Community health workers’ experiences of mobile device-enabled clinical decision support systems for maternal, newborn and child health in developing countries: a qualitative systematic review protocol

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Review question/objective: The objective of this review is to synthesize evidence on the experiences of community health workers (CHWs) of mobile device-enabled clinical decision support systems (CDSSs) interventions designed to support maternal newborn and child health (MNCH) in low-and middle-income countries.

Specific objectives:
- To identify the perceived benefits and barriers of using mobile device-enabled CDSSs.
- To identify the deficiencies in mobile device-enabled CDSSs as perceived by CHWs.
- To understand how these systems affect CHWs work patterns based on behavioral change theories.

Keywords Child health; maternal health; mobile phone; neonatal health; tablets

Background

Maternal, neonatal and child mortality in developing countries remains a dire challenge. Evidence from the World Health Organization (WHO) report suggests that over 99% of 286,000 annual global maternal deaths occur in developing countries, with the sub-Saharan Africa (SSA) region alone accounting for 62% (179,000). Data published in the 2010 WHO report, showed that 350 women die for every 100,000 live births in Ghana, annually. However, institutional maternal mortality rates have declined gradually from 740 per 100,000 live births in 1990 to 451 per 100,000 live births in 2008. If this trend continues, maternal deaths are expected to decline further to 329 per 100,000 live births by 2015. According to these statistics, Ghana may not be able to meet the millennium development goal (MDG) 5 target of 185 maternal deaths per 100,000 live births by the end of 2015. Also, according to Barros et al., while developed countries record low levels of neonatal mortality, about three to four per 100,000 live births, in most low- and middle-income countries (LMICs), about 40% of 10.8 million children die annually within their neonatal period. Within LMICs, these neonatal death rates are even higher among those living in rural areas, less-educated communities and the poorest households.

Consequently, MDG 4, which was aimed at enhancing child health and reducing child mortality, was also not achieved in many LMICs.

Some major factors inhibiting Ghana and many other developing countries’ ability to meet their health-related MDG targets are the low levels of literacy, cultural barriers, poor quality of care at the community level and poor demand for services by women. Others include unavailability of reliable data and shortage in human and financial resources. While these barriers are significant, there is an enormous amount of evidence providing ways to reduce their effect. Even though evidence and decision support systems exist, compliance with healthcare treatment and guidelines remains low.

With the aim to reduce MNCH complications and deaths, CHWs perform home visits and follow-ups to maternal and newborn babies, training and supporting traditional birth attendants, participatory learning and action cycles with women’s groups, and other evidence-based cost-effective interventions. In 2007, the World Health Assembly also emphasized continuum of care as
one of the approaches aimed at reducing maternal newborn and child deaths. However, these interventions have not resulted in much change on the ground. Thus, extra effort is required for developing countries to achieve the MDG 4 and 5 targets of reducing maternal and child mortality rates by two-thirds and three-quarters, respectively, by 2015.

Furthermore, in LMICs, strengthening health systems has been noted as one of the key elements in increasing child survival rates. Therefore, some initiatives have been undertaken to provide quality of care through the promotion of clinical practice guidelines as one of the remedies to improve maternal and child health problems. However, this is often beset with complex challenges and consequently results in fewer or less benefits. These problems require urgent practical and evidence-based innovative health technology solutions at the community level.

With the advancement of information and communication technology (ICT) in health, the application of knowledge at the point of care has been known to simplify adherence to guidelines, which consequently can enhance quality of care. For instance, in a cross-country comparison study, the community intervention of a CDSS was shown to have promising effects. The use of these knowledge-based systems usually involves inputting patient data and generating diagnostic and treatment options through a process of reasoning techniques. There have also been several other examples of implementation of various types of CDSSs; however, these countries often lack the necessary ICT infrastructure to enable these systems to work.

