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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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3 1 **Availability and use of mHealth for disease diagnosis and treatment support by health**
4 2 **workers in Sub-Saharan Africa: A Scoping Review Protocol**

5
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20 **Keywords:** mHealth; Disease diagnosis; Treatment support; Sub-Saharan Africa

27 **ABSTRACT**

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

34 **Methods and Analysis:** This scoping review will be guided by Arksey, H., and O'Malley's
35 scoping review framework, and Levac et al 2010 recommendations and guidelines from
36 Joanna Briggs Institute. A scoping review will be conducted to explore what is known about
37 mHealth for disease diagnosis and treatment support by health workers in SSA and to identify
38 areas for future research. In addition to searching the grey literature, the following databases
39 will be searched from inception onwards: Google Scholar; PubMed; MEDLINE and
40 CINAHL with full-text via EBSCOhost; and Science Direct databases. All peer-reviewed
41 primary studies published apart from review articles will be considered. This scoping review
42 will cover mHealth for disease diagnosis and treatment support by health workers in SSA.
43 The primary investigator will conduct the title screening and subsequently two independent
44 reviewers will carry out abstract and full article screening as well as data extraction. The
45 results of this proposed review will be presented using the Preferred Reporting Items for
46 Systematic Reviews and Meta-analysis: Extension for Scoping Review (PRISMA-ScR)
47 guidelines.

48 **Ethics and dissemination**

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

54 **ARTICLE SUMMARY**

55 **STRENGTHS AND LIMITATIONS OF THIS STUDY**

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

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- 4 • The literature search will be comprehensive, including electronic databases with peer-
5 reviewed literature and grey literature sources including governmental as well as non-
6 governmental websites.
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 - 8 • In this scoping review study is the date, language and study design limits will be
9 removed.
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 - 11 • This review study was also limited to studies conducted within sub-Saharan Africa
12 which may lead to missing other relevant articles.
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For peer review only

87 **BACKGROUND OF THE STUDY**

88 The mass availability and use of mobile health (mHealth) technology provide a greater
89 potential for such technologies to be integrated into clinical services to support quality
90 medical care (1). World Health Organization (WHO) through its global observatory report
91 defined mHealth as ‘medical and public health practice support by mobile devices like
92 mobile phones, patients monitoring devices, personal digital assistants (PDAs) and other
93 wireless devices’(2). In 2015, it was estimated that 52% of smartphone users globally gather
94 health-related information like a medical problem, nutrition, depression, among others on
95 their mobile phones (3). In 2017, the World Health Organization (WHO) estimated users of
96 smartphones in sub-Saharan Africa (SSA) and the Middle East to be about 140.9 million (4).
97 In view of this high mobile penetration rate, mHealth could be explored to supplement the
98 provision of healthcare services in SSA.

99 Research has shown that the use of mHealth can result in some of the following health
100 benefits: First, mHealth has the potential to improve the provision of quality healthcare by
101 enhancing treatment, empowering patients, reducing medical cost and streamline the use of
102 health resources (1). Mobile health in the form of text messages and voice calls given to
103 patients can help health workers to remotely monitor their health conditions and assist them
104 to comply with treatment procedures (5). It can save both patients and health providers’ time,
105 reduce patients' cost and improves doctor-patient relationships through regular interactions
106 (6). mHealth applications like reference apps, diagnostic apps, and others can assist health
107 workers to be more proactive in addressing the health conditions of their patients (7).
108 mHealth can also help patients to receive healthcare services in real-time to prevent late
109 detection of diseases, improves poor clinical outcomes and among others (7). mHealth
110 promotes maternal, child health and routine immunization (8). It also encourages proper self-
111 chronic disease management and the general wellness of patients (1).

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

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3 119 settings and resource-rich settings (10-12). People living in resource-poor settings in SSA
4
5 120 may not have access to quality healthcare because of bad roads, poor health facilities,
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7 121 inadequately skilled health workers, among others (7). To this end, mHealth could be adopted
8
9 122 by health workers to support healthcare delivery in such communities since it can reach many
10
11 123 more people faster than the traditional way of disease control. There is growing evidence
12
13 124 suggesting that countries within SSA have started implementing mHealth programs to
14
15 125 support the provision of healthcare (13-15). mHealth interventions in SSA are mainly for data
16
17 126 collection (16); disease tracking and surveillance (11); medical education (7); treatment
18
19 127 support for medication adherence (17); and improves diagnostic procedures (11). Others
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21 128 include mHealth for exchange of patients data between health providers or between patients
22
23 129 and their health providers (18); facilitate access to healthcare in remote and resource-limited
24
25 130 settings (18) and many others. In view of this numerous usefulness, there is the need to map
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27 131 evidence from existing literature on the availability and use of mHealth for disease diagnosis
28
29 132 and treatment support by health workers in SSA.

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31 133 Despite the potentials of mHealth, no study to the best of our knowledge has mapped
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33 134 evidence on mHealth for disease diagnosis and treatment support by health workers in SSA.
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35 135 We, therefore, propose to map existing evidence on the availability and use of mHealth for
36
37 136 disease diagnosis and treatment support by health workers in SSA. We envisage that the
38
39 137 results of this proposed study will reveal research gaps as well as provide useful information
40
41 138 that will help improve the availability and use of mHealth in SSA.

42 139 **METHOD**

43 140 **Protocol design**

44
45 141 We will carry out a scoping review of evidence on the availability and use of mHealth for
46
47 142 disease diagnosis and treatment support by health workers in SSA under the guidance of
48
49 143 Arksey and O' Malley framework, 2005 (19), Levac *et al.* 2010 (20) and the 2015 Joanna
50
51 144 Briggs Institute (21) guidelines. A five-step framework from Arksey and O'Malley include
52
53 145 the following:

- 54 146 i. Identify the research question
 - 55 147 ii. Identifying relevant studies
 - 56 148 iii. Selection of studies
 - 57 149 iv. Data charting
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3 150 v. Collating, summarizing, and reporting the results
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5
6 151 This scoping review will be conducted in accordance with guidelines from the PRISMA-ScR
7
8 152 (Preferred Reporting Items for Systematic Reviews and Meta-analysis: Extension for Scoping
9
10 153 Reviews) (Figure 1) (22). This protocol has been reported according to the guidelines
11
12 154 provided by Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols
13
14 155 (PRISMA-P) (Additional file 1).

15
16 156 **Step 1: Identify the research question**

17
18 157 The research question of interest is: What are the evidence on the availability and use of
19
20 158 mHealth for disease diagnosis and treatment support by health workers in SSA?

21
22 159 The Population, Concept, and Context (PCC) framework developed by Joanna Briggs
23
24 160 Institute (21) has been used to determine the eligibility of the research question for our
25
26 161 scoping review (Table 1):

27
28 162

29
30 163 **Table 1:** Determining the eligibility of the research question
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33 164

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	<p data-bbox="432 1480 1394 1532">Disease diagnosis and treatment support</p> <p data-bbox="432 1532 1394 1644">Disease diagnosis- Use of mHealth as diagnostic apps to screen patients to detect any form of disease or disorder or injury.</p> <p data-bbox="432 1711 1394 1868">Treatment support- Use of mHealth to provide treatment and assisting patients to manage their disease conditions without traveling to the health facility.</p>
Context	Availability and use in sub-Saharan Africa

	<p>Availability- Is the state of being able to access, use and obtain mHealth application upon a demand to perform a required function.</p> <p>Use- Process of employing mHealth to accomplish a task like a diagnosis, treatment, control, and management of diseases.</p>
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165

166 ***Inclusion criteria***

167 We will include the following:

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

176 **Exclusion criteria**

177 The following will be excluded:

- 178 • Articles that report evidence on patients.
- 179 • Articles reporting evidence on eHealth applications such as electronic health records,
- 180 telemedicine, and others.
- 181 • Articles presenting evidence on mHealth for surveillance.
- 182 • Articles that report evidence on mHealth for health education.
- 183 • Articles reporting evidence on mobile clinics.
- 184 • Articles that present evidence on mHealth for communication.
- 185 • Articles reporting outside sub-Saharan Africa.

