Availability and use of mHealth for disease diagnosis and treatment support by health workers in sub-Saharan Africa: a scoping review protocol

Ernest Osei 1, Desmond Kuupiel 1,2, Tivani Phosa Mashamba-Thompson 1,3

ABSTRACT

Introduction Improving healthcare for all is one of the global health priorities, particularly in disease burdened settings such as sub-Saharan Africa (SSA). Considering the high penetration rate of mobile phones in SSA, mobile health (mHealth) could be used to achieve universal health coverage. The proposed study will map evidence on the availability and use of mHealth for disease diagnosis and treatment support by health workers in SSA.

Methods and analysis This review will be guided by Arksey and O’Malley’s scoping review framework and Levac et al’s recommendations and guidelines from the Joanna Briggs Institute. A scoping review will be conducted to explore what is known about mHealth for disease diagnosis and treatment support by health workers in SSA and to identify areas for future research. In addition to searching the grey literature, the following databases will be explored from PubMed, MEDLINE and CINAHL with full text via EBSCOhost and ScienceDirect databases. A search in Google Scholar will be considered as an additional information source. The literature search will involve published studies from 2000 to 2020 in any language. This review will cover mHealth for disease diagnosis and treatment support by health workers in SSA. The primary investigator will conduct the title screening, and subsequently, two reviewers will independently conduct abstract and full article screening and data extraction. The results of this proposed review will be presented using the Preferred Reporting Items for Systematic Reviews and Meta-analysis: Extension for Scoping Review guidelines.

Ethics and dissemination Ethical approval is not required for the scoping review, which is the first stage in a PhD study in public health on accessing mHealth for disease diagnosis and treatment support by health workers in Ghana. The final review will be submitted for publications to a scientific journal, and our results will be presented at appropriate conferences.

BACKGROUND OF THE STUDY

The mass availability and use of mobile health (mHealth) technology provide a significant potential for such technologies to be integrated into clinical services to support high quality medical care.1 WHO, through its global observatory report defined mHealth as ’medical and public health practice support by mobile devices like mobile phones, smartphones, tablets, patients monitoring devices, personal digital assistants and other wireless devices’.2 In 2015, it was estimated that 52% of smartphone users gather health-related information like a medical problem, nutrition, depression, among others on their mobile phones.3 In sub-Saharan Africa (SSA), mobile phone availability, and utilisation by the population at the end of 2017 was 44% and is forecast to reach 52% by 2025.4 mHealth technologies and applications are available and being utilised for screening diseases, medication adherence, follow-ups, appointment reminders and many others.5,6

Given the large availability and utilisation of mobile phones, mHealth technologies and applications could be explored to supplement the provision of healthcare services in SSA.

Research has shown that the use of mHealth can result in some of the following health benefits: first, mHealth has the potential to


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Strengths and limitations of this study

► The scoping review will use a well-established, rigorous scoping review methodology with a comprehensive strategy.
► The literature search will be comprehensive, including electronic databases with peer-reviewed literature and grey literature sources, including governmental as well as non-governmental websites.
► In this scoping review study, language and study design limits will be removed.
► The review will be limited to studies published from 2000 to 2020.
► This review study was also limited to studies conducted within sub-Saharan Africa, which may lead to missing other relevant articles.
improve the provision of quality healthcare by enhancing treatment, empowering patients, reducing medical cost and streamline the use of health resources. Previous reviews focused on mHealth for data collection, reminders, health education, communication, disease surveillance, medication adherence, exchange of patients’ data between health workers or between patients and their health providers and effectiveness of using mHealth applications in SSA. A review on the availability and use of mHealth for disease diagnosis and treatment would be valuable towards improving access to healthcare services, especially in this era of COVID-19. Despite this, the available evidence illustrates that no previous review has been conducted focusing on mHealth applications for disease diagnosis by health workers in SSA. Therefore, this current review will aim to map existing evidence on the availability and use of mHealth for disease diagnosis and treatment support by health workers in SSA.

**METHODS**

Protocol design

We will carry out a scoping review of evidence on the availability and use of mHealth for disease diagnosis and treatment support by health workers in SSA under the guidance of Arksey and O’Malley’s framework and the 2015 Joanna Briggs Institute guidelines. A five-step structure from Arksey and O’Malley includes the following:

1. Identify the research question.
2. Identifying relevant studies.
3. Selection of studies.
4. Data charting.
5. Collating, summarising and reporting the results.

This scoping review will be conducted following guidelines from the Preferred Reporting Items for Systematic Reviews and Meta-analysis: Extension for Scoping Reviews (PRISMA-ScR, figure 1). This protocol has been reported according to the guidelines provided by Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P, online supplemental additional file 1).

**Step 1: identify the research question**

The research question of interest is: What evidence exists on the availability and use of mHealth for disease diagnosis and treatment support by health workers in SSA?

