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Availability and use of mHealth for disease diagnosis and treatment support by health workers in Sub-Saharan Africa: A Scoping Review Protocol

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Availability and use of mHealth for disease diagnosis and treatment support by health workers in Sub-Saharan Africa: A Scoping Review Protocol

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Keywords: mHealth; Disease diagnosis; Treatment support; Sub-Saharan Africa

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ABSTRACT

Introduction: Improving healthcare to 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 help achieve universal health coverage. The proposed study will aim to map evidence on the availability and use of mHealth for disease diagnosis and treatment support by health workers in SSA.

Methods and Analysis: This scoping review will be guided by Arksey, H., and O'Malley's scoping review framework, and Levac et al 2010 recommendations and guidelines from 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 searched from inception onwards: Google Scholar; PubMed; MEDLINE and CINAHL with full-text via EBSCOhost; and Science Direct databases. All peer-reviewed primary studies published apart from review articles will be considered. This scoping 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 independent reviewers will carry out abstract and full article screening as well as 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 (PRISMA-ScR) guidelines.

Ethics and dissemination

Ethical approval is not required for the scoping review, which is the first stage in a Ph.D. study in public health on accessing mobile health 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.

ARTICLE SUMMARY

STRENGTHS AND LIMITATIONS OF THIS STUDY

- The scoping review will use a well-established, rigorous scoping review methodology with a systematic strategy.

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- 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 is the date, language and study design limits will be removed.
- This review study was also limited to studies conducted within sub-Saharan Africa which may lead to missing other relevant articles.

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BACKGROUND OF THE STUDY

The mass availability and use of mobile health (mHealth) technology provide a greater potential for such technologies to be integrated into clinical services to support quality medical care (1). World Health Organization (WHO) through its global observatory report defined mHealth as 'medical and public health practice support by mobile devices like mobile phones, patients monitoring devices, personal digital assistants (PDAs) and other wireless devices'(2). In 2015, it was estimated that 52% of smartphone users globally gather health-related information like a medical problem, nutrition, depression, among others on their mobile phones (3). In 2017, the World Health Organization (WHO) estimated users of smartphones in sub-Saharan Africa (SSA) and the Middle East to be about 140.9 million (4). In view of this high mobile penetration rate, mHealth 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 improve the provision of quality healthcare by enhancing treatment, empowering patients, reducing medical cost and streamline the use of health resources (1). Mobile health in the form of text messages and voice calls given to patients can help health workers to remotely monitor their health conditions and assist them to comply with treatment procedures (5). It can save both patients and health providers' time, reduce patients' cost and improves doctor-patient relationships through regular interactions (6). mHealth applications like reference apps, diagnostic apps, and others can assist health workers to be more proactive in addressing the health conditions of their patients (7). mHealth can also help patients to receive healthcare services in real-time to prevent late detection of diseases, improves poor clinical outcomes and among others (7). mHealth promotes maternal, child health and routine immunization (8). It also encourages proper self-chronic disease management and the general wellness of patients (1).

Sustainable Development Goal (SDG) 3.8 (9) target has emphasized the importance of accessing quality, safe, effective and affordable universal health for all. To achieve this goal, mHealth intervention could be adopted to support the provision of universal healthcare in all settings due to the high penetration rate of mobile phones. mHealth interventions could be used by frontline health workers to provide healthcare to patients living in hard-to-reach communities with insufficient or no health facilities available. Studies have demonstrated that mHealth has contributed to achieving universal health coverage (UHC) in both resource-poor

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settings and resource-rich settings (10-12). People living in resource-poor settings in SSA may not have access to quality healthcare because of bad roads, poor health facilities, inadequately skilled health workers, among others (7). To this end, mHealth could be adopted by health workers to support healthcare delivery in such communities since it can reach many more people faster than the traditional way of disease control. There is growing evidence suggesting that countries within SSA have started implementing mHealth programs to support the provision of healthcare (13-15). mHealth interventions in SSA are mainly for data collection (16); disease tracking and surveillance (11); medical education (7); treatment support for medication adherence (17); and improves diagnostic procedures (11). Others include mHealth for exchange of patients data between health providers or between patients and their health providers (18); facilitate access to healthcare in remote and resource-limited settings (18) and many others. In view of this numerous usefulness, there is the need to map evidence from existing literature on the availability and use of mHealth for disease diagnosis and treatment support by health workers in SSA.

Despite the potentials of mHealth, no study to the best of our knowledge has mapped evidence on mHealth for disease diagnosis and treatment support by health workers in SSA. We, therefore, propose to map existing evidence on the availability and use of mHealth for disease diagnosis and treatment support by health workers in SSA. We envisage that the results of this proposed study will reveal research gaps as well as provide useful information that will help improve the availability and use of mHealth in SSA.

METHOD

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 framework, 2005 (19), Levac *et al.* 2010 (20) and the 2015 Joanna Briggs Institute (21) guidelines. A five-step framework from Arksey and O'Malley include the following:

i. Identify the research question
ii. Identifying relevant studies
iii. Selection of studies
iv. Data charting

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v. Collating, summarizing, and reporting the results

This scoping review will be conducted in accordance with guidelines from the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-analysis: Extension for Scoping Reviews) (Figure 1) (22). This protocol has been reported according to the guidelines provided by Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) (Additional file 1).

Step 1: Identify the research question

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

The Population, Concept, and Context (PCC) framework developed by Joanna Briggs Institute (21) has been used to determine the eligibility of the research question for our scoping review (Table 1):

Table 1: Determining the eligibility of the research question

Determinants	Description
Population	**Health workers-** This includes all the various categories of trained health workers such as Physicians, Nurses, Pharmacists/dispensing technicians, Biomedical scientists/Technologist, Radiologists, and others working in healthcare facilities within sub-Saharan Africa.
Concept	**Disease diagnosis and treatment support** **Disease diagnosis-** Use of mHealth as diagnostic apps to screen patients to detect any form of disease or disorder or injury. **Treatment support-** Use of mHealth to provide treatment and assisting patients to manage their disease conditions without traveling to the health facility.
Context	**Availability and use in sub-Saharan Africa**

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	Availability- Is the state of being able to access, use and obtain mHealth application upon a demand to perform a required function. **Use-** Process of employing mHealth to accomplish a task like a diagnosis, treatment, control, and management of diseases.

Inclusion criteria

We will include the following:

- Articles reporting evidence on Health Workers.
- Articles presenting evidence on mHealth interventions such as text message, voice calls, mobile apps, multimedia messaging, and among others.
- Articles that report evidence on the availability of mHealth for disease diagnosis.
- Articles that present evidence on the availability of mHealth for treatment support.
- Articles presenting evidence on the use of mHealth for disease diagnosis.
- Articles reporting evidence on the use of mHealth for treatment support.
- Articles that present evidence from sub-Saharan Africa.

Exclusion criteria

The following will be excluded:

- Articles that report evidence on patients.
- Articles reporting evidence on eHealth applications such as electronic health records, telemedicine, and others.
- Articles presenting evidence on mHealth for surveillance.
- Articles that report evidence on mHealth for health education.
- Articles reporting evidence on mobile clinics.
- Articles that present evidence on mHealth for communication.
- Articles reporting outside sub-Saharan Africa.

Step 2: Identifying relevant studies

Language: Studies written in English and any other languages will be included.

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Time frame: Our searches will begin from the inception of mHealth interventions.

Types of studies: This scoping review study will include imperial research studies on qualitative, quantitative, mixed-method, randomized and non-randomized control trials, and grey literature. All review articles will be excluded.