186 **Step 2: Identifying relevant studies**

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

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

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

192 For the identification of relevant articles, an electronic database search will be carried out
 193 using advanced search from the following databases: MEDLINE and CINAHL with full-text
 194 via EBSCOhost; PubMed; Science Direct and Google Scholar. We have sort advice from the
 195 University of KwaZulu-Natal Library Service for the selection of relevant databases for this
 196 study and with keywords searches. World Health Organization (WHO) website and the
 197 departments of health websites will also be searched thoroughly for relevant literature.
 198 Reference lists of all included articles will also be searched for relevant articles. Keywords
 199 for searching the literature will be: “mHealth technology”, “disease”, “diagnosis”,
 200 “treatment”, “support” and “Sub-Saharan Africa”. Boolean terms (AND, OR) will be
 201 used to separate the keywords. MeSH (Medical Subject Headings) terms will also be used
 202 during our electronic search for relevant articles.

203 We have carried out a pilot search in PubMed to show the feasibility of conducting the
 204 proposed scoping review method (Table 2):

205 **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

		("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])	
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208 **Step 3: Selection of studies**

209 Following databases searches for relevant articles, the principal investigator, EO will carry
 210 out a comprehensive study title screening. All eligible study titles will be exported to an
 211 Endnote X9 library purposely created for this scoping review. All identified duplicates will
 212 be deleted before sharing the Endnote library with the review team. Two trained reviewers
 213 (EO and DK) will independently conduct abstract screening in parallel using the screening
 214 tool which will be designed with guidance from the inclusion and exclusion criteria.
 215 Discrepancies between the two reviewers' responses at the abstract screening stage will be
 216 discussed by the review team until a consensus is reached. Two reviewers (EO and DK) will
 217 also perform the full article screening using the eligibility criteria guided tool for the selected
 218 relevant articles. A third reviewer (TPM-T) will be contacted to resolve discrepancies in
 219 reviewers' responses following full article screening. The library services at the University of
 220 KwaZulu-Natal (UKZN) will be requested to support our study search strategy to help
 221 retrieve full articles that were inaccessible in the above-mentioned databases. The results of

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

224 **Step 4: Data charting**

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

227 **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

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

1
2
3 230 the study. Two reviewers (EO and DK) will independently conduct the data extraction in
4
5 231 parallel. The standard bibliographical information (i.e. authors, title and year of publication),
6
7 232 geographical setting, study setting, study design and aim of the study will be reported. For
8
9 233 each included primary studies, information on the target population, type of technology, type
10
11 234 of mHealth intervention, the purpose of mHealth, disease diagnosis, treatment support, key
12
13 235 findings, most significant findings, conclusions, and notes will be tabled. NVivo version 12
14
15 236 software package will assist us in conducting thematic content analysis (23) from the relevant
16
17 237 outcomes of the included articles.

18 238 *Quality Appraisal of studies*

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20 239 The electronic version of the mixed-method appraisal tool (MMAT) Version 2018 (24) will
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22 240 be adopted to assess the quality of the included primary studies. The MMAT will be used for
23
24 241 the quality appraisal and describes the quality of the methodology for qualitative, quantitative
25
26 242 and mixed-method studies. In this quality appraisal, we will examine the aim of each study,
27
28 243 clarity of the research question, appropriate methodology, study design, appropriate data
29
30 244 sources, appropriate sampling technique, suitable data collection procedures, and participant
31
32 245 recruitments. Others include representativeness of population, the suitability of statistical
33
34 246 analysis of data, appropriateness of data interpretation, authors' acknowledgment of potential
35
36 247 biases, presentation of findings, discussions and the authors' conclusions of all the included
37
38 248 primary studies. A quality appraisal will be conducted to understand the strengths,
39
40 249 weaknesses, potential for bias in clinical research as well as the quality of research evidence
41
42 250 which will be presented from each of the included primary studies. Generally, the quality of
43
44 251 all the selected studies will be calculated and rated using the MMAT guidelines as low
45
46 252 quality for 25%; the average for 50%; above average for 75% and the high average for 100
47
48 253 %.

49 254 **Step 5: Collating, summarizing and reporting the results**

50 255 The main aim of this study is to map available existing evidence and summarise the findings
51
52 256 as reported across all the included articles. We will conduct a thematic content analysis (23)
53
54 257 with the support of NVivo version 12 of the included studies. The review team will carefully
55
56 258 analyze the emerging themes and relate them to our research question. The reviewers will
57
58 259 also analyze all the implications on the significant findings with regards to the research
59
60 260 question and stimulate future research in SSA. We will present a narrative account of all our
61
261 findings according to the themes.

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3 262 *Discussion*
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6 263 This scoping review will map evidence on existing literature on the availability and use of
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8 264 mHealth for disease diagnosis and treatment support by health workers in SSA. The World
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10 265 Health Organization (WHO) through its global observatory 2016 report indicated mHealth as
11
12 266 one of the new emerging technologies that can help achieve universal health coverage (UHC)
13
14 267 (18). According to WHO, mHealth services like short message reminders, phone calls can
15
16 268 easily be made available to remote populations and resource-limited settings by providing
17
18 269 mechanisms for the exchange of data between patients and service providers (18). Research
19
20 270 has also shown that mHealth can help increase access to healthcare and the provision of
21
22 271 healthcare in communities with limited infrastructure to support the internet or traditional
23
24 272 healthcare services (2, 18, 25). Providing healthcare through mobile communication is
25
26 273 reported to be cheaper than supplying in-person healthcare services (18). Recent studies
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28 274 demonstrated that mHealth services provided by health workers helped patients especially
29
30 275 those in hard-to-reach communities to stick to the treatment process, appointment adherence
31
32 276 and many others (17, 26). Considering these benefits of mHealth, there is the need to map
33
34 277 evidence on the availability and use of mHealth for disease diagnosis and treatment support
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36 278 by health workers in SSA.

37
38 279 This scoping review will be limited to articles presenting the evidence within SSA because of
39
40 280 the similar health challenges. Our study will not cover articles outside of SSA because they
41
42 281 have different health targets and challenges. The study will exclude articles presenting
43
44 282 evidence on mHealth used by patients because we want to examine the impact of mHealth
45
46 283 usage by health workers to support healthcare delivery. Also, this study will exclude articles
47
48 284 presenting evidence on mHealth for communication in terms of health promotion campaigns
49
50 285 or community mobilization to raise awareness of target groups. In addition, the study will
51
52 286 exclude articles that report evidence on mHealth for surveillance involving routine and
53
54 287 emergency data collection. Again, our proposed study will exclude articles presenting
55
56 288 evidence on mHealth for providing medical education to health workers on professional
57
58 289 development. This study will cover articles that present evidence published from inception to
59
60 290 2019 to identify the patterns of reports on mHealth interventions. The findings of this study
291
292 scoping review study will be published in peer-reviewed journals.
293

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3 294 *Patient and Public Involvement*
4

5 295 No patient and the public will be involved in our study design, conducting and dissemination
6 of the results of the scoping review.
7

8
9 297 **CONCLUSION**

10
11 298 This article provides a scoping review protocol with a comprehensive and detailed
12 methodology. The review includes both peer-reviewed articles and grey literature which will
13 299 contribute to research on mHealth for disease diagnosis and treatment support by health
14 300 workers in SSA. This scoping review will provide evidence on the extent of availability and
15 301 use of mHealth by health workers for disease diagnosis and treatment support in SSA. The
16 302 results of this proposed study will reveal gaps in the literature, influence policymakers,
17 303 contribute to existing knowledge and improve healthcare delivery in SSA.
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24 305 This scoping review is a part of a large study aimed at examining the accessibility of mHealth
25 306 for disease diagnosis and treatment support by health workers in Ghana.
26
27

28 307 **ETHICS AND DISSEMINATION**

29
30 308 This scoping review methodology requires collecting, reviewing as well as synthesising
31 309 materials from all available publications, no ethical approval will be required. The final
32 310 review will be published in a scientific journal. The results of this review will be presented at
33 311 appropriate conferences and workshops.
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40 312

41 313 **Abbreviations**

42
43 314 **LMICs** – Low- and- Middle-Income Countries
44

45 315 **PDA**s – Personal Digital Assistants
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48 316 **SDG** – Sustainable Development Goal
49

50 317 **SSA** – sub-Saharan Africa
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53 318 **UHC**- Universal health coverage
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56 319 **WHO** – World Health Organization
57
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2
3 321 **Declarations**
4

5
6 322 **Acknowledgments**
7

8 323 The authors wish to thank the University of KwaZulu-Natal for giving us all the necessary
9 324 resources in developing this study protocol.
10
11

12
13 325 **Funding**
14

15 326 No funding has been secured yet for this study.
16

17
18 327 **Availability of data and materials**
19

20 328 All articles used in this study will be included in the reference list.
21
22

