



Cochrane
Library

Cochrane Database of Systematic Reviews

Healthcare workers' informal uses of mobile devices to support their work: a qualitative evidence synthesis (Protocol)

Glenton C, Paulsen E, Agarwal S, Gopinathan U, Johansen M, Kyaddondo D, Munabi-Babigumira S, Nabukenya J, Nakityo I, Namitala J, Neumark T, Nsangi A, Pakenham-Walsh NM, Rashidian A, Royston G, Sewankambo N, Tamrat T, Lewin S

Glenton C, Paulsen E, Agarwal S, Gopinathan U, Johansen M, Kyaddondo D, Munabi-Babigumira S, Nabukenya J, Nakityo I, Namitala J, Neumark T, Nsangi A, Pakenham-Walsh NM, Rashidian A, Royston G, Sewankambo N, Tamrat T, Lewin S. Healthcare workers' informal uses of mobile devices to support their work: a qualitative evidence synthesis (Protocol). *Cochrane Database of Systematic Reviews* 2023, Issue 7. Art. No.: CD015705. DOI: [10.1002/14651858.CD015705](https://doi.org/10.1002/14651858.CD015705).

www.cochranelibrary.com

Healthcare workers' informal uses of mobile devices to support their work: a qualitative evidence synthesis (Protocol)

Copyright © 2023 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

WILEY

TABLE OF CONTENTS

ABSTRACT	1
BACKGROUND	2
Figure 1.	5
OBJECTIVES	5
METHODS	5
ACKNOWLEDGEMENTS	10
REFERENCES	11
APPENDICES	13
CONTRIBUTIONS OF AUTHORS	16
DECLARATIONS OF INTEREST	16
SOURCES OF SUPPORT	16

[Qualitative Protocol]

Healthcare workers' informal uses of mobile devices to support their work: a qualitative evidence synthesis

Claire Glenton¹, Elizabeth Paulsen², Smisha Agarwal³, Unni Gopinathan⁴, Marit Johansen⁴, David Kyaddondo⁵, Susan Munabi-Babigumira¹, Josephine Nabukenya⁶, Immaculate Nakityo⁷, Josephine Namitala⁸, Tom Neumark⁹, Allen Nsangi⁷, Neil Martin Pakenham-Walsh¹⁰, Arash Rashidian¹¹, Geoff Royston¹², Nelson Sewankambo¹³, Tigest Tamrat¹⁴, Simon Lewin^{15,16,17}

¹Department of Health and Functioning, Western Norway University of Applied Sciences, Bergen, Norway. ²Department of Health Sciences, Oslo Metropolitan University, Oslo, Norway. ³Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA. ⁴Global Health Cluster, Norwegian Institute of Public Health, Oslo, Norway. ⁵Child Health and Development Centre, Makerere University, Kampala, Uganda. ⁶Department of Information Systems, School of Computing and Informatics Technology, Makerere University, Kampala, Uganda. ⁷College of Health Sciences, Makerere University, Kampala, Uganda. ⁸College of Education and External Studies, Department of Adult and Community Education, Makerere University, Kampala, Uganda. ⁹Centre for Development and the Environment, University of Oslo, Oslo, Norway. ¹⁰Healthcare Information For All, Chipping Norton, UK. ¹¹Department of Health Management and Economics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran. ¹²Global Healthcare Information Network, Oxford, UK. ¹³School of Medicine, Makerere University College of Health Sciences, Kampala, Uganda. ¹⁴UNDP/UNFPA/UNICEF/World Bank Special Program of Research, Development and Research Training in Human Reproduction (HRP), Department of Sexual and Reproductive Health and Research, World Health Organization, Geneva, Switzerland. ¹⁵Department of Health Sciences Ålesund, Norwegian University of Science and Technology (NTNU), Ålesund, Norway. ¹⁶Health Systems Research Unit, South African Medical Research Council, Cape Town, South Africa. ¹⁷Centre for Epidemic Interventions Research (CEIR), Norwegian Institute of Public Health, Oslo, Norway

Contact: Claire Glenton, claire.glenton@hvl.no.