For the identification of relevant articles, an electronic database search will be carried out using advanced search from the following databases: MEDLINE and CINAHL with full-text via EBSCOhost; PubMed; Science Direct and Google Scholar. We have sort advice from the University of KwaZulu-Natal Library Service for the selection of relevant databases for this study and with keywords searches. World Health Organization (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. MeSH (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):

Table 2: Draft search for PubMed/MEDLINE

Date of Search	Search Engine used	Keywords Search	Number of publications retrieved
17/06/2019	PubMed	((("telemedicine"[MeSH Terms] OR "telemedicine"[All Fields] OR ("mobile"[All Fields(((("telemedicine"[MeSH Terms] OR "telemedicine"[All Fields] OR ("mobile"[All Fields] AND "health"[All Fields]) OR "mobile health"[All Fields]) AND ("technology"[MeSH Terms] OR "technology"[All Fields] OR "technologies"[All Fields])) AND (("disease"[MeSH Terms] OR "disease"[All Fields]) AND	932

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		("diagnosis"[Subheading] OR "diagnosis"[All Fields] OR "diagnosis"[MeSH Terms])) OR (("therapy"[Subheading] OR "therapy"[All Fields] OR "treatment"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]) AND support[All Fields])] AND "health"[All Fields]) OR "mobile health"[All Fields]) AND ("technology"[MeSH Terms] OR "technology"[All Fields] OR "technologies"[All Fields])) AND (("disease"[MeSH Terms] OR "disease"[All Fields]) AND ("diagnosis"[Subheading] OR "diagnosis"[All Fields] OR "diagnosis"[MeSH Terms])) OR (("therapy"[Subheading] OR "therapy"[All Fields] OR "treatment"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]) AND support[All Fields])	

Step 3: Selection of studies

Following databases 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. Discrepancies between the two reviewers' responses at the abstract screening stage will be discussed by the review team until a consensus is reached. Two reviewers (EO and DK) will also 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 (UKZN) will be requested to support our study search strategy to help retrieve full articles that were inaccessible in the above-mentioned databases. The results of

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the screening will then be reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram (22).

Step 4: Data charting

A data charting form will be used to extract all the relevant data from the included articles (Table 3).

Table 3: Data charting table

Author and date
Country
Aim of the study
Geographical setting
Study setting
Study design
Study population
Type of technology
Purpose of mHealth
Disease diagnosis
Treatment support
Key findings of the study
Most significant findings of the study
Conclusions
Notes

The data extraction form will be validated by two reviewers using at least the first 5 articles for consistency. We will update and modify the data extraction form throughout the course of

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the study. Two reviewers (EO and DK) will independently conduct the data extraction in parallel. The standard bibliographical information (i.e. authors, title and year of publication), geographical setting, study setting, study design and aim of the study will be reported. For each 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 tabled. NVivo version 12 software package will assist us in conducting thematic content analysis (23) from the relevant outcomes of the included articles.

Quality Appraisal of studies

The electronic version of the mixed-method appraisal tool **(**MMAT) Version 2018 (24) will be adopted to assess the quality of the included primary studies. The MMAT will be used for the 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, appropriate data sources, appropriate 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' acknowledgment 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 as low quality for 25%; the average for 50%; above average for 75% and the high average for 100 %.

Step 5: Collating, summarizing and reporting the results

The main aim of this study is to map available existing evidence and summarise the findings as reported across all the included articles. We will conduct a thematic content analysis (23) with the support of NVivo version 12 of the included studies. The review team will carefully analyze the emerging themes and relate them to our research question. The reviewers will also analyze 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 findings according to the themes.

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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 World Health Organization (WHO) through its global observatory 2016 report indicated mHealth as one of the new emerging technologies that can help achieve universal health coverage (UHC) (18). According to WHO, mHealth services like short message reminders, 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 (18). 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, 18, 25). Providing healthcare through mobile communication is reported to be cheaper than supplying in-person healthcare services (18). Recent studies demonstrated that mHealth services provided by health workers helped patients especially those in hard-to-reach communities to stick to the treatment process, appointment adherence and many others (17, 26). 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 the evidence within SSA because of the similar health challenges. Our study will not cover articles outside of SSA because they have different health targets and challenges. The study will exclude articles presenting evidence 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 evidence on mHealth for communication in terms of health promotion campaigns or community mobilization to raise awareness of target groups. In addition, the study will exclude articles that report evidence on mHealth for surveillance involving routine and emergency data collection. Again, our proposed study will exclude articles presenting evidence on mHealth for providing medical education to health workers on professional development. This study will cover articles that present evidence published from inception to 2019 to identify the patterns of reports on mHealth interventions. The findings of this study scoping review study will be published in peer-reviewed journals.

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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 evidence on the extent of 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 as well as 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.

Abbreviations

LMICs – Low- and- Middle-Income Countries

PDAs – Personal Digital Assistants

SDG – Sustainable Development Goal

SSA – sub-Saharan Africa

UHC- Universal health coverage

WHO – World Health Organization

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Declarations

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Funding

No funding has been secured yet for this study.

Availability of data and materials

All articles used in this study will be included in the reference list.

Author's contribution

EO and TPM-T conceptualized 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.

Ethics approval and consent to participants

This study will not involve human or animal participants; hence, it does not require ethical approval.

Consent for publication

Not applicable.

Competing Interests

None declared.

References

1. Bradway M, Carrion C, Vallespin B, Saadatfard O, Puigdomènech E, Espallargues M, et al. mHealth assessment: conceptualization of a global framework. 2017;5(5):e60.
2. WHO. mHealth New horizons for health through mobile technologies 2011;3:112.
3. Forrest JI, Wiens M, Kanters S, Nsanzimana S, Lester RT, Mills EJJCOiH, et al. Mobile health applications for HIV prevention and care in Africa. 2015;10(6):464-71.
4. WHO. WHO Annual Report 2017: Yemen. 2018.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

5. Afarikumah EJOjophi. Electronic health in Ghana: current status and future prospects. 2014;5(3):230.
6. Steinhubl SR, Muse ED, Topol EJJStm. The emerging field of mobile health. 2015;7(283):283rv3-rv3.
7. Modi SJPPR. Mobile health technology in developing countries: The case of Tanzania. 2013;6(1):5.
8. Davey S, Davey AJIJom, Health p. Mobile-health technology: Can it strengthen and improve public health systems of other developing countries as per Indian strategies? A systematic review of the literature. 2014;4(1).
9. Organization WH. Access to medical devices for Universal Health Coverage and achievement of SDGs. 2018.
10. Crul S. The mHealth opportunity in Sub-Sahara Africa - Deloitte Open Global Mobile Survey. 2012;3:13.
11. Consulting VWJWD, Berkshire U. mHealth for development: the opportunity of mobile technology for healthcare in the developing world. 2009.
12. Babirye D, Shete PB, Farr K, Nalugwa T, Ojok C, Nantale M, et al. Feasibility of a short message service (SMS) intervention to deliver tuberculosis testing results in peri-urban and rural Uganda. Journal of Clinical Tuberculosis and Other Mycobacterial Diseases. 2019;16:100110.
13. Adetunji AA, Muyibi SA, Imhansoloeva M, Ibraheem OM, Sunmola A, Kolawole OO, et al. Mobile phone use for a social strategy to improve antiretroviral refill experience at a low-resource HIV clinic: patient responses from Nigeria. AIDS Care. 2017;29(5):575-8.
14. Hermans SM, Elbireer S, Tibakabikoba H, Hoefman BJ, Manabe YCJPp, adherence. Text messaging to decrease tuberculosis treatment attrition in TB-HIV coinfection in Uganda. 2017;11:1479.
15. Lambdin BH, Micek MA, Koepsell TD, Hughes JP, Sherr K, Pfeiffer J, et al. An assessment of the accuracy and availability of data in electronic patient tracking systems for patients receiving HIV treatment in central Mozambique. BMC Health Services Research. 2012;12:30-.
16. Medhanyie AA, Spigt M, Yebyo H, Little A, Tadesse K, Dinant G-J, et al. Quality of routine health data collected by health workers using smartphone at primary health care in Ethiopia. International journal of medical informatics. 2017;101:9-14.
17. Nhavoto JA, Grönlund Å, Klein GOJPo. Mobile health treatment support intervention for HIV and tuberculosis in Mozambique: Perspectives of patients and healthcare workers. 2017;12(4):e0176051.
18. WHO. Global diffusion_of_eHealth-_Making_universal_health_coverage_achievable Report on the third global survey on eHealth Geneva World Health Organization. 2016:156.
19. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. International Journal of Social Research Methodology. 2005;8(1):19-32.
20. Levac D, Colquhoun H, O'Brien KKJIs. Scoping studies: advancing the methodology. 2010;5(1):69.
21. Institute JB. Joanna Briggs Institute reviewers' manual. 2015 edition:43.
22. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. 2018;169(7):467-73.
23. Braun V, Clarke, Victoria, Hayfield N, Terry GJHoRMiHSS. Using thematic analysis in psychology. Qualitative Research in Psychology. 2019;3(2):77-101.
24. Quan Nha HONG PP, Sergi FÀBREGUES, Gillian BARTLETT, Felicity BOARDMAN, Margaret CARGO PD, Marie-Pierre GAGNON, Frances GRIFFITHS, Belinda NICOLAL, Alicia O'CATHAIN MCR, & Isabelle VEDEL. Mixed-Method Appraisal Methods Tools MMAT_2018_criteria-manual_2018-08-01. 2018.