23 329 **Author's contribution**
24

25 330 EO and TPM-T conceptualized this study and the methodology. EO wrote the first draft and
26 331 DK and TPM-T critically reviewed the manuscript. All authors (TPM-T, DK, and EO)
27 332 reviewed the final drafted manuscript and approved it.
28
29

30
31 333 **Ethics approval and consent to participants**
32

33 334 This study will not involve human or animal participants; hence, it does not require ethical
34 335 approval.
35
36

37
38 336 **Consent for publication**
39

40 337 Not applicable.
41
42

43 338 **Competing Interests**
44

45 339 None declared.
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11 403 **Additional files**

- 12
13 404 1. **PRISMA-P** (Preferred Reporting Items for Systematic Review and Meta-Analysis
14 405 Protocols) 2015 checklist: recommended items to address in a systematic review
15 406 protocol*.
16
17 407 2. **Figure 1:** PRISMA ScR flowchart which demonstrates literature search and study
18 408 selection processes.
19
20 409 3. **Table 1:** Determining the eligibility of the research question.
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22 410 4. **Table 2:** Draft search for PubMed/MEDLINE.
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24 411 5. **Table 3:** Data charting table.
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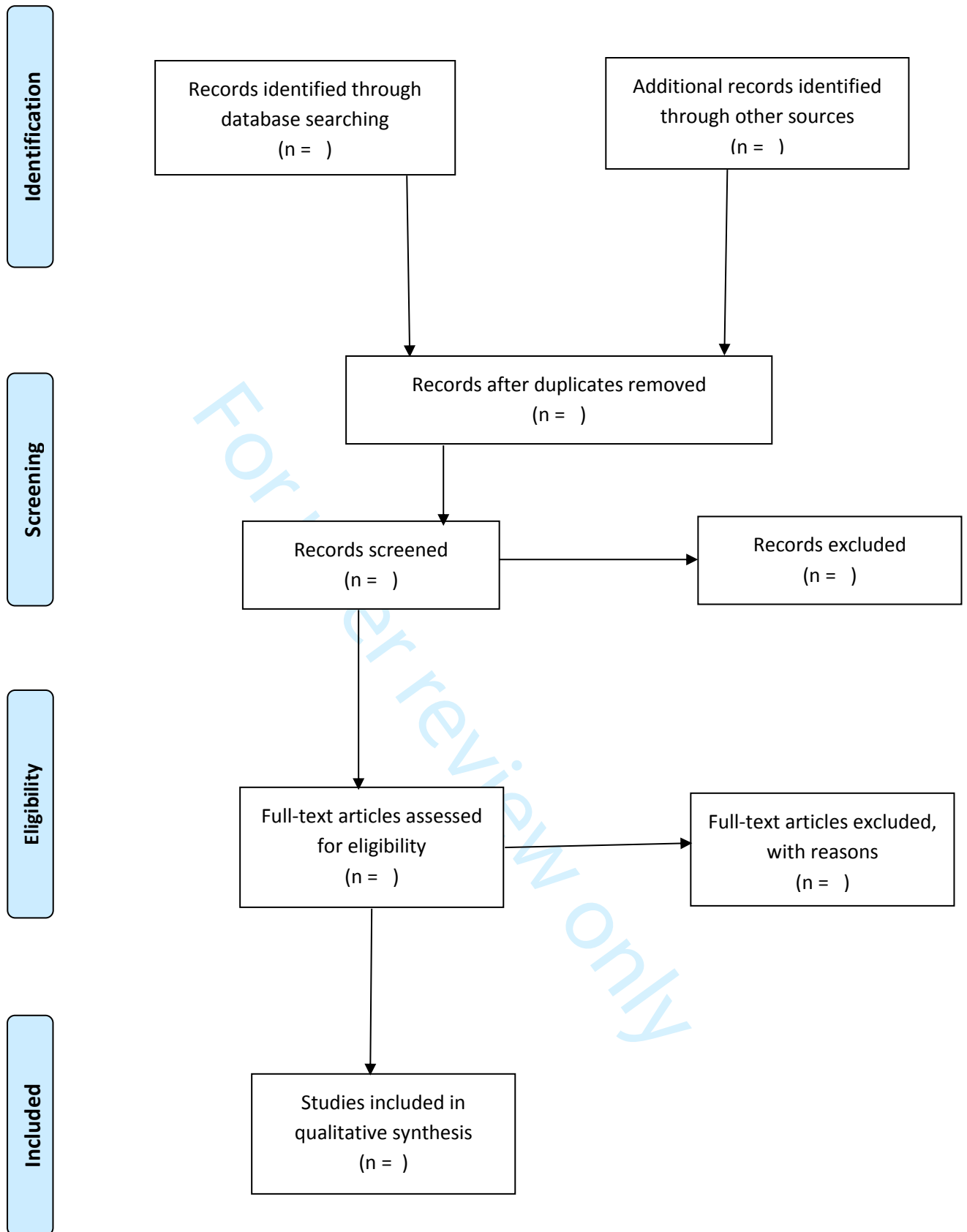


Figure 1: PRISMA ScR flowchart which demonstrates literature search and study selection processes.

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

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
	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 (where 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.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.

BMJ Open

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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1 Availability and use of mHealth for disease diagnosis and treatment 2 support by health workers in Sub-Saharan Africa: A Scoping Review 3 Protocol

4
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22 **Keywords:** mHealth; Disease diagnosis; Treatment support; Sub-Saharan Africa

27 **ABSTRACT**

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

33 **Methods and Analysis:** This review will be guided by Arksey, H., and O'Malley's scoping
34 review framework and Levac et al. 2010 recommendations and guidelines from the Joanna
35 Briggs Institute. A scoping review will be conducted to explore what is known about
36 mHealth for disease diagnosis and treatment support by health workers in SSA and to identify
37 areas for future research. In addition to searching the grey literature, the following databases
38 will be explored from PubMed; MEDLINE, and CINAHL with full-text via EBSCOhost and
39 Science Direct databases. A search in Google Scholar will be considered as an additional
40 information source. The literature search will involve published studies from 1900 to 2020 in
41 any language. This review will cover mHealth for disease diagnosis and treatment support by
42 health workers in SSA. The primary investigator will conduct the title screening, and
43 subsequently, two reviewers will independently conduct abstract and full article screening
44 and data extraction. The results of this proposed review will be presented using the Preferred
45 Reporting Items for Systematic Reviews and Meta-analysis: Extension for Scoping Review
46 guidelines.

47 **Ethics and dissemination**

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

52 **ARTICLE SUMMARY**

53 **STRENGTHS AND LIMITATIONS OF THIS STUDY**

- 54 • The scoping review will use a well-established, rigorous scoping review methodology
55 with a comprehensive strategy.
- 56 • The literature search will be comprehensive, including electronic databases with peer-
57 reviewed literature and grey literature sources, including governmental as well as non-
58 governmental websites.

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- In this scoping review study, date, language, and study design limits will be removed.
- 4 60
- This review study was also be limited to studies conducted within sub-Saharan Africa,
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- which may lead to missing other relevant articles.
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For peer review only

86 BACKGROUND OF THE STUDY

87 The mass availability and use of mobile health (mHealth) technology provide a significant
88 potential for such technologies to be integrated into clinical services to support quality
89 medical care (1). World Health Organization (WHO), through its global observatory report
90 defined mHealth as ‘medical and public health practice support by mobile devices like
91 mobile phones, smartphones, tablets, patients monitoring devices, personal digital assistants
92 (PDAs) and other wireless devices’(2). In 2015, it was estimated that 52% of smartphone
93 users globally gather health-related information like a medical problem, nutrition, depression,
94 among others on their mobile phones (3). In sub-Saharan Africa (SSA), mobile phone
95 availability, and utilization by the population at the end of 2017 was 44% and is forecast to
96 reach 52% by 2025 (4). Mobile health technologies and applications are available and being
97 utilized for screening diseases, medication adherence, follow-ups, appointment reminders,
98 and many others (5, 6). Given the large availability and utilization of mobile phones, mHealth
99 technologies and applications could be explored to supplement the provision of healthcare
100 services in SSA.