Editorial group: Cochrane Central Editorial Service.

Publication status and date: New, published in Issue 7, 2023.

Citation: Glenton C, Paulsen E, Agarwal S, Gopinathan U, Johansen M, Kyaddondo D, Munabi-Babigumira S, Nabukenya J, Nakityo I, Namitala J, Neumark T, Nsangi A, Pakenham-Walsh N, Martin, Rashidian A, Royston G, Sewankambo N, Tamrat T, Lewin S. Healthcare workers' informal uses of mobile devices to support their work: a qualitative evidence synthesis (Protocol). *Cochrane Database of Systematic Reviews* 2023, Issue 7. Art. No.: CD015705. DOI: [10.1002/14651858.CD015705](https://doi.org/10.1002/14651858.CD015705).

Copyright © 2023 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ABSTRACT

Objectives

This is a protocol for a Cochrane Review (qualitative). The objectives are as follows:

To explore the views, experiences, and practices of healthcare workers, managers and other professionals working in healthcare services regarding their informal, innovative uses of mobile devices to support their work.

BACKGROUND

This review focuses on healthcare workers' informal use of mobile phones to support their everyday work. Countries are increasingly implementing digital interventions, including through mobile phones and other mobile devices, in an effort to increase access to healthcare, enhance health workforce performance, and strengthen health systems (WHO 2021). However, it can be challenging to implement these strategies, and they may have mixed success (Agarwal 2018; Agarwal 2020; Agarwal 2021; Ames 2019; Gonçalves-Bradley 2020; Gonçalves-Bradley 2018; Odendaal 2020; Palmer 2020; Palmer 2020a; Vasudevan 2021). At the same time, individual healthcare workers are increasingly using mobile phones to find their own solutions to the challenges they face in their daily work and to address gaps in the system (Hampshire 2021). These informal and sometimes innovative solutions can represent approaches that health systems can learn from, but they can also create challenges of their own. This review aims to explore what we can learn from healthcare workers' own solutions by exploring their views, experiences, and practices regarding informal mobile phone use. We will use these review findings to discuss the implications of these solutions for formal practice, policy, and governance.

The review covers all types of mobile devices such as mobile phones, laptops, and tablets. However, as the most common type of mobile device is the mobile phone, we will use these two terms interchangeably.

Description of the topic

Formal digital health strategies

Over the past few decades, digital technologies have increasingly been adopted to address health needs and are now a common part of most healthcare systems. In the World Health Assembly Resolution on Digital Health from 2018, ministries of health were urged to consider the use of digital technologies as a means of promoting equitable, affordable, and universal access to health for all (WHO 2018). The World Health Organization (WHO) was also given the task of providing guidance on the use of these technologies (WHO 2018).

In response to this call, WHO published its first guidelines on digital technologies for health systems strengthening in 2019 (WHO 2019a). The guidelines focused on digital interventions accessible through healthcare workers' mobile devices, including tools and channels that enabled them to communicate with patients and other healthcare workers, receive training and decision support, manage drug stocks and other commodities, and notify births and deaths. To inform the guidelines, Cochrane prepared a series of Cochrane Reviews exploring the effectiveness, acceptability, and feasibility of these interventions (Agarwal 2018; Agarwal 2020; Agarwal 2021; Ames 2019; Gonçalves-Bradley 2020; Gonçalves-Bradley 2018; Odendaal 2020; Palmer 2020; Palmer 2020a; Vasudevan 2021). Several co-authors of the current review (TT, CG, SL, SA) were closely involved in the guideline process and in the preparation of the related Cochrane Reviews.