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25. Pop-Eleches C, Thirumurthy H, Habyarimana JP, Zivin JG, Goldstein MP, de Walque D, et al. Mobile phone technologies improve adherence to antiretroviral treatment in a resource-limited setting: a randomized controlled trial of text message reminders. AIDS. 2011;25(6):825-34.
26. Moodley J, Constant D, Botha MH, van der Merwe FH, Edwards A, Momberg M. Exploring the feasibility of using mobile phones to improve the management of clients with cervical cancer precursor lesions. BMC Women's Health. 2019;19(1): N.PAG-N.PAG.

Additional files

1. **PRISMA-P** (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*.
2. **Figure 1:** PRISMA ScR flowchart which demonstrates literature search and study selection processes.
3. **Table 1:** Determining the eligibility of the research question.
4. **Table 2:** Draft search for PubMed/MEDLINE.
5. **Table 3:** Data charting table.

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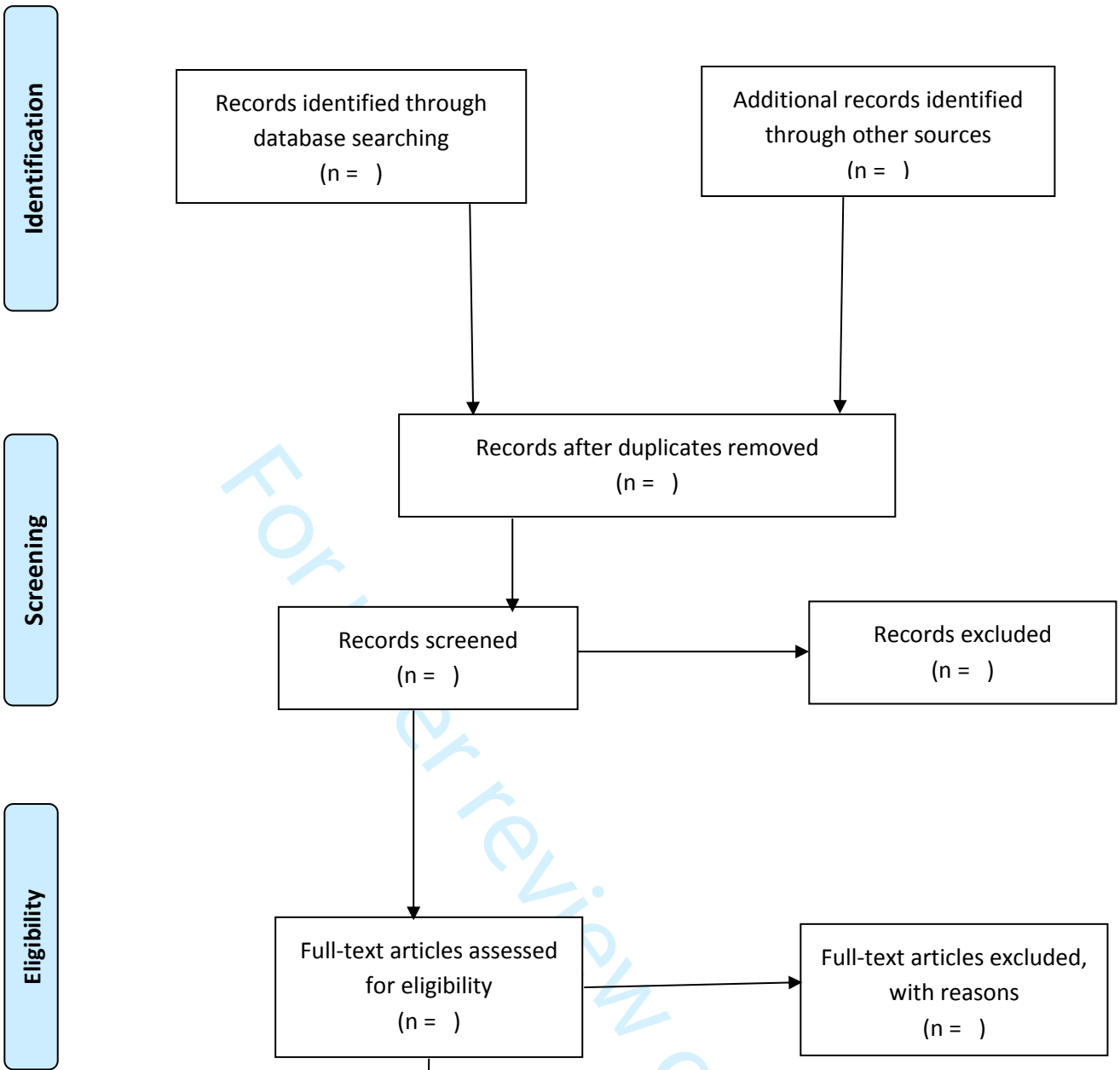

Figure 1: PRISMA ScR flowchart which demonstrates literature search and study selection processes.

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PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	(Page No.#)
ADMINISTRATIVE INFORMATION			
Title:		Availability and use of mHealth for disease diagnosis and treatment support by health workers in Sub-Saharan Africa: A Scoping Review Protocol	
Identification	1a	Identify the report as a protocol of a systematic review: **Protocol of a systematic scoping review**	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	N/A
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	N/A
Authors:		Ernest Osei[1], Desmond Kuupiel[1,2], Tivani P. Mashamba-Thompson[1,2]	
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	1/14
Amendments	4	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	N/A
Support:			
Sources	5a	Indicate sources of financial or other support for the review	N/A
Sponsor	5b	Provide name for the review funder and/or sponsor	N/A
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	N/A
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	4-5
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO) - **PCC**	6
METHODS			
Eligibility criteria	8	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	7-8

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Information sources	9	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	8
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	8 and Table 2
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	7-9
Selection process	11b	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)	9
Data collection process	11c	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	10
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	6
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	5-11
Risk of bias in individual studies	14	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	N/A
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	N/A
	15b	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)	N/A N/A
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	N/A
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	N/A
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	N/A
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	N/A

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Availability and use of mHealth for disease diagnosis and treatment support by health workers in Sub-Saharan Africa: A Scoping Review Protocol

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Keywords: mHealth; Disease diagnosis; Treatment support; Sub-Saharan Africa

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ABSTRACT

Introduction: Improving healthcare to 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, 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, H., and O'Malley's scoping review framework and Levac et al. 2010 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 Science Direct databases. A search in Google Scholar will be considered as an additional information source. The literature search will involve published studies from 1900 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 Ph.D. 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.

ARTICLE SUMMARY

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.

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- In this scoping review study, date, language, and study design limits will be removed.
- This review study was also be limited to studies conducted within sub-Saharan Africa, which may lead to missing other relevant articles.

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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 quality medical care (1). World Health Organization (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 (PDAs) and other wireless devices'(2). In 2015, it was estimated that 52% of smartphone users globally 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 utilization by the population at the end of 2017 was 44% and is forecast to reach 52% by 2025 (4). Mobile health technologies and applications are available and being utilized for screening diseases, medication adherence, follow-ups, appointment reminders, and many others (5, 6). Given the large availability and utilization 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 improve the provision of quality healthcare by enhancing treatment, empowering patients, reducing medical cost, and streamline the use of health resources (1). Mobile health in the form of text messages and voice calls given to patients can help health workers to monitor their health conditions remotely and assist them in complying with treatment procedures (7). It can save both patients and health providers' time, reduce patients' costs, and improves doctor-patient relationships through regular interactions (8). mHealth applications like reference apps, diagnostic apps, and others can help health workers be more proactive in addressing their patients' health conditions (9). mHealth can also help patients to receive healthcare services in real-time to prevent late detection of diseases, improves poor clinical outcomes, and among others (9). mHealth promotes maternal, child health, and routine immunization (10). It also encourages proper self-chronic disease management and the general wellness of patients (1).