The subresearch questions are as follows:

1. What evidence exists on the availability of mHealth for disease diagnosis and treatment support by health workers in SSA?
2. What evidence exists on the use of mHealth for disease diagnosis and treatment support by health workers in SSA?

The Population, Concept and Context framework developed by Joanna Briggs Institute has been used to determine the eligibility of the research question for our scoping review (table 1).

**Step 2: identifying relevant studies**

For the identification of relevant articles, an electronic database search will be carried out using advanced search
from the University of KwaZulu-Natal Library Service for selecting relevant databases for this study and with keywords searches. WHO website and the departments of health websites will also be searched thoroughly for relevant literature. Reference lists of all included articles will also be searched for relevant articles. Keywords for searching the literature will be: ‘mHealth technology’, ‘disease’, ‘diagnosis’, ‘treatment’, ‘support’ and ‘sub-Saharan Africa’. Boolean terms (AND, OR) will be used to separate the keywords. Medical Subject Headings terms will also be used during our electronic search for relevant articles.

We have carried out a pilot search in PubMed to show the feasibility of conducting the proposed scoping review method (table 2).

**Inclusion criteria**

We will include the following:
1. Studies involving healthcare workers using mHealth.
2. Articles presenting findings on mHealth interventions such as text message, voice calls, mobile apps and multimedia messaging among others.
3. Articles that report findings on the availability of mHealth for disease diagnosis.
4. Articles that present findings on the availability of mHealth for treatment support.
5. Articles presenting findings on the use of mHealth for disease diagnosis.
6. Articles reporting findings on the use of mHealth for treatment support.
7. Articles that present findings on mHealth from SSA.
8. Primary research studies on qualitative, quantitative, mixed-method, randomised controlled trials and non-randomised controlled trials, and grey literature.
9. All articles published from 2000 to 2020 in any language.

**Table 1** Determining the eligibility of the research question

<table>
<thead>
<tr>
<th>Determinants</th>
<th>Description</th>
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<tbody>
<tr>
<td>Population</td>
<td><strong>Healthcare workers</strong> — this includes all the various categories of trained health workers such as physicians, nurses, community health workers, pharmacists/dispensing technicians, biomedical scientists/laboratory technicians, radiologists, physiotherapists, occupational therapists, speech therapists, disease control officers and others working in healthcare facilities within SSA. These are the group of professionals who have been given the requisite skills and training in providing healthcare services to the public. Some of these healthcare professionals have been given additional skills on how to use mHealth applications to render quality healthcare services to their clients.</td>
</tr>
</tbody>
</table>
| Concept                    | **Disease diagnosis and treatment support**  
**Disease diagnosis** — the use of mHealth applications to assist in identifying the nature of an illness or any other problem by examining the symptoms. These mHealth applications could help in screening patients’ conditions or cases to detect any form of diseases, disorders or injuries.  
**Treatment support** — the use of mHealth applications to assist patients in treating and managing their conditions in terms of medication adherence, appointment reminders, follow-ups, communication, health monitoring, prevention and others without travelling to the health facility. |
| Context                    | **Availability and use in SSA**  
**Availability** — is the state of being able to access, use and obtain mHealth applications on a demand to perform the required functions such as disease screening and diagnosis, treatment and medication adherence, follow-ups, maternal and child health, appointment reminders and others.  
**Use** — the process of employing mHealth applications to accomplish tasks such as diagnoses and screening of diseases, treatment and management of conditions of patients. |

mHealth, mobile health; SSA, sub-Saharan Africa.
Exclusion criteria
The following will be excluded:
1. Studies involving patients using mHealth applications.
2. Articles reporting findings on eHealth applications such as medical health records, personal health records and many others.
3. Articles that report findings on mHealth for health education.
4. Articles reporting findings on mHealth for data collection without diagnosis and treatment support of conditions.
5. Articles that present findings on mHealth for communication without disease diagnosis and treatment support of conditions.
6. Articles reporting findings on mHealth outside SSA.
7. Review articles.

Step 3: selection of studies
Following database searches for relevant articles, the principal investigator, EO, will carry out a comprehensive study title screening. All eligible study titles will be exported to an Endnote X9 library purposely created for this scoping review. All identified duplicates will be deleted before sharing the Endnote library with the review team. Two trained reviewers (EO and DK) will independently conduct abstract screening in parallel using the screening tool, which will be designed with guidance from the inclusion and exclusion criteria. The review team will discuss discrepancies between the two reviewers’ responses at the abstract screening stage until a consensus is reached. Two reviewers (EO and DK) will perform the full-article screening using the eligibility criteria guided tool for the selected relevant articles. A third reviewer (TPM-T) will be contacted to resolve discrepancies in reviewers’ responses following full-article screening. The library services at the University of KwaZulu-Natal will be requested to support our study search strategy to help retrieve full articles that were not accessible in the databases, as mentioned earlier. The screening results will then be reported using the PRISMA flow diagram.27

Step 4: data charting
A data charting form will be used to extract all the relevant data from the included articles (box 1).