When preparing the guidelines, WHO's focus was on formal rather than informal digital health interventions, a distinction explained more fully below. Similarly, most of the studies identified through the Cochrane Reviews for the guideline

focused on strategies initiated by government departments, non-governmental organisations or by research teams, rather than by healthcare workers (although this was not a requirement of the reviews). These reviews highlighted many research gaps. Where research did exist, it indicated mixed results regarding the effectiveness and the acceptability of these types of strategies, as well as a range of implementation challenges, many with equity implications (Agarwal 2018; Agarwal 2020; Agarwal 2021; Ames 2019; Gonçalves-Bradley 2020; Gonçalves-Bradley 2018; Odendaal 2020; Palmer 2020; Palmer 2020a; Vasudevan 2021). Common challenges included healthcare workers' out-of-pocket expenses (e.g. for the costs of phones, electricity, mobile phone data and airtime), poor access to electricity and the internet, and limited literacy or digital literacy. In addition, as underlined by WHO when publicising the guidelines, digital strategies cannot replace other strategies that aim to foster functioning health systems, including ensuring sufficient healthcare workers, drugs, and supplies (WHO 2019). While acknowledging these challenges, the guideline panel chose to recommend most of the interventions, at least in settings where specific health system and infrastructure components were in place. Their decision to recommend these interventions was based on a belief in the *potential* of digital interventions to strengthen health systems and increase access to health services (WHO 2019a).

While formal implementation of digital interventions has many challenges, we were aware anecdotally that healthcare workers were using mobile phones and other mobile devices informally to develop their own solutions. We were therefore keen to explore these informal practices and to assess whether formal systems could learn any lessons from these on-the-ground initiatives. This led to the establishment of the mHEALTH-INNOVATE project, which received funding from the Norwegian Research Council in 2021, and of which this systematic review is a central part.

Healthcare workers' informal use of mobile devices to address infrastructural and health system bottlenecks

In many settings, healthcare workers face infrastructural and health systems challenges including lack of adequate transportation to reach their communities, limited training opportunities, workforce shortages, inadequate financing, drug stock-outs, and problems with referral pathways. These challenges are often exacerbated by a lack of supervisory support, undermining healthcare workers' roles and the development of learning health systems (Karimi-Shahanjarini 2019; Sheikh 2020). Events such as natural and man-made disasters, conflicts, and, most recently, the COVID-19 pandemic, add additional challenges that health systems may not be prepared for. To overcome these challenges and deliver the services expected of them, healthcare workers and managers may take the initiative to develop their own informal solutions (Alwy 2020; Munabi-Babigumira 2019). These solutions increasingly involve the use of mobile devices (Anstey 2018; Hampshire 2021).

At the beginning of the mHEALTH-INNOVATE project, we carried out several rounds of discussion and feedback to create a working definition of informal mobile device use. This was based on existing research and on input from project members, the international advisory group, and a stakeholder discussion (Glenton 2022). We define informal mobile device use as healthcare workers' use of mobile phones and other mobile devices to support their work, using approaches that are *initiated* by the healthcare workers themselves, and that are *not initially standardised, regulated, or*

endorsed by the health system or organisation to which they belong.

Informal digital solutions can vary in the amount of work that has gone into their development and the number of people they involve. Some may be simple solutions implemented by individual healthcare workers. For instance, healthcare workers may use their own phones to communicate directly with patients, colleagues, or specialists (Glenton 2022), to retrieve test results, or to gain information (Anstey 2018; Hampshire 2021). Healthcare workers may see this direct communication as quicker and more convenient than the health system's formal systems. Other solutions may require more planning and involve larger numbers of people. For instance, healthcare workers may establish private WhatsApp groups that healthcare workers and managers use to contact each other about clinical and practical matters (Anstey 2018; Glenton 2022; Hampshire 2021). They may also design their own digital applications, for instance to improve referral processes or specialist consultations (Anstey 2018). Finally, in some cases, solutions that may start off as simple, spontaneous, and individualised responses to everyday challenges may evolve into something larger.