In addition, with the proliferation of mobile device ownership and networks across SSA, mobile device-based technology in healthcare (mHealth) has been considered to be one of the most cost-effective solutions to healthcare disparities related to cost, distance and infrastructure. Furthermore, the momentum behind the use of mobile and wireless communication technologies to support medical and public health practice, education and research is increasing. This provides opportunities to rapidly connect people, effectively solve information-sharing gaps and therefore reduce delays in making consequential health decisions, and positively affect the lives of millions. Again, development and implementations of mHealth applications, including mobile device-enabled CDSS, has increased in tandem with the mobile device explosion in order to help improve health outcomes in developing countries. However, these CDSSs can only be as efficient as the strength of the underlying evidence base. That is, the efficiency of these CDSSs will be limited by any inadequacies in the quality or relevance of research evidence. Therefore, in addition to generating more clinical or public health research evidence, one major step in developing more effective CDSSs is to generate more high-quality, useful and actionable evidence that is up to date and easily accessible.

Several studies in the mHealth ecosystem on decision support systems have shown that mHealth is being most commonly applied as a tool for CHWs who are the point of care for newborns and women during delivery. Some of these tools include momConnect, a free cell-phone-based health service for pregnant women and mothers of children less than one year old, Open Data Kit Clinic, which stores patient-specific data, and Healthline and voice response technology, a “call-in” system to provide expert medical advice and information to people in need of quality health care. Other tools are e-IMCI, a personal digital assistant (PDA)-assisted system for administering a clinical triage protocol for Integrated Management of Childhood Illnesses; CommCare, a phone-based patient/case management tool that provides behavioral change messages about maternal health, and MumHealth, a mobile messaging service delivering maternal, newborn and child health information to pregnant women and new mothers through voice and text messages in local dialects.

Although a few primary studies have reported on perceptions of CHWs on these mobile device-enabled CDSS tools, a preliminary search of PROSPERO, DARE, Cochrane Library, Campbell Collaboration Library, PubMed and JBI Database of Systematic Reviews and Implementation Reports showed that no systematic review has been done using qualitative assessment of CHWs’ experiences of mobile device-enabled CDSSs for improving MNCH in LMICs.

The current qualitative synthesis is important as it has the potential to identify experiences of CHWs that would inform the design, development and implementation of newer mobile-enabled CDSSs in resource-starved countries. Thus, the implication of
the results of this systematic review could be of great value for public health researchers, government policies on ICT and developers of new mHealth applications for evidence-informed policy-making in developing countries. Hence, generating evidence on the experiences of community-based healthcare providers who have used mobile applications to enhance clinical decision support for MNCH in LMICs, will fill an important gap in health policy decision and practice in Africa.

Inclusion criteria

Types of participants
The review will consider studies that report on CHWs or officers who were involved in the use of mobile device-enabled decision support systems in improving maternal, newborn and child health in developing countries. Community health workers reside within hard-to-reach communities and are the first point of contact for healthcare delivery. They operate in and out of healthcare facilities and provide basic services to the population. Some functions of CHWs include treatment of malaria, acute respiratory infections and diarrheal diseases. Community health workers also provide comprehensive childhood immunization and family planning care.32-34

Types of intervention(s)/phenomena of interest
The review will focus on studies that investigate experiences of CHWs in the use of mobile device-enabled decision support systems for improving maternal, newborn and child health. Mobile device-enabled CDSS including mHealth applications installed on mobile devices such as PDAs, smartphones and tablet computers which have been used as tools to support clinical decision making at the point of care35 will be considered.

Context
The review will consider studies conducted in LMICs.

Types of studies
The review will consider studies that focus on qualitative data including, but not limited to, designs such as phenomenology, grounded theory, ethnography, action research and feminist research.

For studies containing mixed-methods research, both qualitative and quantitative, relating to this topic, the qualitative data will be extracted and included in this review.

In the absence of research studies, other text such as opinion papers and reports will be considered. Studies published in languages other than English will not be considered for this review. This review is restricted to developing countries because CHWs work in hard-to-reach communities of such countries. Furthermore, it will help researchers and policy-makers in these countries to overcome complex implementation challenges relating to newly developed mobile-enabled CDSSs meant to improve on MNCH services. When necessary, authors of original papers will be contacted for clarification on issues relevant to their papers.