101 Research has shown that the use of mHealth can result in some of the following health
102 benefits: First, mHealth has the potential to improve the provision of quality healthcare by
103 enhancing treatment, empowering patients, reducing medical cost, and streamline the use of
104 health resources (1). Mobile health in the form of text messages and voice calls given to
105 patients can help health workers to monitor their health conditions remotely and assist them
106 in complying with treatment procedures (7). It can save both patients and health providers’
107 time, reduce patients' costs, and improves doctor-patient relationships through regular
108 interactions (8). mHealth applications like reference apps, diagnostic apps, and others can
109 help health workers be more proactive in addressing their patients' health conditions (9).
110 mHealth can also help patients to receive healthcare services in real-time to prevent late
111 detection of diseases, improves poor clinical outcomes, and among others (9). mHealth
112 promotes maternal, child health, and routine immunization (10). It also encourages proper
113 self-chronic disease management and the general wellness of patients (1).

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

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3 118 significant population of people in countries within SSA are illiterate and are poor digitally
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5 119 (12). Other studies have also revealed some mHealth challenges as the small size of the
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7 120 mobile phone screen, the quality of image, poor network connection in transmitting data, and
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9 121 weak legislation to regulate mHealth in SSA (12, 13). In addition, other challenges of
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11 122 mHealth applications in SSA are technical, financial, and infrastructural barriers, data
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13 123 security, and the accuracy of mHealth diagnostic tools (14). Similar implementational
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15 124 challenges are technology usability, sustainable funding, learning environment, the culture of
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17 125 information use, and cost-effectiveness (15).

18 126 Sustainable Development Goal (SDG) 3.8 (16) target has emphasized the importance of
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20 127 accessing quality, safe, effective, and affordable universal health for all. To achieve this goal,
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22 128 mHealth intervention could be adopted to support universal healthcare provision in all
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24 129 settings despite some of these implementational challenges and barriers. mHealth
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26 130 interventions could be used by frontline health workers to provide healthcare to patients
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28 131 living in hard-to-reach communities with insufficient or no health facilities. Studies have
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30 132 demonstrated that mHealth has contributed to achieving Universal Health Coverage (UHC) in
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32 133 both resource-poor settings and resource-rich settings (11, 17, 18). People living in resource-
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34 134 poor settings in SSA may not have access to quality healthcare because of bad roads,
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36 135 inadequate health facilities, and inadequately skilled workers, among others (9). To this end,
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38 136 mHealth could be adopted by health workers to support healthcare delivery in such
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40 137 communities since it can reach many more people faster than the traditional way of
41
42 138 controlling diseases. There is growing evidence suggesting that countries within SSA have
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44 139 started implementing mHealth programs to support healthcare provision (19-21). mHealth
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46 140 interventions in SSA are mainly for data collection (22), disease tracking and surveillance
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48 141 (17), medical education (9); treatment support for medication adherence (23); and improves
49
50 142 diagnostic procedures (17). Others include mHealth for exchange of patients data between
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52 143 health providers or between patients and their health providers (24), facilitate access to
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54 144 healthcare in remote and resource-limited settings (24), and many others.

55 145 Despite these numerous usefulness and challenges of mHealth, there is the need to map
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57 146 evidence from existing literature on the availability and use of mHealth for disease diagnosis
58
59 147 and treatment support by health workers in SSA. This review aims to map existing evidence
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148 on the availability and use of mHealth for disease diagnosis and treatment support by health
149 workers in SSA. This study will provide the extent of availability and use of mHealth
150 applications by healthcare workers for diagnosing, screening, and testing of diseases in SSA.

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3 151 It will also provide the extent of availability and use of mHealth to support medication and
4 152 treatment adherence, appointment reminders, disease surveillance, and health monitoring, and
5 153 others in SSA. We envisage that the results of this proposed study will reveal research gaps
6 154 as well as provide useful information that will help improve the availability and use of
7 155 mHealth in SSA.

156 **METHOD**

157 **Protocol design**

158 We will carry out a scoping review of evidence on the availability and use of mHealth for
159 disease diagnosis and treatment support by health workers in SSA under the guidance of
160 Arksey and O' Malley framework, 2005 (25), Levac *et al.* 2010 (26) and the 2015 Joanna
161 Briggs Institute (27) guidelines. A five-step structure from Arksey and O'Malley include the
162 following:

- 163 i. Identify the research question
- 164 ii. Identifying relevant studies
- 165 iii. Selection of studies
- 166 iv. Data charting
- 167 v. Collating, summarizing, and reporting the results

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

173 **Step 1: Identify the research question.**

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

176 The sub-research questions are as follows:

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

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

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

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

185

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	<p>Disease diagnosis and treatment support</p> <p>Disease diagnosis- Use of mHealth as diagnostic apps to screen patients to detect any form of disease, disorder, or injury.</p> <p>Treatment support- Use of mHealth to provide treatment and assisting patients in managing their disease conditions without traveling to the health facility.</p>
Context	<p>Availability and use in sub-Saharan Africa</p> <p>Availability- Is the state of being able to access, use, and obtain mHealth application upon a demand to perform a required function.</p> <p>Use- Process of employing mHealth to accomplish a task like a diagnosis, treatment, control, and management of diseases.</p>

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3 **188 Step 2: Identifying relevant studies**
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6 189 For the identification of relevant articles, an electronic database search will be carried out
7
8 190 using advanced search from the following databases: MEDLINE and CINAHL with full-text
9
10 191 via EBSCOhost; PubMed, and Science Direct. A search in Google Scholar will be considered
11
12 192 as an additional source of information. We have sought advice from the University of
13
14 193 KwaZulu-Natal Library Service for selecting relevant databases for this study and with
15
16 194 keywords searches. World Health Organization (WHO) website and the departments of
17
18 195 health websites will also be searched thoroughly for relevant literature. Reference lists of all
19
20 196 included articles will also be searched for relevant articles. Keywords for searching the
21
22 197 literature will be: “mHealth technology”, “disease”, “diagnosis”, “treatment”,
23
24 198 “support” and “Sub-Saharan Africa”. Boolean terms (AND, OR) will be used to separate
25
26 199 the keywords. MeSH (Medical Subject Headings) terms will also be used during our
27
28 200 electronic search for relevant articles.

29 201 We have carried out a pilot search in PubMed to show the feasibility of conducting the
30
31 202 proposed scoping review method (Table 2):

32 **Table 2:** Draft search for PubMed/MEDLINE
33
34 204

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

		<p>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])</p>	
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205

206 ***Inclusion criteria***

207 We will include the following:

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

219 **Exclusion criteria**

220 The following will be excluded:

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

229 **Step 3: Selection of studies**

230 Following databases searches for relevant articles, the principal investigator, EO, will carry
231 out a comprehensive study title screening. All eligible study titles will be exported to an
232 Endnote X9 library purposely created for this scoping review. All identified duplicates will
233 be deleted before sharing the Endnote library with the review team. Two trained reviewers
234 (EO and DK) will independently conduct abstract screening in parallel using the screening
235 tool, which will be designed with guidance from the inclusion and exclusion criteria. The
236 review team will discuss discrepancies between the two reviewers' responses at the abstract
237 screening stage until a consensus is reached. Two reviewers (EO and DK) will perform the
238 full article screening using the eligibility criteria guided tool for the selected relevant articles.
239 A third reviewer (TPM-T) will be contacted to resolve discrepancies in reviewers' responses
240 following full article screening. The library services at the University of KwaZulu-Natal
241 (UKZN) will be requested to support our study search strategy to help retrieve full articles
242 that were inaccessible in the databases, as mentioned earlier. The screening results will then
243 be reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses
244 flow diagram (28).

245 **Step 4: Data charting**

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

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253 **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

254 The data extraction form will be validated by two reviewers using at least the first five
 255 articles for consistency. We will update and modify the data extraction form throughout the
 256 study. Two reviewers (EO and DK) will independently conduct the data extraction in parallel.
 257 The standard bibliographical information (i.e., authors, title, and year of publication),
 258 geographical setting, study setting, study design, and aim of the study will be reported. For
 259 each included primary studies, information on the target population, type of technology, type

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2
3 260 of mHealth intervention, the purpose of mHealth, disease diagnosis, treatment support, key
4 261 findings, most significant findings, conclusions, and notes will be tabled. NVivo version 12
5 262 software package will assist us in conducting thematic content analysis (29) from the relevant
6 263 outcomes of the included articles.