Informal approaches are developed in direct response to a felt need by the people who go on to use them. This may differ from formal digital strategies that are sometimes designed by groups working at a distance from people's actual needs and expectations and without a good understanding of contextual realities (van Niekerk 2017). Since such approaches evolve organically by healthcare workers, they are also more likely to have addressed the challenges that have been identified within formal digital programmes (Odendaal 2020). In other words, they may be low-cost, easier to learn and to use, and work well within the given ecosystem with possible infrastructural challenges such as poor electricity or internet access. Informal approaches can therefore remove bottlenecks, create opportunities, and empower and enable health workers.

Challenges when healthcare workers adopt (informal) mobile device solutions

Informal approaches can, however, also lead to challenges. Some of these challenges are also found in formal strategies, but may be exacerbated by informal approaches. For instance, an increased use of mobile phones, particularly when these phones are the healthcare worker's own, could push the *burden of cost* from the health system on to healthcare workers (Odendaal 2020). In addition, the use of digital channels or tools that are not available to all healthcare workers or citizens, for example because of poor access to electricity, the internet, or mobile phones or because of lower literacy and digital literacy levels, could increase access for some but *worsen inequities* for others (Odendaal 2020).

Other challenges may be particular to informal approaches. For instance, private WhatsApp groups could improve communication for some healthcare workers, but could also *exclude* others as groups may be based on social rather than organisational ties. In addition, the sharing of information via unregulated digital communication channels can have implications for data security and patient privacy and can breach medical ethics standards.

Informal digital systems can also undermine the goals that formal digital systems are designed to address, particularly if they are used *instead* of formal systems. The digitisation of healthcare

systems is often motivated by a desire to gather information in more efficient ways, monitor staff performance, streamline decision-making, and increase standardisation (Alshallaqi 2022). Healthcare workers' transfer of information *away* from these formal systems can lead to the development of other parallel systems and weaken governments' and organisations' opportunities to gain oversight, learn, and improve. The limited oversight of devices and information flows also poses concerns for cybersecurity, particularly in situations where data may be hacked or compromised beyond the control of the health worker and requires timely resolution through a formal institution.

Theoretical perspectives relevant to the development and uptake of work practices such as digital strategies

Several theoretical perspectives may be helpful when studying the development and uptake of work practices such as the informal use of mobile devices. In this protocol, we will focus on three theories that we consider to be of relevance for the topic area. We discuss these three theories briefly below. However, we recognise that other theories may be equally or more relevant, and may revisit this issue after becoming more familiar with the included study data.

Social innovation theory

The concept of social innovation has been defined by Phills and colleagues as "any novel and useful solution to a social need or problem, that is better than existing approaches (i.e., more effective, efficient, sustainable, or just) and for which the value created (benefits) accrues primarily to society as a whole rather than private individuals" (Phills 2008).

In our review, we plan to explore healthcare workers' development of useful and sometimes novel solutions to their work-related needs and problems, in many cases motivated by a desire to benefit their patients (and thereby society) and not only themselves. One possible difference between our topic and the social innovation literature is that much of this literature is framed in terms of a business model that aims to achieve social value and is a response to the 'for-profit' business model which focuses on personal or shareholder wealth (Phillips 2015). In this literature, social innovators do not only *respond* to their own individual challenges. They also *proactively* search for problems to solve, and the solutions they develop are designed with *wide scale uptake* in mind. While some of the healthcare workers that are the focus of our review may have similar ambitions, many are likely to have goals that are more modest and limited to their own practice. Nevertheless, the social innovation literature may help us frame our analysis of healthcare worker initiatives, consider what the healthcare workers' goals of these initiatives are, and the extent of their uptake.

Normalisation Process Theory

So-called Normalisation Process Theory (NPT) aims to explain how individuals and groups 'normalise' interventions so that they become part of routine practice (May 2007; Murray 2010). In NPT, several processes need to take place for an intervention or practice to be successfully embedded in routine practice. These are described in four components: (1) coherence – where the new practice 'makes sense' to the people involved; (2) cognitive participation – where they are engaged and invested in its implementation; (3) collective action – where they are able to work together to make it function; and (4) reflexive monitoring – where

they consider the impacts of the practice after using it for a while (Murray 2010). These four components do not make up a linear process. Instead, the theory emphasises how each component is in a relationship with the others as well as with the wider context of the intervention. This context can include characteristics of the health system, such as organisational structures and processes, as well as broader issues such as social norms (Murray 2010).