Although a lot has been published on the potential benefits of mHealth technologies and applications in SSA (8-11), the uptake of mHealth has been faced with several challenges and barriers. Prominent among the challenges is the inadequate ICT trained healthcare professionals who could effectively use mHealth applications (12). Research has shown that a

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significant population of people in countries within SSA are illiterate and are poor digitally (12). Other studies have also revealed some mHealth challenges as the small size of the mobile phone screen, the quality of image, poor network connection in transmitting data, and weak legislation to regulate mHealth in SSA (12, 13). In addition, other challenges of mHealth applications in SSA are technical, financial, and infrastructural barriers, data security, and the accuracy of mHealth diagnostic tools (14). Similar implementational challenges are technology usability, sustainable funding, learning environment, the culture of information use, and cost-effectiveness (15).

Sustainable Development Goal (SDG) 3.8 (16) target has emphasized the importance of accessing quality, safe, effective, and affordable universal health for all. To achieve this goal, mHealth intervention could be adopted to support universal healthcare provision in all settings despite some of these implementational challenges and barriers. mHealth interventions could be used by frontline health workers to provide healthcare to patients living in hard-to-reach communities with insufficient or no health facilities. Studies have demonstrated that mHealth has contributed to achieving Universal Health Coverage (UHC) in both resource-poor settings and resource-rich settings (11, 17, 18). People living in resource-poor settings in SSA may not have access to quality healthcare because of bad roads, inadequate health facilities, and inadequately skilled workers, among others (9). To this end, mHealth could be adopted by health workers to support healthcare delivery in such communities since it can reach many more people faster than the traditional way of controlling diseases. There is growing evidence suggesting that countries within SSA have started implementing mHealth programs to support healthcare provision (19-21). mHealth interventions in SSA are mainly for data collection (22), disease tracking and surveillance (17), medical education (9); treatment support for medication adherence (23); and improves diagnostic procedures (17). Others include mHealth for exchange of patients data between health providers or between patients and their health providers (24), facilitate access to healthcare in remote and resource-limited settings (24), and many others.

Despite these numerous usefulness and challenges of mHealth, there is the need to map evidence from existing literature on the availability and use of mHealth for disease diagnosis and treatment support by health workers in SSA. This review aims to map existing evidence on the availability and use of mHealth for disease diagnosis and treatment support by health workers in SSA. This study will provide the extent of availability and use of mHealth applications by healthcare workers for diagnosing, screening, and testing of diseases in SSA.

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It will also provide the extent of availability and use of mHealth to support medication and treatment adherence, appointment reminders, disease surveillance, and health monitoring, and others in SSA. We envisage that the results of this proposed study will reveal research gaps as well as provide useful information that will help improve the availability and use of mHealth in SSA.

METHOD

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 framework, 2005 (25), Levac *et al.* 2010 (26) and the 2015 Joanna Briggs Institute (27) guidelines. A five-step structure from Arksey and O'Malley include the following:

i. Identify the research question
ii. Identifying relevant studies
iii. Selection of studies
iv. Data charting
v. Collating, summarizing, and reporting the results

This scoping review will be conducted following guidelines from the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-analysis: Extension for Scoping Reviews) (Figure 1) (28). This protocol has been reported according to the guidelines provided by Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) (Additional file 1).

Step 1: Identify the research question.

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

The sub-research questions are as follows:

What is the extent of evidence on the availability of mHealth for disease diagnosis and treatment support by health workers in SSA?

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What is the extent of evidence on the use of mHealth for disease diagnosis and treatment support by health workers in SSA?

The Population, Concept, and Context (PCC) framework developed by Joanna Briggs Institute (27) has been used to determine the eligibility of the research question for our scoping review (Table 1):

Table 1: Determining the eligibility of the research question

Determinants	Description
Population	**Health workers**- 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, and others working in healthcare facilities within sub-Saharan Africa.
Concept	**Disease diagnosis and treatment support** **Disease diagnosis-** Use of mHealth as diagnostic apps to screen patients to detect any form of disease, disorder, or injury. **Treatment support-** Use of mHealth to provide treatment and assisting patients in managing their disease conditions without traveling to the health facility.
Context	**Availability and use in sub-Saharan Africa** **Availability-** Is the state of being able to access, use, and obtain mHealth application upon a demand to perform a required function. **Use-** Process of employing mHealth to accomplish a task like a diagnosis, treatment, control, and management of diseases.

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Step 2: Identifying relevant studies

For the identification of relevant articles, an electronic database search will be carried out using advanced search from the following databases: MEDLINE and CINAHL with full-text via EBSCOhost; PubMed, and Science Direct. A search in Google Scholar will be considered as an additional source of information. We have sought advice from the University of KwaZulu-Natal Library Service for selecting relevant databases for this study and with keywords searches. World Health Organization (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. MeSH (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):

Table 2: Draft search for PubMed/MEDLINE

Date of Search	Search Engine used	Keywords Search	Number of publications retrieved
17/06/2019	PubMed	((("telemedicine"[MeSH Terms] OR "telemedicine"[All Fields] OR ("mobile"[All Fields(("telemedicine"[MeSH Terms] OR "telemedicine"[All Fields] OR ("mobile"[All Fields] AND "health"[All Fields]) OR "mobile health"[All Fields]) AND ("technology"[MeSH Terms] OR "technology"[All Fields] OR "technologies"[All Fields])) AND (("disease"[MeSH Terms] OR "disease"[All Fields]) AND ("diagnosis"[Subheading] OR "diagnosis"[All Fields] OR "diagnosis"[MeSH Terms]))) OR (("therapy"[Subheading]	932

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		OR "therapy"[All Fields] OR "treatment"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]) AND support[All Fields])] AND "health"[All Fields]) OR "mobile health"[All Fields]) AND ("technology"[MeSH Terms] OR "technology"[All Fields] OR "technologies"[All Fields])) AND (("disease"[MeSH Terms] OR "disease"[All Fields]) AND ("diagnosis"[Subheading] OR "diagnosis"[All Fields] OR "diagnosis"[MeSH Terms]))) OR (("therapy"[Subheading] OR "therapy"[All Fields] OR "treatment"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]) AND support[All Fields])	

Inclusion criteria

We will include the following:

- Studies involving healthcare workers using mHealth.
- Articles presenting findings on mHealth interventions such as text message, voice calls, mobile apps, multimedia messaging, and among others.
- Articles that report findings on the availability of mHealth for disease diagnosis.
- Articles that present findings on the availability of mHealth for treatment support.
- Articles presenting findings on the use of mHealth for disease diagnosis.
- Articles reporting findings on the use of mHealth for treatment support.
- Articles that present findings on mHealth from sub-Saharan Africa.
- Primary research studies on qualitative, quantitative, mixed-method, randomized controlled trials and non-randomized controlled trials, and grey literature.
- All articles published from 1900 to 2020 in any language.

Exclusion criteria

The following will be excluded:

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- Studies involving patients using mHealth applications.
- Articles reporting findings on eHealth applications such as medical health records, personal health records, and many others.
- Articles that report findings on mHealth for health education.
- Articles reporting findings on mHealth for data collection.
- Articles that present findings on mHealth for communication.
- Articles reporting findings on mHealth outside sub-Saharan Africa.
- Review articles.

Step 3: Selection of studies

Following databases 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 (UKZN) will be requested to support our study search strategy to help retrieve full articles that were inaccessible in the databases, as mentioned earlier. The screening results will then be reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram (28).

Step 4: Data charting

A data charting form will be used to extract all the relevant data from the included articles (Table 3).