10 264 *Quality Appraisal of studies*

11 265 The electronic version of the mixed-method appraisal tool (MMAT) Version 2018 (30) will
12 266 be adopted to assess the quality of the included primary studies. The MMAT will be used for
13 267 quality appraisal and describes the quality of the methodology for qualitative, quantitative,
14 268 and mixed-method studies. In this quality appraisal, we will examine the aim of each study,
15 269 clarity of the research question, appropriate methodology, study design, relevant data sources,
16 270 proper sampling technique, suitable data collection procedures, and participant recruitments.
17 271 Others include representativeness of population, the suitability of statistical analysis of data,
18 272 appropriateness of data interpretation, authors' acknowledgment of potential biases,
19 273 presentation of findings, discussions, and the authors' conclusions of all the included primary
20 274 studies. A quality appraisal will be conducted to understand the strengths, weaknesses,
21 275 potential for bias in clinical research as well as the quality of research evidence which will be
22 276 presented from each of the included primary studies. Generally, the quality of all the selected
23 277 studies will be calculated and rated using the MMAT guidelines for the low quality of 25%,
24 278 the average for 50%, above average for 75%, and the high average for 100 %.

27 279 **Step 5: Collating, summarizing and reporting the results**

28 280 This study's main aim is to map available evidence and summarise the findings as reported
29 281 across all the included articles. We will conduct a thematic content analysis (29) with the
30 282 support of NVivo version 12 of the included studies. The review team will carefully analyze
31 283 the emerging themes and relate them to our research question. The reviewers will also
32 284 analyze all the implications on the significant findings with regards to the research question
33 285 and stimulate future research in SSA. We will present a narrative account of all our results
34 286 according to the themes.

35 287 *Discussion*

36 288 This scoping review will map evidence on existing literature on the availability and use of
37 289 mHealth for disease diagnosis and treatment support by health workers in SSA. The World
38 290 Health Organization (WHO), through its global observatory 2016 report indicated mHealth as

291 one of the new emerging technologies that can help achieve universal health for all (24).
292 According to WHO, mHealth services like short message reminders, phone calls can easily
293 be made available to remote populations and resource-limited settings by providing
294 mechanisms for the exchange of data between patients and service providers (24). Research
295 has also shown that mHealth can help increase access to healthcare and the provision of
296 healthcare in communities with limited infrastructure to support the internet or traditional
297 healthcare services (2, 24, 31). Providing healthcare through mobile communication is
298 reported to be cheaper than supplying in-person healthcare services (24). Recent studies
299 demonstrated that mHealth services helped patients, especially those in hard-to-reach
300 communities stick to treatment procedures, appointment adherence, and many others (23, 32).
301 Considering these benefits of mHealth, there is the need to map evidence on the availability
302 and use of mHealth for disease diagnosis and treatment support by health workers in SSA.

303 This scoping review will be limited to articles presenting findings from SSA because of the
304 similar health challenges. Our study will not cover articles outside of SSA because they have
305 different health targets and problems. The study will exclude articles presenting findings on
306 mHealth used by patients because we want to examine the impact of mHealth usage by health
307 workers to support healthcare delivery. Also, this study will exclude articles presenting
308 findings on mHealth for communication in terms of health promotion campaigns or
309 community mobilization to raise awareness of target groups. Also, the study will exclude
310 articles that report findings on mHealth for surveillance involving routine and emergency
311 data collection. Again, our proposed research will exclude articles presenting findings on
312 mHealth for providing medical education to health workers on professional development.
313 This study will cover articles that offer evidence published from 1900 to 2020 to identify the
314 patterns of reports on mHealth interventions. The findings of this scoping review study will
315 be published in peer-reviewed journals.

316 *Patient and Public Involvement*

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

319 **CONCLUSION**

320 This article provides a scoping review protocol with a comprehensive and detailed
321 methodology. The review includes both peer-reviewed articles and grey literature, which will
322 contribute to research on mHealth for disease diagnosis and treatment support by health

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3 323 workers in SSA. This scoping review will provide evidence on the extent of availability and
4
5 324 use of mHealth by health workers for disease diagnosis and treatment support in SSA. The
6
7 325 results of this proposed study will reveal gaps in the literature, influence policymakers,
8
9 326 contribute to existing knowledge, and improve healthcare delivery in SSA.

10
11 327 This scoping review is a part of a large study aimed at examining the accessibility of mHealth
12
13 328 for disease diagnosis and treatment support by health workers in Ghana.

14 15 329 **ETHICS AND DISSEMINATION**

16
17 330 This scoping review methodology requires collecting, reviewing, and synthesizing materials
18
19 331 from all available publications; no ethical approval will be required. The final review will be
20
21 332 published in a scientific journal. The results of this review will be presented at appropriate
22
23 333 conferences and workshops.

24
25 334

26 27 335 **Abbreviations**

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29
30 336 **LMICs** – Low- and- Middle-Income Countries

31
32 337 **PDAs** – Personal Digital Assistants

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35 338 **SDG** – Sustainable Development Goal

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37 339 **SSA** – sub-Saharan Africa

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40 340 **UHC**- Universal health coverage

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42 341 **WHO** – World Health Organization

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46 47 343 **Declarations**

48 49 344 **Acknowledgments**

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53 345 The authors wish to thank the University of KwaZulu-Natal for giving us all the necessary
54
55 346 resources in developing this study protocol.

56 57 347 **Funding**

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59
60 348 No funding has been secured yet for this study.

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6 350 **Availability of data and materials**7
8 351 All articles used in this study will be included in the reference list.9
10
11 352 **Author's contribution**12
13 353 EO and TPM-T conceptualized this study and the methodology. EO wrote the first draft, and
14 354 DK and TPM-T critically reviewed the manuscript. All authors (TPM-T, DK, and EO)
15 355 reviewed the final drafted manuscript and approved it.16
17
18
19 356 **Ethics approval and consent to participants**20
21
22 357 This study will not involve human or animal participants; hence, it does not require ethical
23 358 approval.24
25
26 359 **Consent for publication**27
28
29 360 Not applicable.30
31 361 **Competing Interests**32
33
34 362 None declared.35
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41 365 **References**

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18 444 **Additional files**

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21 445 1. **PRISMA-P** (Preferred Reporting Items for Systematic Review and Meta-Analysis
22 446 Protocols) 2015 checklist: recommended items to address in a systematic review
23 447 protocol*.
- 24
25
26 448 2. **Figure 1:** PRISMA ScR flowchart, which demonstrates the literature search and
27 449 study selection processes.
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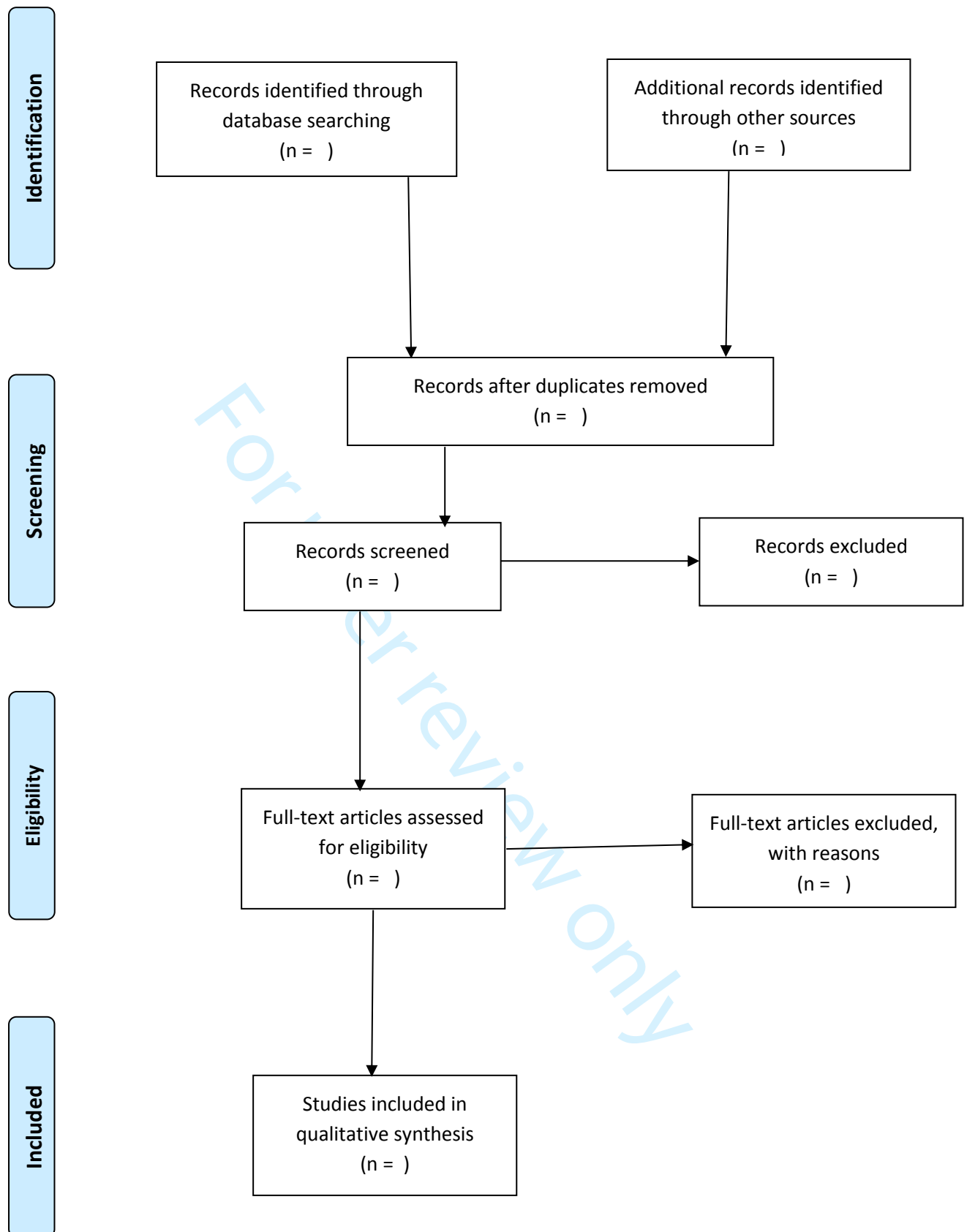