Normalisation Process Theory focuses on interventions that aim to "introduce new, or modify existing, patterns of *collective action* in health care" (May 2007). This theory is therefore similar to social innovation theory in that both aim to understand the *planned* and *widespread uptake* of an innovation, as opposed to more ad hoc and individualised approaches. However, as opposed to social innovation theory and to the focus of our own review, NPT has often focused on the processes by which ground-level staff normalise interventions that are *institutionally sanctioned* (May 2007).

Despite these differences, NPT is still likely to be a useful perspective. It can help us think through why formal systems are not always used routinely and why informal systems may be preferred. It can also help us consider the extent to which informal approaches initiated by individual healthcare workers are likely to be taken up by other healthcare workers. The emphasis placed in NPT on group processes and on the impact of the wider context is also a helpful reminder that even highly individualised informal practice is likely to be dependent on interactions with others and on the broader setting within which they work.

Street-level bureaucracy

Lipsky's 'street-level bureaucrat' concept is also concerned with the interpretation and adoption of practices that are directed from higher levels of the system (Lipsky 1980). However, in contrast with NPT, the focus here is on street-level providers' *adaption* of these practices rather than on their successful (or unsuccessful) implementation. Lipsky describes how people working at the interface between citizens and government – including healthcare workers – and who are expected to deliver policies and practices

established elsewhere, create *their own* interpretations, routines, and strategies to deliver the services required of them. Most street-level providers deal with situations that are far more complex than policies and guidelines can account for and that involve many human dimensions. Provider discretion is therefore necessary (Lipsky 1980). In addition, providers are usually dealing with high caseloads and a lack of resources. Providers therefore develop their own routines and simplifications as necessary coping behaviours (Lipsky 1980).

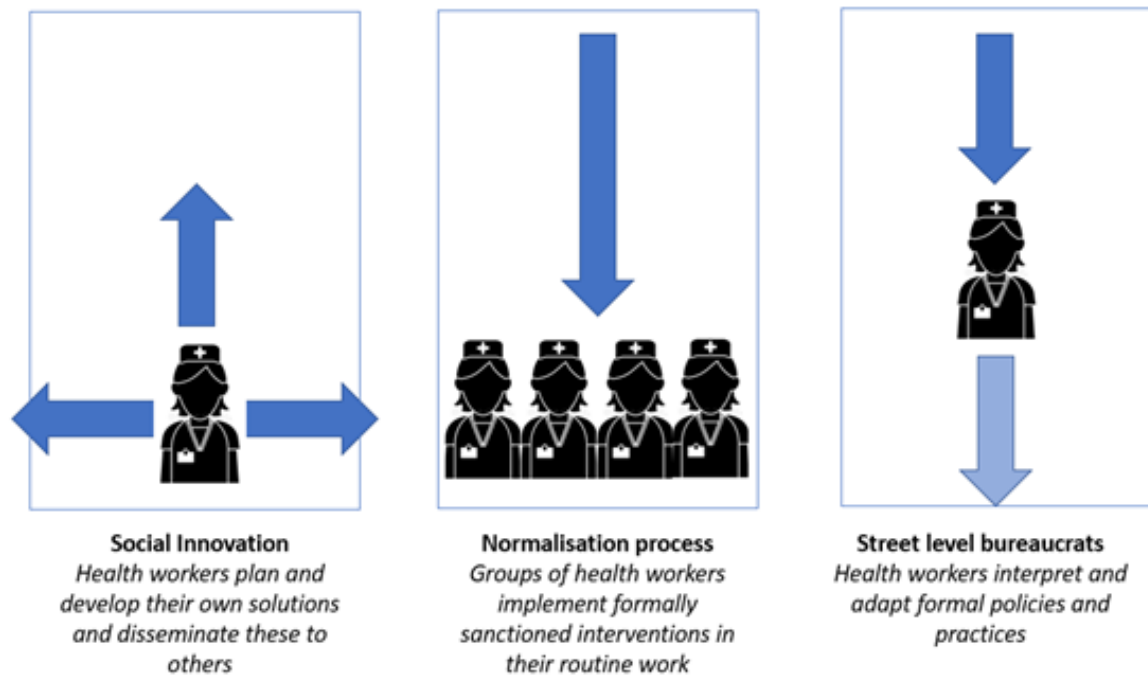
Street-level bureaucrats' often ad hoc and individual solutions contrast with social innovators who spend time designing solutions and planning the broader uptake of these solutions (van Niekerk 2017). In addition, while social innovators are portrayed as motivated by a desire to benefit society, street-level bureaucrats are often described in negative terms. Some may use their discretion to limit client's access to services, or to negatively impact the client's experience in other ways (Lipsky 1980). However, recent applications of the theory have emphasised how this discretion can be exercised in a variety of ways as providers attempt to serve a variety of needs, including those of the clients, the providers themselves, the health system, and the broader setting (Buchely 2015; Finlay 2009; Harris 2013). When considering healthcare workers' informal mobile device practices, it is useful to consider the challenges and demands this practice is trying to address and the impacts such practices may have on patients.