The data extraction form will be validated by two reviewers using at least the first five articles for consistency. We will update and modify the data extraction form throughout the study. Two reviewers (EO and DK) will independently conduct the data extraction in parallel. The standard bibliographical information (ie, authors, title and year of publication), geographical setting, study setting, study design and aim of the study will be reported. For each of the included primary studies, information on the target population, type of technology,
type of mHealth intervention, the purpose of mHealth, disease diagnosis, treatment support, key findings, most significant findings, conclusions and notes will be tabulated. NVivo V.12 software package will assist us in conducting thematic content analysis\(^{29}\) from the relevant outcomes of the included articles.

Quality appraisal of studies
The electronic version of the mixed-method appraisal tool (MMAT) V.2018\(^{29}\) will be adopted to assess the quality of the included primary studies. The MMAT will be used for quality appraisal and describes the quality of the methodology for qualitative, quantitative and mixed-method studies. In this quality appraisal, we will examine the aim of each study, clarity of the research question, appropriate methodology, study design, relevant data sources, proper sampling technique, suitable data collection procedures and participant recruitments. Others include representativeness of population, the suitability of statistical analysis of data, appropriateness of data interpretation, authors’ acknowledgement of potential biases, presentation of findings, discussions and the authors’ conclusions of all the included primary studies. A quality appraisal will be conducted to understand the strengths, weaknesses, potential for bias in clinical research as well as the quality of research evidence which will be presented from each of the included primary studies. Generally, the quality of all the selected studies will be calculated and rated using the MMAT guidelines for the low quality of 25\%, the average for 50\%, above average for 75\% and the high average for 100\%.

Step 5: collating, summarizing and reporting the results
This study’s main aim is to map available evidence and summarise the findings as reported across all the included articles. We will conduct a thematic content analysis\(^{29}\) with the support of NVivo V.12 of the included studies. The review team will carefully analyse the emerging themes and relate them to our research question. The reviewers will also analyse all the implications on the significant findings with regards to the research question and stimulate future research in SSA. We will present a narrative account of all our results according to the themes.

DISCUSSION
This scoping review will map evidence on existing literature on the availability and use of mHealth for disease diagnosis and treatment support by health workers in SSA. The WHO, through its global observatory 2016 report, indicated mHealth as one of the new emerging technologies that could help achieve universal health for all.\(^{30}\) According to WHO, mHealth services like short message reminders and phone calls can easily be made available to remote populations and resource-limited settings by providing mechanisms for the exchange of data between patients and service providers.\(^{30}\) Research has also shown that mHealth can help increase access to healthcare and the provision of healthcare in communities with limited infrastructure to support the internet or traditional healthcare services.\(^{2,30,31}\) Providing healthcare through mobile communication is reported to be cheaper than supplying in-person healthcare services.\(^{30}\) Recent studies demonstrated that mHealth services helped patients, especially those in hard-to-reach communities stick to treatment procedures, appointment adherence and many others.\(^{6,92}\) Considering these benefits of mHealth, there is the need to map evidence on the availability and use of mHealth for disease diagnosis and treatment support by health workers in SSA.

This scoping review will be limited to articles presenting findings from SSA because of the similar health challenges. Our study will not cover articles outside of SSA because they have different health targets and problems. The study will exclude articles presenting findings on mHealth used by patients because we want to examine the impact of mHealth usage by health workers to support healthcare delivery. Also, this study will exclude articles presenting findings on mHealth for communication in terms of health promotion campaigns or community mobilisation to raise awareness of target groups. Again, our proposed research will exclude articles presenting findings on mHealth for providing medical education to health workers on professional development. This study will cover articles that offer evidence published from 2000 to 2020 to obtain current information on the reports of mHealth applications. The findings of this scoping review study will be published in a peer-reviewed journal.

Patient and public involvement
No patient and the public will be involved in our study design, conducting and dissemination of the results of the scoping review.

CONCLUSION
This article provides a scoping review protocol with a comprehensive and detailed methodology. The review includes both peer-reviewed articles and grey literature, which will contribute to research on mHealth for disease diagnosis and treatment support by health workers in SSA. This scoping review will provide existing evidence on the availability and use of mHealth by health workers for disease diagnosis and treatment support in SSA. The results of this proposed study will reveal gaps in the literature, influence policymakers, contribute to existing knowledge and improve healthcare delivery in SSA. This scoping review is a part of a large study aimed at examining the accessibility of mHealth for disease diagnosis and treatment support by health workers in Ghana.