Figure 1: PRISMA ScR flowchart which demonstrates literature search and study selection processes.

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

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
	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.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.

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BMJ Open

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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Primary Subject Heading:	Public health
Secondary Subject Heading:	Health informatics, Global health
Keywords:	Public health < INFECTIOUS DISEASES, Health informatics < BIOTECHNOLOGY & BIOINFORMATICS, Information management < BIOTECHNOLOGY & BIOINFORMATICS, Telemedicine < BIOTECHNOLOGY & BIOINFORMATICS

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1 Availability and use of mHealth for disease diagnosis and treatment 2 support by health workers in Sub-Saharan Africa: A Scoping Review 3 Protocol

4
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22 **Keywords:** mHealth; Disease diagnosis; Treatment support; Sub-Saharan Africa

27 ABSTRACT

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

33 **Methods and Analysis:** This review will be guided by Arksey, H., and O'Malley's scoping
34 review framework and Levac et al. 2010 recommendations and guidelines from the Joanna
35 Briggs Institute. A scoping review will be conducted to explore what is known about mHealth
36 for disease diagnosis and treatment support by health workers in SSA and to identify areas for
37 future research. In addition to searching the grey literature, the following databases will be
38 explored from PubMed; MEDLINE, and CINAHL with full-text via EBSCOhost and Science
39 Direct databases. A search in Google Scholar will be considered as an additional information
40 source. The literature search will involve published studies from 2000 to 2020 in any language.
41 This review will cover mHealth for disease diagnosis and treatment support by health workers
42 in SSA. The primary investigator will conduct the title screening, and subsequently, two
43 reviewers will independently conduct abstract and full article screening and data extraction.
44 The results of this proposed review will be presented using the Preferred Reporting Items for
45 Systematic Reviews and Meta-analysis: Extension for Scoping Review guidelines.

46 Ethics and dissemination

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

51 ARTICLE SUMMARY

52 STRENGTHS AND LIMITATIONS OF THIS STUDY

- 53 • The scoping review will use a well-established, rigorous scoping review methodology
54 with a comprehensive strategy.
- 55 • The literature search will be comprehensive, including electronic databases with peer-
56 reviewed literature and grey literature sources, including governmental as well as non-
57 governmental websites.
- 58 • 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.
- 4 60
- This review study was also be limited to studies conducted within sub-Saharan Africa,
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- which may lead to missing other relevant articles.
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For peer review only

86 BACKGROUND OF THE STUDY

87 The mass availability and use of mobile health (mHealth) technology provide a significant
88 potential for such technologies to be integrated into clinical services to support quality medical
89 care (1). World Health Organization (WHO), through its global observatory report defined
90 mHealth as ‘medical and public health practice support by mobile devices like mobile phones,
91 smartphones, tablets, patients monitoring devices, personal digital assistants (PDAs) and other
92 wireless devices’(2). In 2015, it was estimated that 52% of smartphone users globally gather
93 health-related information like a medical problem, nutrition, depression, among others on their
94 mobile phones (3). In sub-Saharan Africa (SSA), mobile phone availability, and utilization by
95 the population at the end of 2017 was 44% and is forecast to reach 52% by 2025 (4). Mobile
96 health technologies and applications are available and being utilized for screening diseases,
97 medication adherence, follow-ups, appointment reminders, and many others (5, 6). Given the
98 large availability and utilization of mobile phones, mHealth technologies and applications
99 could be explored to supplement the provision of healthcare services in SSA.

100 Research has shown that the use of mHealth can result in some of the following health benefits:
101 First, mHealth has the potential to improve the provision of quality healthcare by enhancing
102 treatment, empowering patients, reducing medical cost, and streamline the use of health
103 resources (1). Mobile health in the form of text messages and voice calls given to patients could
104 help healthcare workers to monitor patients’ health conditions remotely and assist them in
105 complying with treatment procedures (7). It could save both patients and health providers’ time,
106 reduce patients' costs, and improves doctor-patient relationships through regular interactions
107 (8). mHealth applications like reference apps, diagnostic apps, and others could help healthcare
108 workers to be more proactive in addressing their patients' health conditions (9). mHealth could
109 also assist patients to receive healthcare services in real-time to prevent late detection of
110 diseases, improves poor clinical outcomes, and several others (9). mHealth promotes maternal
111 and child health, and routine immunization (10). It also encourages proper self-chronic disease
112 management and the general wellness of patients (1).

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

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3 118 (12). Other studies have demonstrated that the small size of the mobile phone screen, the quality
4
5 119 of image, poor network connection in transmitting data, and weak legislation are some of the
6
7 120 challenges affecting mHealth in SSA (12, 13). In addition, other challenges of mHealth
8
9 121 applications in SSA are technical, financial, and infrastructural barriers, data security, and the
10
11 122 accuracy of mHealth diagnostic tools (14). Similar implementational challenges are technology
12
13 123 usability, sustainable funding, learning environment, the culture of information use, and cost-
14
15 124 effectiveness (15).

16 125 Sustainable Development Goal (SDG) 3.8 (16) target has emphasized the importance of
17
18 126 accessing quality, safe, effective, and affordable universal health for all. To achieve this goal,
19
20 127 mHealth interventions could be adopted to support universal healthcare provision in all settings
21
22 128 despite some of these implementational challenges and barriers. mHealth interventions could
23
24 129 be used by frontline health workers to provide healthcare to patients living in hard-to-reach
25
26 130 communities with insufficient or no healthcare facilities. Studies have demonstrated that
27
28 131 mHealth has contributed to achieving Universal Health Coverage (UHC) in both resource-poor
29
30 132 settings and resource-rich settings (11, 17, 18). People living in resource-poor settings in SSA
31
32 133 may not have access to quality healthcare because of bad roads, inadequate health facilities,
33
34 134 and inadequately skilled workers, among others (9). To this end, mHealth could be adopted by
35
36 135 health workers to support healthcare delivery in such communities since it can reach many
37
38 136 more people faster than the traditional way of controlling diseases.

39 137 Previous reviews focused on mHealth for data collection, reminders, health education,
40
41 138 communication, disease surveillance, medication adherence, exchange of patients' data
42
43 139 between health workers or between patients and their health providers, and effectiveness of
44
45 140 using mHealth applications in SSA (19-23). A review on the availability and use of mHealth
46
47 141 for disease diagnosis and treatment would be valuable towards improving access to healthcare
48
49 142 services, especially in this era of COVID-19. Despite this, the available evidence illustrates
50
51 143 that no previous review has been conducted focusing on mHealth applications for disease
52
53 144 diagnosis by health workers in SSA. Therefore, this current review will aim to map existing
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55 145 evidence on the availability and use of mHealth for disease diagnosis and treatment support by
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57 146 health workers in SSA.