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Table 3: Data charting table

Author and date
Country
Aim of the study
Geographical setting
Study setting
Study design
Study population
Type of technology
Purpose of mHealth
Disease diagnosis
Treatment support
Key findings of the study
Most significant findings of the study
Conclusions
Notes

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 (i.e., authors, title, and year of publication), geographical setting, study setting, study design, and aim of the study will be reported. For each included primary studies, information on the target population, type of technology, type

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of mHealth intervention, the purpose of mHealth, disease diagnosis, treatment support, key findings, most significant findings, conclusions, and notes will be tabled. NVivo version 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) Version 2018 (30) 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' acknowledgment 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 version 12 of the included studies. The review team will carefully analyze the emerging themes and relate them to our research question. The reviewers will also analyze 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 World Health Organization (WHO), through its global observatory 2016 report indicated mHealth as

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one of the new emerging technologies that can help achieve universal health for all (24). According to WHO, mHealth services like short message reminders, 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 (24). 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, 24, 31). Providing healthcare through mobile communication is reported to be cheaper than supplying in-person healthcare services (24). Recent studies demonstrated that mHealth services helped patients, especially those in hard-to-reach communities stick to treatment procedures, appointment adherence, and many others (23, 32). 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 mobilization to raise awareness of target groups. Also, the study will exclude articles that report findings on mHealth for surveillance involving routine and emergency data collection. 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 1900 to 2020 to identify the patterns of reports on mHealth interventions. The findings of this scoping review study will be published in peer-reviewed journals.

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

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workers in SSA. This scoping review will provide evidence on the extent of 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 synthesizing 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.

Abbreviations

LMICs – Low- and- Middle-Income Countries

PDAs – Personal Digital Assistants

SDG – Sustainable Development Goal

SSA – sub-Saharan Africa

UHC- Universal health coverage

WHO – World Health Organization

Declarations

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No funding has been secured yet for this study.

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Availability of data and materials

All articles used in this study will be included in the reference list.

Author's contribution

EO and TPM-T conceptualized 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.

Ethics approval and consent to participants

This study will not involve human or animal participants; hence, it does not require ethical approval.

Consent for publication

Not applicable.

Competing Interests

None declared.

References

1. Bradway M, Carrion C, Vallespin B, Saadatfard O, Puigdomènech E, Espallargues M, et al. mHealth assessment: conceptualization of a global framework. 2017;5(5):e60.
2. WHO. mHealth New horizons for health through mobile technologies 2011;3:112.
3. Forrest JI, Wiens M, Kanters S, Nsanzimana S, Lester RT, Mills EJJCOiH, et al. Mobile health applications for HIV prevention and care in Africa. 2015;10(6):464-71.
4. GSMA. Mobile Economy Sub- Saharan Africa. 2019:50.
5. Haberer JE, Musiimenta A, Atukunda EC, Musinguzi N, Wyatt MA, Ware NC, et al. Short message service (SMS) reminders and real-time adherence monitoring improve antiretroviral therapy adherence in rural Uganda. AIDS (London, England). 2016;30(8):1295.
6. Nhavoto JA, Grönlund Å, Klein GO. Mobile health treatment support intervention for HIV and tuberculosis in Mozambique: Perspectives of patients and healthcare workers. PloS one. 2017;12(4).
7. Afarikumah EJOjophi. Electronic health in Ghana: current status and future prospects. 2014;5(3):230.
8. Steinhubl SR, Muse ED, Topol EJJStm. The emerging field of mobile health. 2015;7(283):283rv3-rv3.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

9. Modi S. Mobile health technology in developing countries: The case of Tanzania. Pepperdine Policy Review. 2013;6(1):5.
10. Davey S, Davey AJIJom, Health p. Mobile-health technology: Can it strengthen and improve public health systems of other developing countries as per Indian strategies? A systematic review of the literature. 2014;4(1).
11. Crul S. The mHealth opportunity in Sub-Sahara Africa - Deloitte Open Global Mobile Survey. 2012;3:13.
12. Eilu E. Improving Access to Health Services in Sub-Saharan Africa Using Mobile and Wireless Technologies. Current and Emerging mHealth Technologies: Springer; 2018. p. 225-40.
13. WHO. World Health Organization Guidelines. 2018:116.
14. Brinkel J, May J, Krumkamp R, Lamshoft M, Kreuels B, Owusu-Dabo E, et al. Mobile phone-based interactive voice response as a tool for improving access to healthcare in remote areas in Ghana - an evaluation of user experiences. Tropical medicine & international health : TM & IH. 2017;22(5):622-30.
15. Leon N, Schneider H, Daviaud E. Applying a framework for assessing the health system challenges to scaling up mHealth in South Africa. BMC medical informatics and decision making. 2012;12:123-.
16. Organization WH. Access to medical devices for Universal Health Coverage and achievement of SDGs. 2018.
17. Consulting VWJWD, Berkshire U. mHealth for development: the opportunity of mobile technology for healthcare in the developing world. 2009.
18. Babirye D, Shete PB, Farr K, Nalugwa T, Ojok C, Nantale M, et al. Feasibility of a short message service (SMS) intervention to deliver tuberculosis testing results in peri-urban and rural Uganda. Journal of Clinical Tuberculosis and Other Mycobacterial Diseases. 2019;16:100110.
19. Adetunji AA, Muyibi SA, Imhansoloeva M, Ibraheem OM, Sunmola A, Kolawole OO, et al. Mobile phone use for a social strategy to improve antiretroviral refill experience at a low-resource HIV clinic: patient responses from Nigeria. AIDS Care. 2017;29(5):575-8.
20. Hermans SM, Elbireer S, Tibakabikoba H, Hoefman BJ, Manabe YCJPp, adherence. Text messaging to decrease tuberculosis treatment attrition in TB-HIV coinfection in Uganda. 2017;11:1479.
21. Lambdin BH, Micek MA, Koepsell TD, Hughes JP, Sherr K, Pfeiffer J, et al. An assessment of the accuracy and availability of data in electronic patient tracking systems for patients receiving HIV treatment in central Mozambique. BMC Health Services Research. 2012;12:30-.
22. Medhanyie AA, Spigt M, Yebyo H, Little A, Tadesse K, Dinant G-J, et al. Quality of routine health data collected by health workers using smartphone at primary health care in Ethiopia. International journal of medical informatics. 2017;101:9-14.
23. Nhavoto JA, Grönlund Å, Klein GOJPo. Mobile health treatment support intervention for HIV and tuberculosis in Mozambique: Perspectives of patients and healthcare workers. 2017;12(4):e0176051.
24. WHO. Global diffusion_of_eHealth-_Making_universal_health_coverage_achievable Report on the third global survey on eHealth Geneva World Health Organization. 2016:156.
25. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. International Journal of Social Research Methodology. 2005;8(1):19-32.
26. Levac D, Colquhoun H, K OBK. Scoping studies: advancing the methodology. Implementation science 2010;5(1):69.
27. Institute JB. Joanna Briggs Institute reviewers' manual. 2015 edition:43.
28. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. 2018;169(7):467-73.

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29. Braun V, Clarke, Victoria, Hayfield N, Terry GJHoRMiHSS. Using thematic analysis in psychology. Qualitative Research in Psychology. 2019;3(2):77-101.
30. Quan Nha HONG PP, Sergi FÀBREGUES, Gillian BARTLETT, Felicity BOARDMAN,, Margaret CARGO PD, Marie-Pierre GAGNON, Frances GRIFFITHS, Belinda NICOLAL,, Alicia O'CATHAIN MCR, & Isabelle VEDEL. Mixed Method Appraisal Methods Tools MMAT_2018_criteria-manual_2018-08-01. 2018.
31. Pop-Eleches C, Thirumurthy H, Habyarimana JP, Zivin JG, Goldstein MP, de Walque D, et al. Mobile phone technologies improve adherence to antiretroviral treatment in a resource-limited setting: a randomized controlled trial of text message reminders. AIDS (London, England). 2011;25(6):825-34.
32. Moodley J, Constant D, Botha MH, van der Merwe FH, Edwards A, Momberg M. Exploring the feasibility of using mobile phones to improve the management of clients with cervical cancer precursor lesions. BMC Women's Health. 2019;19(1):N.PAG-N.PAG.

Additional files

1. **PRISMA-P** (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*.
2. **Figure 1:** PRISMA ScR flowchart, which demonstrates the literature search and study selection processes.