How can these theories help us explore informal practice?

Although we have developed a working definition of informal mobile device use for the purposes of this review, this topic is still underexplored. This review will help improve our understanding of the topic and possibly also help us to refine our working definition. The theories described above can support this process.

As illustrated in Figure 1, the three theories portray providers and the development and uptake of work practices in different ways. These different perspectives can help us to think through several aspects of informal practice.

Figure 1. Theoretical perspectives relevant to the development and uptake of practices.



- One such aspect involves the healthcare workers' *motivations* when using informal solutions and the extent to which they are driven by the needs and demands of patients, of colleagues, of management, or of others.
- A second aspect is the amount of *time and effort* that healthcare workers spend planning the practice. This might range from quick, ad hoc solutions to carefully designed strategies.
- A third, and related, aspect is the *extent of uptake* and whether widespread uptake is a goal at the start, later on, or at all. Is this practice primarily carried out by individuals or small groups, or is it part of a larger 'community of practice'? And to what extent do healthcare workers actively disseminate their solutions to others?
- A fourth aspect concerns the *relationship to formally sanctioned policy and practice*. Is the informal practice clearly distinct from the formal system, or is it an adaptation of this system? It may be helpful here to distinguish between 'shadow IT' and 'non-prescribed use'. In a 'shadow IT' approach (Wikipedia 2022), the systems, devices, software, or applications that healthcare workers are using are not standardised or regulated or endorsed by the health system or organisation. On the other hand, with 'non-prescribed use' (Schwartz 2013), the systems, devices, software, or applications are standardised or regulated or endorsed, but the manner in which healthcare workers are using them is not.
- A fifth aspect concerns *why formal systems are not used* and why healthcare workers may prefer their own solutions.
- And finally, a sixth, related aspect concerns *the influence of the wider context* and how informal approaches are shaped by structures, processes, events, and norms both within the workplace, the wider healthcare system, and society in general.

OBJECTIVES

To explore the views, experiences, and practices of healthcare workers, managers and other professionals working in healthcare services regarding their informal, innovative uses of mobile devices to support their work.

METHODS

When preparing this protocol, we used Cochrane Effective Practice and Organisation of Care (EPOC's) Protocol and Review Template for Qualitative Evidence Synthesis (Glenton 2022a).

Review co-production with relevant stakeholders

When developing the protocol, we collaborated with a range of stakeholders to explore the topic and define the scope of the review (see below). We will continue to collaborate with stakeholders during the later stages of the review process, when considering study sampling, interpreting the findings, and developing implementation considerations. To inform these processes, we have used guidance from the Cochrane training resources on involving people, Pollock 2022, and the TRANSFER approach (Munthe-Kaas 2020).