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3 149 **METHOD**
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6 150 **Protocol design**
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8 151 We will carry out a scoping review of evidence on the availability and use of mHealth for
9 152 disease diagnosis and treatment support by health workers in SSA under the guidance of
10 153 Arksey and O' Malley framework, 2005 (24), Levac *et al.* 2010 (25) and the 2015 Joanna
11 154 Briggs Institute (26) guidelines. A five-step structure from Arksey and O'Malley include the
12 155 following:

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16
17 156 i. Identify the research question
18 157 ii. Identifying relevant studies
19 158 iii. Selection of studies
20 159 iv. Data charting
21 160 v. Collating, summarizing, and reporting the results
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27 161 This scoping review will be conducted following guidelines from the PRISMA-ScR (Preferred
28 162 Reporting Items for Systematic Reviews and Meta-analysis: Extension for Scoping Reviews)
29 163 (Figure 1) (27). This protocol has been reported according to the guidelines provided by
30 164 Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P)
31 165 (Additional file 1).
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36

37 166 **Step 1: Identify the research question.**
38

39 167 The research question of interest is: What evidence exists on the availability and use of mHealth
40 168 for disease diagnosis and treatment support by health workers in SSA?
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43 169 The sub-research questions are as follows:
44
45

46 170 What evidence exists on the availability of mHealth for disease diagnosis and treatment support
47 171 by health workers in SSA?

48
49
50 172 What evidence exists on the use of mHealth for disease diagnosis and treatment support by
51 173 health workers in SSA?
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53

54 174 The Population, Concept, and Context (PCC) framework developed by Joanna Briggs Institute
55 175 (26) has been used to determine the eligibility of the research question for our scoping review
56 176 (Table 1):
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177 **Table 1:** Determining the eligibility of the research question

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Determinants	Description
Population	<p>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.</p>
Concept	<p>Disease diagnosis and treatment support</p> <p>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.</p> <p>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.</p>
Context	<p>Availability and use in sub-Saharan Africa</p> <p>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.</p>

	Use- The process of employing mHealth applications to accomplish tasks such as diagnoses and screening of diseases, treatment, and management of conditions of patients.
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179

180 **Step 2: Identifying relevant studies**

181 For the identification of relevant articles, an electronic database search will be carried out using
182 advanced search from the following databases: MEDLINE and CINAHL with full-text via
183 EBSCOhost; PubMed, and Science Direct. A search in Google Scholar will be considered as
184 an additional source of information. We have sought advice from the University of KwaZulu-
185 Natal Library Service for selecting relevant databases for this study and with keywords
186 searches. World Health Organization (WHO) website and the departments of health websites
187 will also be searched thoroughly for relevant literature. Reference lists of all included articles
188 will also be searched for relevant articles. Keywords for searching the literature will be:
189 “mHealth technology”, “disease”, “diagnosis”, “treatment”, “support” and “sub-Saharan
190 Africa”. Boolean terms (AND, OR) will be used to separate the keywords. MeSH (Medical
191 Subject Headings) terms will also be used during our electronic search for relevant articles.

192 We have carried out a pilot search in PubMed to show the feasibility of conducting the proposed
193 scoping review method (Table 2):

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203 **Table 2:** Draft search for PubMed/MEDLINE

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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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3 206 ***Inclusion criteria***
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5
6 207 We will include the following:
7

- 8 208 • Studies involving healthcare workers using mHealth.
9
10 209 • Articles presenting findings on mHealth interventions such as text message, voice calls,
11 mobile apps, multimedia messaging, and among others.
12 210
13 211 • Articles that report findings on the availability of mHealth for disease diagnosis.
14 212 • Articles that present findings on the availability of mHealth for treatment support.
15 213 • Articles presenting findings on the use of mHealth for disease diagnosis.
16 214 • Articles reporting findings on the use of mHealth for treatment support.
17 215 • Articles that present findings on mHealth from sub-Saharan Africa.
18 216 • Primary research studies on qualitative, quantitative, mixed-method, randomized
19 217 controlled trials and non-randomized controlled trials, and grey literature.
20 218 • All articles published from 2000 to 2020 in any language.
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28
29 219 ***Exclusion criteria***
30

31 220 The following will be excluded:
32

- 33
34 221 • Studies involving patients using mHealth applications.
35 222 • Articles reporting findings on eHealth applications such as medical health records,
36 223 personal health records, and many others.
37 224 • Articles that report findings on mHealth for health education.
38 225 • Articles reporting findings on mHealth for data collection without diagnosis and
39 226 treatment support of conditions.
40 227 • Articles that present findings on mHealth for communication without disease diagnosis
41 228 and treatment support of conditions.
42 229 • Articles reporting findings on mHealth outside sub-Saharan Africa.
43 230 • Review articles.
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52 231 **Step 3: Selection of studies**
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55 232 Following database searches for relevant articles, the principal investigator, EO, will carry out
56 233 a comprehensive study title screening. All eligible study titles will be exported to an Endnote
57 234 X9 library purposely created for this scoping review. All identified duplicates will be deleted
58 235 before sharing the Endnote library with the review team. Two trained reviewers (EO and DK)
59
60

1
2
3 236 will independently conduct abstract screening in parallel using the screening tool, which will
4
5 237 be designed with guidance from the inclusion and exclusion criteria. The review team will
6
7 238 discuss discrepancies between the two reviewers' responses at the abstract screening stage until
8
9 239 a consensus is reached. Two reviewers (EO and DK) will perform the full article screening
10
11 240 using the eligibility criteria guided tool for the selected relevant articles. A third reviewer
12
13 241 (TPM-T) will be contacted to resolve discrepancies in reviewers' responses following full
14
15 242 article screening. The library services at the University of KwaZulu-Natal (UKZN) will be
16
17 243 requested to support our study search strategy to help retrieve full articles that were not
18
19 244 accessible in the databases, as mentioned earlier. The screening results will then be reported
20
21 245 using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram
22
23 246 (27).

23 247 **Step 4: Data charting**

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25 248 A data charting form will be used to extract all the relevant data from the included articles
26
27 249 (Table 3).

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262 **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

263 The data extraction form will be validated by two reviewers using at least the first five
 264 articles for consistency. We will update and modify the data extraction form throughout the
 265 study. Two reviewers (EO and DK) will independently conduct the data extraction in parallel.
 266 The standard bibliographical information (i.e., authors, title, and year of publication),
 267 geographical setting, study setting, study design, and aim of the study will be reported. For
 268 each of the included primary studies, information on the target population, type of
 269 technology, type of mHealth intervention, the purpose of mHealth, disease diagnosis,
 270 treatment support, key findings, most significant findings, conclusions, and notes will be

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3 271 tabled. NVivo version 12 software package will assist us in conducting thematic content
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5 272 analysis (28) from the relevant outcomes of the included articles.

6
7 273 *Quality Appraisal of studies*

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9
10 274 The electronic version of the mixed-method appraisal tool (MMAT) Version 2018 (29) will
11
12 275 be adopted to assess the quality of the included primary studies. The MMAT will be used for
13
14 276 quality appraisal and describes the quality of the methodology for qualitative, quantitative,
15
16 277 and mixed-method studies. In this quality appraisal, we will examine the aim of each study,
17
18 278 clarity of the research question, appropriate methodology, study design, relevant data sources,
19
20 279 proper sampling technique, suitable data collection procedures, and participant recruitments.
21
22 280 Others include representativeness of population, the suitability of statistical analysis of data,
23
24 281 appropriateness of data interpretation, authors' acknowledgment of potential biases,
25
26 282 presentation of findings, discussions, and the authors' conclusions of all the included primary
27
28 283 studies. A quality appraisal will be conducted to understand the strengths, weaknesses,
29
30 284 potential for bias in clinical research as well as the quality of research evidence which will be
31
32 285 presented from each of the included primary studies. Generally, the quality of all the selected
33
34 286 studies will be calculated and rated using the MMAT guidelines for the low quality of 25%,
35
36 287 the average for 50%, above average for 75%, and the high average for 100 %.

37
38 288 **Step 5: Collating, summarizing and reporting the results**

39
40 289 This study's main aim is to map available evidence and summarise the findings as reported
41
42 290 across all the included articles. We will conduct a thematic content analysis (28) with the
43
44 291 support of NVivo version 12 of the included studies. The review team will carefully analyze
45
46 292 the emerging themes and relate them to our research question. The reviewers will also
47
48 293 analyze all the implications on the significant findings with regards to the research question
49
50 294 and stimulate future research in SSA. We will present a narrative account of all our results
51
52 295 according to the themes.