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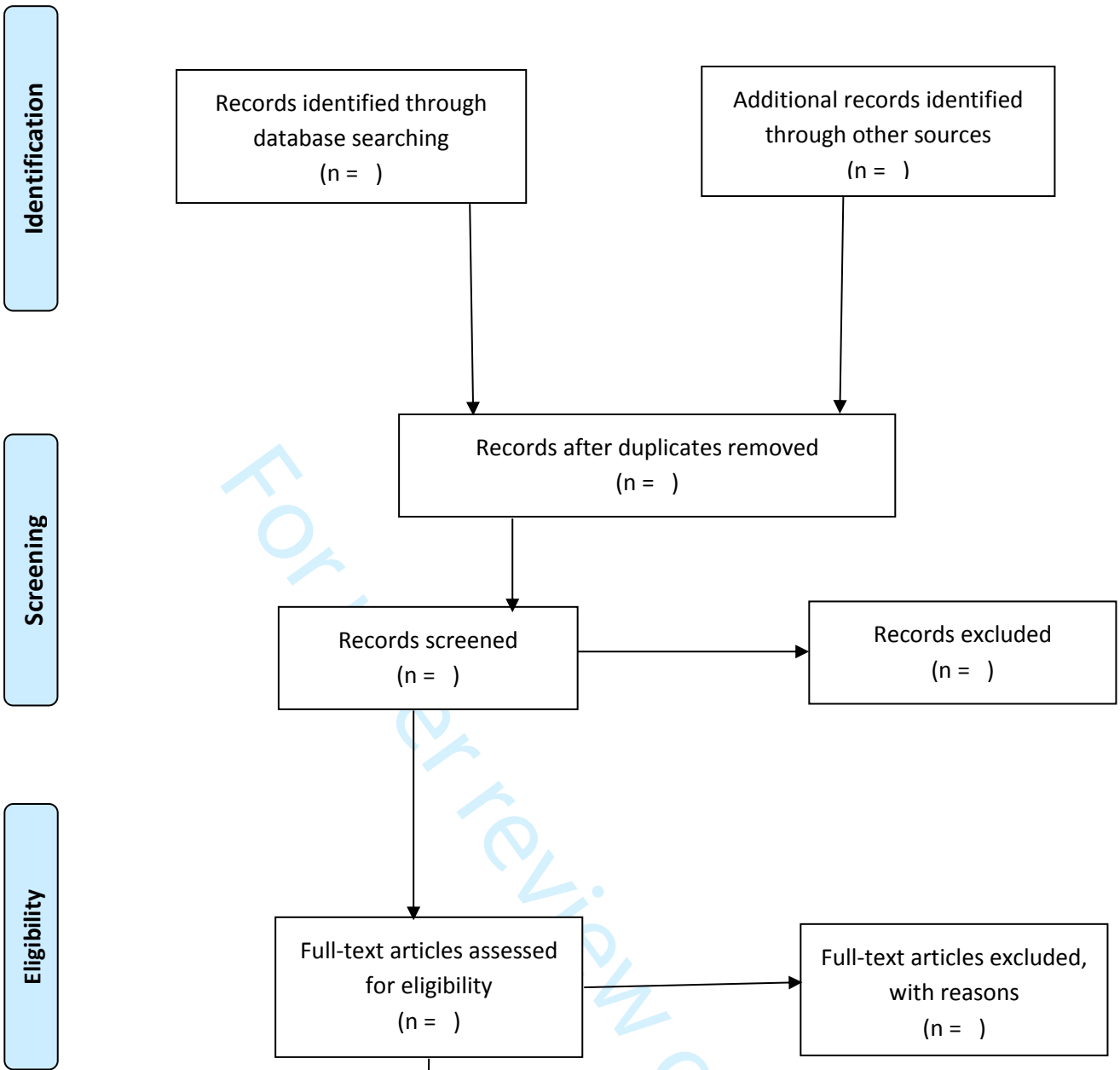

Figure 1: PRISMA ScR flowchart which demonstrates literature search and study selection processes.

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PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	(Page No.#)
ADMINISTRATIVE INFORMATION			
Title:		Availability and use of mHealth for disease diagnosis and treatment support by health workers in Sub-Saharan Africa: A Scoping Review Protocol	
Identification	1a	Identify the report as a protocol of a systematic review: **Protocol of a systematic scoping review**	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	N/A
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	N/A
Authors:		Ernest Osei[1], Desmond Kuupiel[1,2], Tivani P. Mashamba-Thompson[1,2]	
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	1/15
Amendments	4	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	N/A
Support:			
Sources	5a	Indicate sources of financial or other support for the review	N/A
Sponsor	5b	Provide name for the review funder and/or sponsor	N/A
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	N/A
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	4-6
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO) - **PCC**	7
METHODS			
Eligibility criteria	8	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	7-9

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Information sources	9	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	8-9
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	8 and Table 2
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	6-10
Selection process	11b	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)	10
Data collection process	11c	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	10-12
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	7
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	6-12
Risk of bias in individual studies	14	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	N/A
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	N/A
	15b	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)	N/A N/A
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	N/A
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	N/A
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	N/A
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	N/A

*** 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.**

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Availability and use of mHealth for disease diagnosis and treatment support by health workers in Sub-Saharan Africa: A Scoping Review Protocol

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Keywords: mHealth; Disease diagnosis; Treatment support; Sub-Saharan Africa

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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, 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, H., and O'Malley's scoping review framework and Levac et al. 2010 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 Science Direct 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 Ph.D. 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.

ARTICLE SUMMARY

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.

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- The review will be limited to studies published from 2000 to 2020.
- This review study was also be limited to studies conducted within sub-Saharan Africa, which may lead to missing other relevant articles.

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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 quality medical care (1). World Health Organization (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 (PDAs) and other wireless devices'(2). In 2015, it was estimated that 52% of smartphone users globally 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 utilization by the population at the end of 2017 was 44% and is forecast to reach 52% by 2025 (4). Mobile health technologies and applications are available and being utilized for screening diseases, medication adherence, follow-ups, appointment reminders, and many others (5, 6). Given the large availability and utilization 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 improve the provision of quality healthcare by enhancing treatment, empowering patients, reducing medical cost, and streamline the use of health resources (1). Mobile health in the form of text messages and voice calls given to patients could help healthcare workers to monitor patients' health conditions remotely and assist them in complying with treatment procedures (7). It could save both patients and health providers' time, reduce patients' costs, and improves doctor-patient relationships through regular interactions (8). mHealth applications like reference apps, diagnostic apps, and others could help healthcare workers to be more proactive in addressing their patients' health conditions (9). mHealth could also assist patients to receive healthcare services in real-time to prevent late detection of diseases, improves poor clinical outcomes, and several others (9). mHealth promotes maternal and child health, and routine immunization (10). It also encourages proper self-chronic disease management and the general wellness of patients (1).

Although a lot has been published on the potential benefits of mHealth technologies and applications in SSA (8-11), the uptake of mHealth has been faced with several challenges and barriers. Prominent among the challenges is the inadequate ICT trained healthcare professionals who could effectively use mHealth applications (12). Research has shown that a significant population of people in countries within SSA are illiterate and are poor digitally

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(12). Other studies have demonstrated that the small size of the mobile phone screen, the quality of image, poor network connection in transmitting data, and weak legislation are some of the challenges affecting mHealth in SSA (12, 13). In addition, other challenges of mHealth applications in SSA are technical, financial, and infrastructural barriers, data security, and the accuracy of mHealth diagnostic tools (14). Similar implementational challenges are technology usability, sustainable funding, learning environment, the culture of information use, and cost-effectiveness (15).

Sustainable Development Goal (SDG) 3.8 (16) target has emphasized the importance of accessing quality, safe, effective, and affordable universal health for all. To achieve this goal, mHealth interventions could be adopted to support universal healthcare provision in all settings despite some of these implementational challenges and barriers. mHealth interventions could be used by frontline health workers to provide healthcare to patients living in hard-to-reach communities with insufficient or no healthcare facilities. Studies have demonstrated that mHealth has contributed to achieving Universal Health Coverage (UHC) in both resource-poor settings and resource-rich settings (11, 17, 18). People living in resource-poor settings in SSA may not have access to quality healthcare because of bad roads, inadequate health facilities, and inadequately skilled workers, among others (9). To this end, mHealth could be adopted by health workers to support healthcare delivery in such communities since it can reach many more people faster than the traditional way of controlling diseases.

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 (19-23). 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.