Developing a working definition for 'informal use' of mobile devices: To inform the scope of the review and the broader mHEALTH-INNOVATE project, we organised a stakeholder discussion on the Healthcare Information For All (HIFA) online forum on health workers' informal use of mobile devices (Glenton 2022). We also asked HIFA forum participants, international advisory group members, and project group members to share relevant studies on the topic. We used the results of the HIFA discussion, published research on the topic, and input from experts within our research team and its international advisory group, to

develop our working definition of health workers' informal mobile device use.

Informing the design of the review: We will continue to involve other stakeholders in the design of the review. We will begin by organising a meeting among partners in the larger mHEALTH-INNOVATE project group to discuss the types of stakeholders that are important to consider. We will do this by discussing the topic of the review, the type of healthcare decisions the review might inform, and the type of individuals and groups who might be affected by these decisions and by the results of the review.

We will then invite these stakeholders to participate in a structured discussion using the TRANSFER conversation guide (Munthe-Kaas 2020). During this discussion, we will ask the stakeholders to identify contextual factors they believe are likely to influence the review findings. These could be factors tied to, for instance, the healthcare workers themselves, their age, gender, profession or digital competence; their setting; and the context and the age of the study.

We will use these factors as a basis for study sampling strategies and subgroup analyses. We will also consider these factors when assessing the 'relevance' component of our GRADE-CERQual assessment (see below) and when carrying out our analysis.

Interpreting the review findings: We have described how we will involve stakeholders in this part of the review in the section on 'Implications for practice'.

Criteria for considering studies for this review

Types of studies

We will include primary studies that use qualitative study designs such as ethnography, phenomenology, case studies, grounded theory studies, and qualitative process evaluations. We will include studies that use both qualitative methods for data collection (e.g. focus group discussions, individual interviews, observation, diaries, document analysis, open-ended survey questions) and qualitative methods for data analysis (e.g. thematic analysis, framework analysis, grounded theory). We will exclude studies that collect data using qualitative methods but do not analyse these data using qualitative analysis methods (e.g. open-ended survey questions where the response data are analysed using descriptive statistics only).

We will include both published and unpublished studies and studies published in any language (see also 'Language translation' section below).

We will include mixed-methods studies where it is possible to extract data that were collected and analysed using qualitative methods.

We will not exclude studies based on our assessment of methodological limitations. We will use information about methodological limitations to assess our confidence in the review findings.

Topic of interest

- We will include studies that focus on healthcare workers' views, experiences, and practices regarding mobile phones and other

mobile devices, and that include data about healthcare workers' informal use of these devices.

- For the purposes of this review, we define informal mobile phone use as healthcare workers' use of mobile phones and other mobile devices to support their work, using approaches that are initiated by the healthcare workers themselves and that are not initially standardised, regulated, or endorsed by the health system or organisation to which they belong (see 'Review co-production with relevant stakeholders' section above for more information on how this definition was developed).
- We will include studies that describe informal use of mobile devices that fall under the category of '**shadow IT**'. In a 'shadow IT' approach, healthcare workers use devices, software, or applications instead of or in addition to those provided to them by their workplace. This could include, for instance, use of the healthcare workers' own mobile phones or the use of digital programs or apps that are not initially standardised, regulated, or endorsed by their workplace.
- We will also include studies that describe informal use of mobile devices that fall under the category of '**non-prescribed use**'. In a 'non-prescribed use' approach, healthcare workers use devices, software, or applications provided to them by their workplace, but in ways that have not been standardised, regulated, or endorsed.
- In both cases, we will include studies where healthcare workers use these tools and channels:
 - to communicate with any other person about service delivery or service management, including for instance the exchange of information or decision support about patient treatment or care, work processes, or resources needs;
 - to manage data related to service delivery or service management, including the collection, storage, or analysis of patient information, logistical information, or any other information regarded as relevant for performing their work;
 - for any other task in ways that are self-initiated, and not standardised, regulated, or endorsed by the health system or organisation.