ETHICS AND DISSEMINATION
This scoping review methodology requires collecting, reviewing and synthesising materials from all available publications; no ethical approval will be required. The
final review will be published in a scientific journal. The results of this review will be presented at appropriate conferences and workshops.

Acknowledgements The authors wish to thank the University of KwaZulu-Natal for giving all the necessary resources in developing this study protocol.

Contributors EO and TPM-T conceptualised this study and the methodology. EO wrote the first draft, and DK and TPM-T critically reviewed the manuscript. All authors (TPM-T, DK and EO) reviewed the final drafted manuscript and approved it.

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Patient consent for publication Not required.

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2. WHO. mHealth new horizons for health through mobile technologies, 2011.
23. Aranda-Jan CB, Mohutsiwa-Dibe N, Lounkano S. Systematic review on what works, what does not work and why of implementation of mobile health (mHealth) projects in Africa. BMC Public Health 2014;14:188.
**PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol**

<table>
<thead>
<tr>
<th>Section and topic</th>
<th>Item No</th>
<th>Checklist item</th>
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<tr>
<td><strong>ADMINISTRATIVE INFORMATION</strong></td>
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<td>Identification</td>
<td>1a</td>
<td>Identify the report as a protocol of a systematic review: <strong>Protocol of a systematic scoping review</strong></td>
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<tr>
<td>Update</td>
<td>1b</td>
<td>If the protocol is for an update of a previous systematic review, identify as such</td>
<td>N/A</td>
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<tr>
<td>Registration</td>
<td>2</td>
<td>If registered, provide the name of the registry (such as PROSPERO) and registration number</td>
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<tr>
<td>Authors: Ernest Osei¹, Desmond Kuupiel¹,², Tivani P. Mashamba-Thompson¹,²</td>
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<tr>
<td>Contact</td>
<td>3a</td>
<td>Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author</td>
<td>1</td>
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<tr>
<td>Contributions</td>
<td>3b</td>
<td>Describe contributions of protocol authors and identify the guarantor of the review</td>
<td>1/16</td>
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<tr>
<td>Amendments</td>
<td>4</td>
<td>If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments</td>
<td>N/A</td>
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<tr>
<td>Support: Sources</td>
<td>5a</td>
<td>Indicate sources of financial or other support for the review</td>
<td>N/A</td>
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<td>Sponsor</td>
<td>5b</td>
<td>Provide name for the review funder and/or sponsor</td>
<td>N/A</td>
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<td>Role of sponsor or funder</td>
<td>5c</td>
<td>Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol</td>
<td>N/A</td>
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<tr>
<td><strong>INTRODUCTION</strong></td>
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<td>Rationale</td>
<td>6</td>
<td>Describe the rationale for the review in the context of what is already known</td>
<td>4-5</td>
</tr>
<tr>
<td>Objectives</td>
<td>7</td>
<td>Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO) - PCC</td>
<td>7-8</td>
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<tr>
<td><strong>METHODS</strong></td>
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<tr>
<td>Eligibility criteria</td>
<td>8</td>
<td>Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review</td>
<td>7-10</td>
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<tr>
<td>Category</td>
<td>Item</td>
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<tr>
<td>Information sources</td>
<td>9</td>
<td>Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage</td>
<td>10-12</td>
</tr>
<tr>
<td>Search strategy</td>
<td>10</td>
<td>Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated</td>
<td>9 and Table 2</td>
</tr>
<tr>
<td>Study records:</td>
<td>11a</td>
<td>Describe the mechanism(s) that will be used to manage records and data throughout the review</td>
<td>6-11</td>
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<td></td>
<td>11b</td>
<td>State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)</td>
<td>10-11</td>
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<td></td>
<td>11c</td>
<td>Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators</td>
<td>10-13</td>
</tr>
<tr>
<td>Data items</td>
<td>12</td>
<td>List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications</td>
<td>7</td>
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<tr>
<td>Outcomes and prioritization</td>
<td>13</td>
<td>List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale</td>
<td>6-13</td>
</tr>
<tr>
<td>Risk of bias in individual studies</td>
<td>14</td>
<td>Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis</td>
<td>N/A</td>
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<tr>
<td>Data synthesis</td>
<td>15a</td>
<td>Describe criteria under which study data will be quantitatively synthesised</td>
<td>N/A</td>
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<tr>
<td></td>
<td>15b</td>
<td>If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall’s τ)</td>
<td>N/A</td>
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<td>15c</td>
<td>Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)</td>
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<td>15d</td>
<td>If quantitative synthesis is not appropriate, describe the type of summary planned</td>
<td>N/A</td>
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<tr>
<td>Meta-bias(es)</td>
<td>16</td>
<td>Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)</td>
<td>N/A</td>
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<tr>
<td>Confidence in cumulative evidence</td>
<td>17</td>
<td>Describe how the strength of the body of evidence will be assessed (such as GRADE)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.