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METHOD

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 framework, 2005 (24), Levac *et al.* 2010 (25) and the 2015 Joanna Briggs Institute (26) guidelines. A five-step structure from Arksey and O'Malley include the following:

i. Identify the research question
ii. Identifying relevant studies
iii. Selection of studies
iv. Data charting
v. Collating, summarizing, and reporting the results

This scoping review will be conducted following guidelines from the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-analysis: Extension for Scoping Reviews) (Figure 1) (27). This protocol has been reported according to the guidelines provided by Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) (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 sub-research questions are as follows:

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

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

The Population, Concept, and Context (PCC) framework developed by Joanna Briggs Institute (26) has been used to determine the eligibility of the research question for our scoping review (Table 1):

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

178

Determinants	Description
Population	**Healthcare workers-** 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 sub-Saharan Africa. 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.
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 sub-Saharan Africa** **Availability-** Is the state of being able to access, use, and obtain mHealth applications upon 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.

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	Use- The process of employing mHealth applications to accomplish tasks such as diagnoses and screening of diseases, treatment, and management of conditions of patients.

Step 2: Identifying relevant studies

For the identification of relevant articles, an electronic database search will be carried out using advanced search from the following databases: MEDLINE and CINAHL with full-text via EBSCOhost; PubMed, and Science Direct. A search in Google Scholar will be considered as an additional source of information. We have sought advice from the University of KwaZulu-Natal Library Service for selecting relevant databases for this study and with keywords searches. World Health Organization (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. MeSH (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):

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Table 2: Draft search for PubMed/MEDLINE

Date of Search	Search Engine used	Keywords Search	Number of publications retrieved
17/06/2019	PubMed	((("telemedicine"[MeSH Terms] OR "telemedicine"[All Fields] OR ("mobile"[All Fields(("telemedicine"[MeSH Terms] OR "telemedicine"[All Fields] OR ("mobile"[All Fields] AND "health"[All Fields]) OR "mobile health"[All Fields]) AND ("technology"[MeSH Terms] OR "technology"[All Fields] OR "technologies"[All Fields])) AND (("disease"[MeSH Terms] OR "disease"[All Fields]) AND ("diagnosis"[Subheading] OR "diagnosis"[All Fields] OR "diagnosis"[MeSH Terms]))) OR (("therapy"[Subheading] OR "therapy"[All Fields] OR "treatment"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]) AND support[All Fields])] AND "health"[All Fields]) OR "mobile health"[All Fields]) AND ("technology"[MeSH Terms] OR "technology"[All Fields] OR "technologies"[All Fields])) AND (("disease"[MeSH Terms] OR "disease"[All Fields]) AND ("diagnosis"[Subheading] OR "diagnosis"[All Fields] OR "diagnosis"[MeSH Terms]))) OR (("therapy"[Subheading] OR "therapy"[All Fields] OR "treatment"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]) AND support[All Fields])	932

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Inclusion criteria

We will include the following:

- Studies involving healthcare workers using mHealth.
- Articles presenting findings on mHealth interventions such as text message, voice calls, mobile apps, multimedia messaging, and among others.
- Articles that report findings on the availability of mHealth for disease diagnosis.
- Articles that present findings on the availability of mHealth for treatment support.
- Articles presenting findings on the use of mHealth for disease diagnosis.
- Articles reporting findings on the use of mHealth for treatment support.
- Articles that present findings on mHealth from sub-Saharan Africa.
- Primary research studies on qualitative, quantitative, mixed-method, randomized controlled trials and non-randomized controlled trials, and grey literature.
- All articles published from 2000 to 2020 in any language.

Exclusion criteria

The following will be excluded:

- Studies involving patients using mHealth applications.
- Articles reporting findings on eHealth applications such as medical health records, personal health records, and many others.
- Articles that report findings on mHealth for health education.
- Articles reporting findings on mHealth for data collection without diagnosis and treatment support of conditions.
- Articles that present findings on mHealth for communication without disease diagnosis and treatment support of conditions.
- Articles reporting findings on mHealth outside sub-Saharan Africa.
- 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)

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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 (UKZN) 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 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram (27).

Step 4: Data charting

A data charting form will be used to extract all the relevant data from the included articles (Table 3).

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Table 3: Data charting table

Author and date
Country
Aim of the study
Geographical setting
Study setting
Study design
Study population
Type of technology
Purpose of mHealth
Disease diagnosis
Treatment support
Key findings of the study
Most significant findings of the study
Conclusions
Notes

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 (i.e., 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

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tabled. NVivo version 12 software package will assist us in conducting thematic content analysis (28) from the relevant outcomes of the included articles.

Quality Appraisal of studies

The electronic version of the mixed-method appraisal tool **(**MMAT) Version 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' acknowledgment 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 (28) with the support of NVivo version 12 of the included studies. The review team will carefully analyze the emerging themes and relate them to our research question. The reviewers will also analyze 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 World Health Organization (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

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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 (32, 33). 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 mobilization 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

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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 synthesizing 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.

Abbreviations

LMICs – Low- and- Middle-Income Countries

PDAs – Personal Digital Assistants

SDG – Sustainable Development Goal

SSA – sub-Saharan Africa

UHC- Universal health coverage

WHO – World Health Organization

Declarations

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Funding

No funding has been secured for this study.

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Availability of data and materials

All articles used in this study will be included in the reference list.

Author's contribution

EO and TPM-T conceptualized 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.

Ethics approval and consent to participants

This study will not involve human or animal participants; hence, it does not require ethical approval.

Consent for publication

Not applicable.

Competing Interests

None declared.

References

1. Bradway M, Carrion C, Vallespin B, Saadatfard O, Puigdomènech E, Espallargues M, et al. mHealth assessment: conceptualization of a global framework. 2017;5(5):e60.
2. WHO. mHealth New horizons for health through mobile technologies 2011;3:112.
3. Forrest JI, Wiens M, Kanters S, Nsanzimana S, Lester RT, Mills EJJCOiH, et al. Mobile health applications for HIV prevention and care in Africa. 2015;10(6):464-71.
4. GSMA. Mobile Economy Sub- Saharan Africa. 2019:50.
5. Haberer JE, Musiimenta A, Atukunda EC, Musinguzi N, Wyatt MA, Ware NC, et al. Short message service (SMS) reminders and real-time adherence monitoring improve antiretroviral therapy adherence in rural Uganda. AIDS (London, England). 2016;30(8):1295.
6. Nhavoto JA, Grönlund Å, Klein GO. Mobile health treatment support intervention for HIV and tuberculosis in Mozambique: Perspectives of patients and healthcare workers. PloS one. 2017;12(4).
7. Afarikumah EJOjophi. Electronic health in Ghana: current status and future prospects. 2014;5(3):230.
8. Steinhubl SR, Muse ED, Topol EJJStm. The emerging field of mobile health. 2015;7(283):283rv3-rv3.
9. Modi S. Mobile health technology in developing countries: The case of Tanzania. Pepperdine Policy Review. 2013;6(1):5.
10. Davey S, Davey AJIJom, Health p. Mobile-health technology: Can it strengthen and improve public health systems of other developing countries as per Indian strategies? A systematic review of the literature. 2014;4(1).