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 CINAHL will be undertaken followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe the article. A second search using all identified keywords and index terms will then be undertaken across all included databases. Third, the reference list of all identified reports and articles will be searched for additional studies. Studies published in the English language will be considered for inclusion in this review. Studies published from January 1, 2000 will be considered for inclusion in this review. This timeline was selected because mHealth applications in MNCH started 15 years ago, in 2000.36 Also, this will ensure the contemporaneity of the review and that conclusions that are relevant to e-health policy formulation and practice in LMICs are developed.

The databases to be searched include: IEEE Xplore, CINAHL, SCOPUS, Health Technology Assessment (HTA) Database (via Cochrane library), Maternity and Infant Care, PsycINFO, PubMed/Medline, EMBASE and Web of Science. The search for unpublished studies will include OpenGrey, WHO library, Google scholar, OAlster, NHS evidence, Social Science Research Network and ProQuest Open Access Dissertations and Theses (PQDT).

Initial keywords to be used will be:
Mobile phone, tablets, clinical decision support systems, maternal health, neonatal health, child health, community health officers, community
health workers, rural health workers, qualitative, developing countries, Africa, experience, meaning, perception and sub-Saharan Africa.

**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 Joanna Briggs Institute Qualitative Assessment and Review Instrument (JBI-QARI) (Appendix I). 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 from JBI-QARI (Appendix II). The data extracted will include specific details about the phenomena of interest, populations, study methods and outcomes of significance to the review question and specific objectives.

**Data synthesis**

Qualitative research findings will, where possible, be pooled using JBI-QARI. This will involve the aggregation or synthesis of findings to generate a set of statements that represent that aggregation, through assembling the findings rated according to their quality, and categorizing these findings on the basis of similarity in meaning. These categories are then subjected to a meta-synthesis in order to produce a single comprehensive set of synthesized findings that can be used as a basis for evidence-based practice. Where textual pooling is not possible, the findings will be presented in narrative form.

**Acknowledgements**

The authors would like to gratefully acknowledge the people who helped to put this protocol together. Many thanks to the following individuals for their exchanges, reviews, discussions, resources and the time they took out of their busy schedules to contribute and provide insight throughout this process: Lawrence Febir and Seeba Amenga-Etego.

**References**

SYSTEMATIC REVIEW PROTOCOL

F. Dzabeng et al.


Appendix I: Appraisal instrument

**JBI QARI Critical Appraisal Checklist for Interpretive & Critical Research**

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<th>Reviewer</th>
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1. Is there congruity between the stated philosophical perspective and the research methodology?  
   - Yes  
   - No  
   - Unclear  
   - Not Applicable

2. Is there congruity between the research methodology and the research question or objectives?  
   - Yes  
   - No  
   - Unclear  
   - Not Applicable

3. Is there congruity between the research methodology and the methods used to collect data?  
   - Yes  
   - No  
   - Unclear  
   - Not Applicable

4. Is there congruity between the research methodology and the representation and analysis of data?  
   - Yes  
   - No  
   - Unclear  
   - Not Applicable

5. Is there congruity between the research methodology and the interpretation of results?  
   - Yes  
   - No  
   - Unclear  
   - Not Applicable

6. Is there a statement locating the researcher culturally or theoretically?  
   - Yes  
   - No  
   - Unclear  
   - Not Applicable

7. Is the influence of the researcher on the research, and vice-versa, addressed?  
   - Yes  
   - No  
   - Unclear  
   - Not Applicable

8. Are participants, and their voices, adequately represented?  
   - Yes  
   - No  
   - Unclear  
   - Not Applicable

9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?  
   - Yes  
   - No  
   - Unclear  
   - Not Applicable

10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?  
    - Yes  
    - No  
    - Unclear  
    - Not Applicable

Overall appraisal:  
   - Include  
   - Exclude  
   - Seek further info.

Comments (Including reason for exclusion)
Appendix II: Data extraction instrument

**JBI QARI Data Extraction Form for Interpretive & Critical Research**

- Reviewer ___________________________ Date ___________________________
- Author ___________________________ Year ___________________________
- Journal ___________________________ Record Number ___________________________

**Study Description**

- Methodology
- Method
- Phenomena of Interest
- Setting
- Geographical
- Cultural
- Participants
- Data analysis
- Authors Conclusions
- Comments

Complete Yes ☐ No ☐
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Extraction of findings complete Yes ☐ No ☐