53
54 296 *Discussion*

55
56 297 This scoping review will map evidence on existing literature on the availability and use of
57
58 298 mHealth for disease diagnosis and treatment support by health workers in SSA. The World
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60 299 Health Organization (WHO), through its global observatory 2016 report indicated mHealth as
300
301 300 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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3 302 easily be made available to remote populations and resource-limited settings by providing
4 303 mechanisms for the exchange of data between patients and service providers (30). Research
5 304 has also shown that mHealth can help increase access to healthcare and the provision of
6 305 healthcare in communities with limited infrastructure to support the internet or traditional
7 306 healthcare services (2, 30, 31). Providing healthcare through mobile communication is
8 307 reported to be cheaper than supplying in-person healthcare services (30). Recent studies
9 308 demonstrated that mHealth services helped patients, especially those in hard-to-reach
10 309 communities stick to treatment procedures, appointment adherence, and many others (32, 33).
11 310 Considering these benefits of mHealth, there is the need to map evidence on the availability
12 311 and use of mHealth for disease diagnosis and treatment support by health workers in SSA.

13 312 This scoping review will be limited to articles presenting findings from SSA because of the
14 313 similar health challenges. Our study will not cover articles outside of SSA because they have
15 314 different health targets and problems. The study will exclude articles presenting findings on
16 315 mHealth used by patients because we want to examine the impact of mHealth usage by health
17 316 workers to support healthcare delivery. Also, this study will exclude articles presenting
18 317 findings on mHealth for communication in terms of health promotion campaigns or
19 318 community mobilization to raise awareness of target groups. Again, our proposed research
20 319 will exclude articles presenting findings on mHealth for providing medical education to
21 320 health workers on professional development. This study will cover articles that offer evidence
22 321 published from 2000 to 2020 to obtain current information on the reports of mHealth
23 322 applications. The findings of this scoping review study will be published in a peer-reviewed
24 323 journal.

25 324 *Patient and Public Involvement*

26 325 No patient and the public will be involved in our study design, conducting, and dissemination
27 326 of the results of the scoping review.

28 327 **CONCLUSION**

29 328 This article provides a scoping review protocol with a comprehensive and detailed
30 329 methodology. The review includes both peer-reviewed articles and grey literature, which will
31 330 contribute to research on mHealth for disease diagnosis and treatment support by health
32 331 workers in SSA. This scoping review will provide existing evidence on the availability and
33 332 use of mHealth by health workers for disease diagnosis and treatment support in SSA. The

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3 333 results of this proposed study will reveal gaps in the literature, influence policymakers,
4 334 contribute to existing knowledge, and improve healthcare delivery in SSA.

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6
7 335 This scoping review is a part of a large study aimed at examining the accessibility of mHealth
8 336 for disease diagnosis and treatment support by health workers in Ghana.

11 337 **ETHICS AND DISSEMINATION**

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13
14 338 This scoping review methodology requires collecting, reviewing, and synthesizing materials
15 339 from all available publications; no ethical approval will be required. The final review will be
16 340 published in a scientific journal. The results of this review will be presented at appropriate
17 341 conferences and workshops.

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21 342

22 343 **Abbreviations**

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24
25 344 **LMICs** – Low- and- Middle-Income Countries

26
27 345 **PDA**s – Personal Digital Assistants

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29 346 **SDG** – Sustainable Development Goal

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31 347 **SSA** – sub-Saharan Africa

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33 348 **UHC**- Universal health coverage

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35 349 **WHO** – World Health Organization

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40 351 **Declarations**

41 352 **Acknowledgments**

42
43
44 353 The authors wish to thank the University of KwaZulu-Natal for giving us all the necessary
45 354 resources in developing this study protocol.

46 355 **Funding**

47
48 356 No funding has been secured for this study.

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1
2
3 **358 Availability of data and materials**
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6 359 All articles used in this study will be included in the reference list.
7

8 **360 Author's contribution**
9

10
11 361 EO and TPM-T conceptualized this study and the methodology. EO wrote the first draft, and
12
13 362 DK and TPM-T critically reviewed the manuscript. All authors (TPM-T, DK, and EO)
14
15 363 reviewed the final drafted manuscript and approved it.
16

17 **364 Ethics approval and consent to participants**
18

19 365 This study will not involve human or animal participants; hence, it does not require ethical
20
21 366 approval.
22

23 **367 Consent for publication**
24

25
26 368 Not applicable.
27

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29 **369 Competing Interests**
30

31 370 None declared.
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14
15 453 **Additional files**

- 16
17
18 454 1. **PRISMA-P** (Preferred Reporting Items for Systematic Review and Meta-Analysis
19 455 Protocols) 2015 checklist: recommended items to address in a systematic review
20 456 protocol*.
21
22 457 2. **Figure 1:** PRISMA ScR flowchart, which demonstrates the literature search and
23 458 study selection processes.
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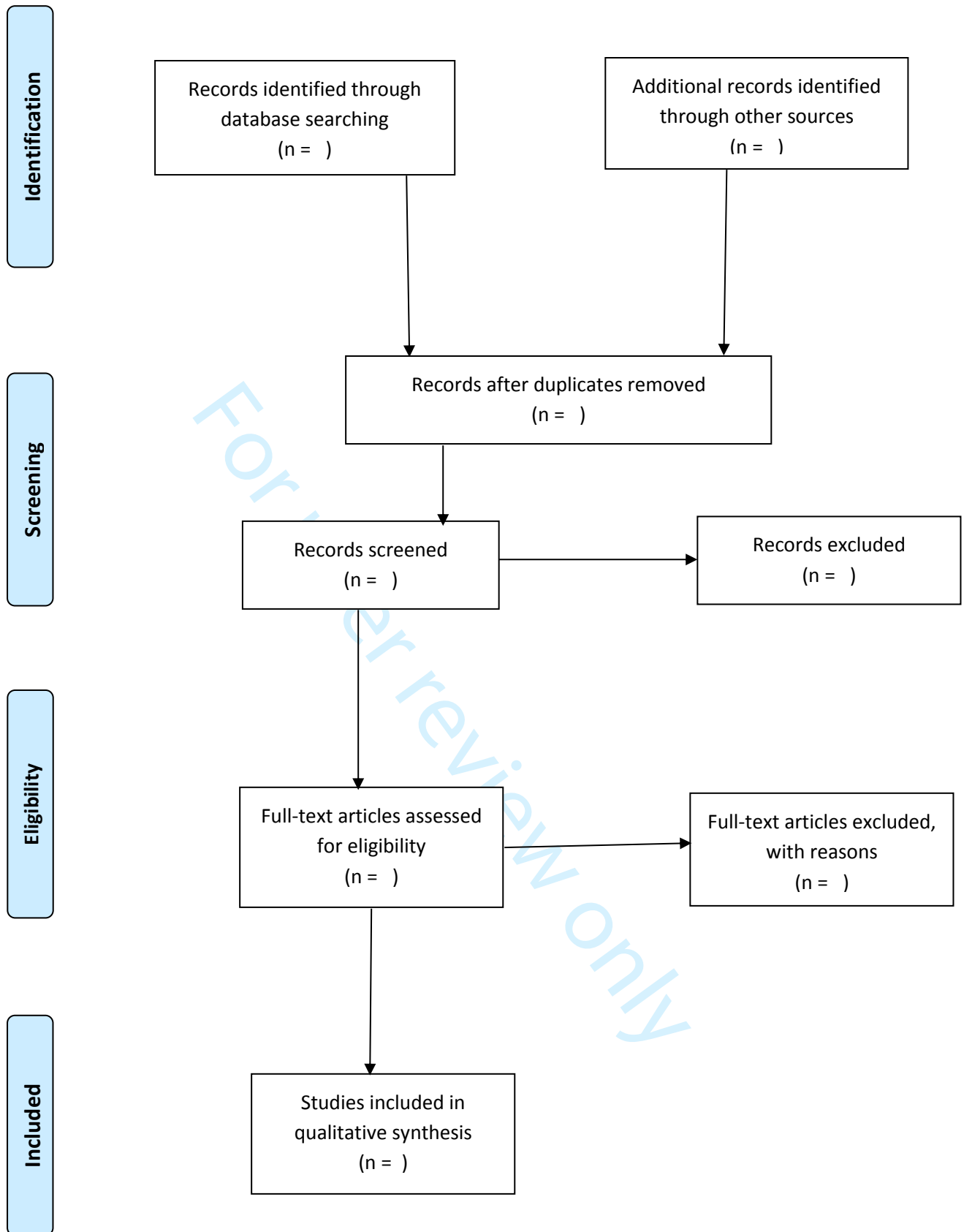


Figure 1: PRISMA ScR flowchart which demonstrates literature search and study selection processes.

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

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
	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 (where 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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