLINE and Embase will be undertaken followed by an analysis of the text words contained in the title and abstract, and of the index terms used to describe article. A second search using all identified keywords and index terms will then be undertaken across all included databases. Third, the reference lists of all identified reports and articles will be searched for additional studies. Studies published in English language will be considered for inclusion in this review. Studies published since January 2001 will be included as mobile technologies were not widely available, especially in LMIC, prior to this period. We will include countries identified as low or medium income according to the United Nations Human Development Report released in 2015. We are aware that the status of countries in such indices changes over time and will therefore note the date of the articles.

The databases to be searched include: MEDLINE, Embase and Cochrane Central Register of Controlled Trials.

The search for unpublished studies will include: Grey Literature Report through WHO Reproductive Health Library, ProQuest Dissertations and Theses, and a standard Google search using keywords.

Initial keywords to be used will be: mHealth, mobile health, antenatal care, skilled birth attendant, low- and middle-income countries.

Following the search, all identified citations will be collated and uploaded into EndNote and duplicates removed. Titles and abstracts will then be screened by two independent reviewers for assessment against the inclusion criteria for the review. Studies that may meet the inclusion criteria will be retrieved in full and their details imported into JBI System for the Unified Management, Assessment and Review of Information (JBI-SUMARI). The full text of selected studies will be retrieved and assessed in detail against the inclusion criteria. Full text studies that do not meet the inclusion criteria will be excluded and reasons for exclusion will be provided in an appendix in the final systematic review report. Included studies will undergo a process of critical appraisal. The results of the search will be reported in full in the final report and presented in a PRISMA flow diagram. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer.

Assessment of methodological quality
Papers selected for retrieval will be assessed by two independent reviewers for methodological validity prior to inclusion in the review using standardized critical appraisal instruments from the JBI for randomized controlled trials, non-randomized controlled trials and cohort studies. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer.

Data extraction
Data will be extracted from papers included in the review using the standardized data extraction tool available in JBI-SUMARI by two independent reviewers. The data extracted will include specific details about the interventions, populations, study methods and outcomes of significance to the review question and specific objectives. Any disagreements that arise will be resolved through discussion, or with a third reviewer. Authors of papers will be contacted to request missing or additional data where required.

Data synthesis
Papers will, where possible, be pooled in statistical meta-analysis using JBI-SUMARI. Effect sizes will be expressed as odds ratios (for dichotomous data) and
their 95% confidence intervals will be calculated for analysis. Heterogeneity will be assessed statistically using the standard chi-squared and I-squared tests. The choice of model (random or fixed effects) and method for meta-analysis will be based on the guidance by Tufanaru et al. Subgroup analyses will be conducted where there is sufficient data to investigate the relationship between different comparator interventions in the selected studies. Where statistical pooling is not possible, the findings will be presented in narrative form, including tables and figures to aid in data presentation where appropriate.

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References

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