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

11. Crul S. The mHealth opportunity in Sub-Sahara Africa - Deloitte Open Global Mobile Survey. 2012;3:13.
12. Eilu E. Improving Access to Health Services in Sub-Saharan Africa Using Mobile and Wireless Technologies. Current and Emerging mHealth Technologies: Springer; 2018. p. 225-40.
13. WHO. World Health Organization Guidelines. 2018:116.
14. Brinkel J, May J, Krumkamp R, Lamshoft M, Kreuels B, Owusu-Dabo E, et al. Mobile phone-based interactive voice response as a tool for improving access to healthcare in remote areas in Ghana - an evaluation of user experiences. Tropical medicine & international health : TM & IH. 2017;22(5):622-30.
15. Leon N, Schneider H, Daviaud E. Applying a framework for assessing the health system challenges to scaling up mHealth in South Africa. BMC medical informatics and decision making. 2012;12:123-.
16. Organization WH. Access to medical devices for Universal Health Coverage and achievement of SDGs. 2018.
17. Consulting VWJWD, Berkshire U. mHealth for development: the opportunity of mobile technology for healthcare in the developing world. 2009.
18. Babirye D, Shete PB, Farr K, Nalugwa T, Ojok C, Nantale M, et al. Feasibility of a short message service (SMS) intervention to deliver tuberculosis testing results in peri-urban and rural Uganda. Journal of Clinical Tuberculosis and Other Mycobacterial Diseases. 2019;16:100110.
19. Braun R, Catalani C, Wimbush J, Israelski D. Community health workers, and mobile technology: a systematic review of the literature. PloS one. 2013;8(6):e65772.
20. Källander K, Tibenderana JK, Akpogheneta OJ, Strachan DL, Hill Z, ten Asbroek AHA, et al. Mobile health (mHealth) approaches and lessons for increased performance and retention of community health workers in low- and middle-income countries: a review. Journal of medical Internet research. 2013;15(1):e17-e.
21. Hermans SM, Elbireer S, Tibakabikoba H, Hoefman BJ, Manabe YCJPp, adherence. Text messaging to decrease tuberculosis treatment attrition in TB-HIV coinfection in Uganda. 2017;11:1479.
22. Agarwal S, Perry HB, Long LA, Labrique AB. Evidence on the feasibility and effective use of mH ealth strategies by frontline health workers in developing countries: a systematic review. Tropical medicine international health. 2015;20(8):1003-14.
23. Aranda-Jan CB, Mohutsiwa-Dibe N, Loukanova S. Systematic review on what works, what does not work, and why of the implementation of mobile health (mHealth) projects in Africa. BMC Public Health. 2014;14:188-.
24. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. International Journal of Social Research Methodology. 2005;8(1):19-32.
25. Levac D, Colquhoun H, K OBK. Scoping studies: advancing the methodology. Implementation science 2010;5(1):69.
26. Institute JB. Joanna Briggs Institute reviewers' manual. 2015 edition:43.
27. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. 2018;169(7):467-73.
28. Braun V, Clarke, Victoria, Hayfield N, Terry GJHoRMiHSS. Using thematic analysis in psychology. Qualitative Research in Psychology. 2019;3(2):77-101.
29. Quan Nha HONG PP, Sergi FÀBREGUES, Gillian BARTLETT, Felicity BOARDMAN, Margaret CARGO PD, Marie-Pierre GAGNON, Frances GRIFFITHS, Belinda NICOLAL, Alicia O'CATHAIN MCR, & Isabelle VEDEL. Mixed-Method Appraisal Methods Tools MMAT_2018_criteria-manual_2018-08-01. 2018.
30. WHO. Global diffusion_of_eHealth-_Making_universal_health_coverage_achievable Report on the third global survey on eHealth Geneva World Health Organization. 2016:156.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

31. Pop-Eleches C, Thirumurthy H, Habyarimana JP, Zivin JG, Goldstein MP, de Walque D, et al. Mobile phone technologies improve adherence to antiretroviral treatment in a resource-limited setting: a randomized controlled trial of text message reminders. AIDS (London, England). 2011;25(6):825-34.
32. Nhavoto JA, Grönlund Å, Klein GOJPo. Mobile health treatment support intervention for HIV and tuberculosis in Mozambique: perspectives of patients and healthcare workers. 2017;12(4):e0176051.
33. Moodley J, Constant D, Botha MH, van der Merwe FH, Edwards A, Momberg M. Exploring the feasibility of using mobile phones to improve the management of clients with cervical cancer precursor lesions. BMC Women's Health. 2019;19(1): N.PAG-N.PAG.

Additional files

1. **PRISMA-P** (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*.
2. **Figure 1:** PRISMA ScR flowchart, which demonstrates the literature search and study selection processes.

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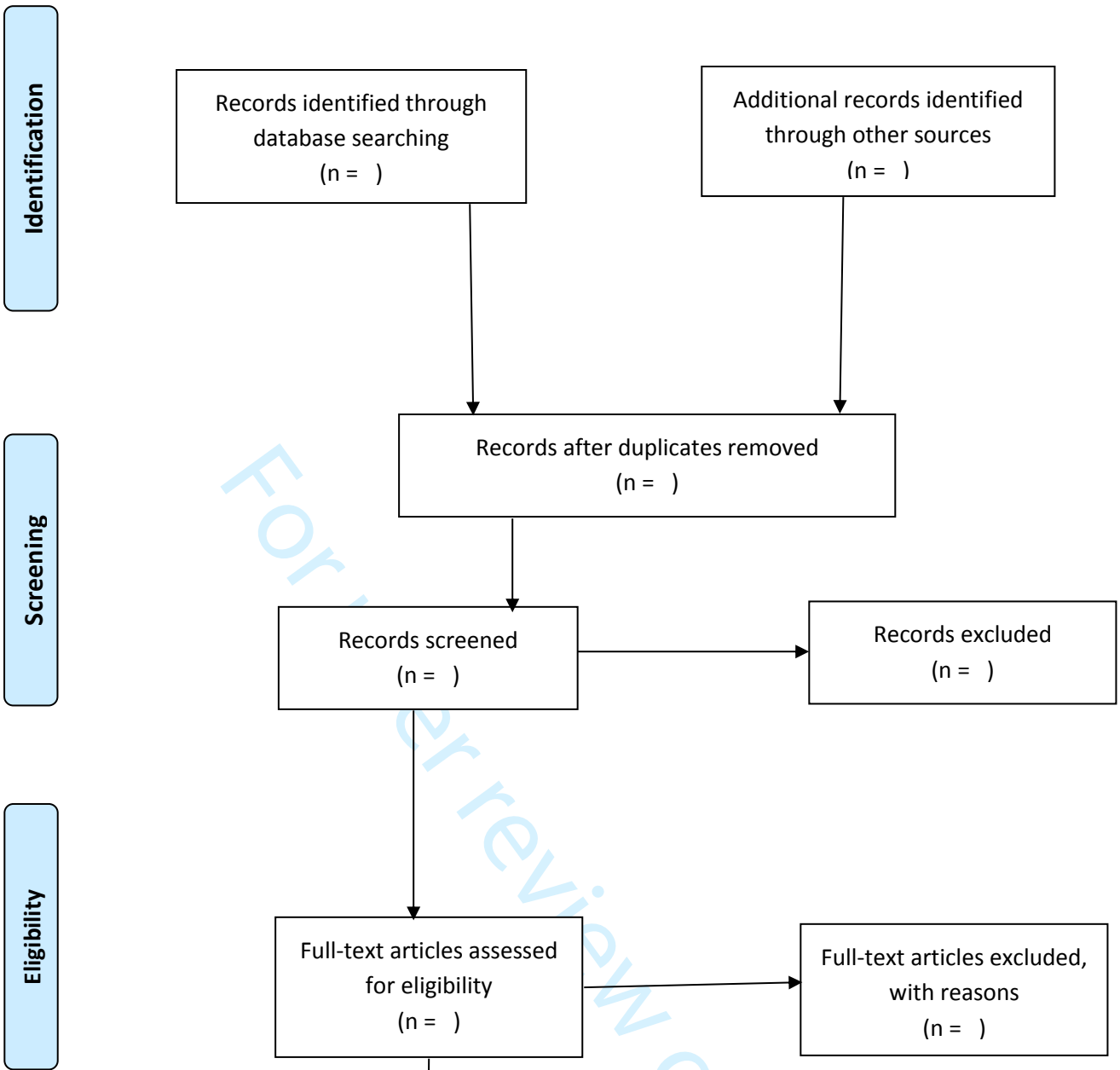

Figure 1: PRISMA ScR flowchart which demonstrates literature search and study selection processes.

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PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	(Page No.#)
ADMINISTRATIVE INFORMATION			
Title:		Availability and use of mHealth for disease diagnosis and treatment support by health workers in Sub-Saharan Africa: A Scoping Review Protocol	
Identification	1a	Identify the report as a protocol of a systematic review: **Protocol of a systematic scoping review**	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	N/A
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	N/A
Authors:		Ernest Osei[1], Desmond Kuupiel[1,2], Tivani P. Mashamba-Thompson[1,2]	
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	1/16
Amendments	4	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	N/A
Support:			
Sources	5a	Indicate sources of financial or other support for the review	N/A
Sponsor	5b	Provide name for the review funder and/or sponsor	N/A
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	N/A
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	4-5
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO) - **PCC**	7-8
METHODS			
Eligibility criteria	8	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	7-10

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Information sources	9	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	10-12
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	9 and Table 2
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	6-11
Selection process	11b	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)	10-11
Data collection process	11c	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	10-13
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	7
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	6-13
Risk of bias in individual studies	14	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	N/A
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	N/A
	15b	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)	N/A N/A
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	N/A
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	N/A
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	N/A
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	N/A

*** 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.**

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