Types of mobile device

- We will include studies of any type of mobile device, including mobile phones of any kind (but not analogue landline telephones) in addition to, for example, laptops and tablets. Our search strategy uses search terms specifically linked to the most common type of mobile device, that is the mobile phone. We have also used search terms linked to mobile devices and mobile health more generally. These search terms are also likely to identify studies of other types of mobile devices such as laptops and tablets, in which case these studies will be included.
- We will include studies that explore healthcare workers' use of their own private mobile devices as well as mobile devices provided by their workplace, as long as they use the device to support their work.

Types of participants

We will include studies that focus on the views, experiences, and practices of:

- any type of healthcare worker, including lay or community health workers, and health facility administrators or managers;

- students in training to be healthcare workers if the study describes their use of mobile devices while delivering health care.

Types of setting

We will include studies from any country, and in any setting where health care is delivered.

Exclusion criteria

We will exclude studies that:

- focus on healthcare workers' informal use of mobile devices for **personal and non-work-related activities** (e.g. healthcare workers using their phones for personal conversations with friends or lending their work phones to their children);
- focus on the use of mobile devices to support **pre-service training** or **continuing professional** development;
- have **social media** as their primary subject. This includes studies where the main aim is to analyse the contents of social media accounts or studies where the main aim is to explore how health workers use social media. As the focus of these studies is on social media behaviour rather than behaviour linked to service delivery or management, much of this information is not directly relevant. This includes descriptions of activities outside health workers' professional work (e.g. descriptions of leisure activities); and behaviour that is of professional relevance (e.g. posting comments about the healthcare sector, sharing information about new research) but that is not directly linked to service delivery or management.

Search methods for identification of studies

Electronic searches

The EPOC Information Specialist will develop the search strategies in consultation with the review authors.

We will search Epistemonikos (www.epistemonikos.org) for related reviews to identify eligible primary studies for inclusion in the review.

We will also search the following electronic databases:

- MEDLINE, Ovid;
- CINAHL (Cumulative Index to Nursing and Allied Health Literature), EBSCOhost;
- Scopus, Elsevier;
- Embase, Ovid (conference proceedings).

We will develop search strategies for each database. We will not apply any language limits. We have chosen a cut-off date of 2008, as this date reflects when mobile phones became widely used in many settings worldwide. The International Telecommunication Union calculates that low- and middle-income countries had a roughly 50% mobile phone coverage rate by 2008 (ITU 2022). We will limit the search to studies published in 2008 and onwards. We will include a methodological filter for qualitative studies. See [Appendix 1](#) for the MEDLINE search strategy, which we will adapt for other databases.

Grey literature

We will consider conducting a further grey literature search if our database searches listed above do not identify relevant studies. If so, we will search in the following source:

- BASE (www.base-search.net/).

Searching other resources

We will conduct a search in citationchaser (estech.shinyapps.io/citationchaser/) for all included studies and carry out a backward and forward search for citations.

We will contact the authors of included studies to clarify published information and to seek unpublished data.

Selection of studies

We will upload the results of our search into EPPI-Reviewer (Thomas 2010). We will then remove any duplicate records. Two review authors (CG, EP) will independently assess the titles and abstracts of the identified records to evaluate eligibility. We will retrieve the full text of all papers identified as potentially relevant by one or both review authors. Two review authors will then independently assess these papers. Any disagreements will be resolved by discussion or by involving a third review author if required. Where appropriate, we will contact the study authors for further information.

We will include a table listing studies that were excluded only after considerable discussion within the review team ('near misses').

Where the same study, using the same sample and methods, is presented in different reports, we will collate these reports so that each study (rather than each report) is the unit of interest in the review.

Machine learning

To maximise efficiency, we will use machine learning functions in the systematic review software EPPI-Reviewer (Thomas 2010), in the screening and study selection processes.

- We will initiate priority screening in EPPI-Reviewer. Priority screening is a ranking algorithm that continuously learns from researcher decisions of screening based on title and abstract text and pushes relevant studies to the front of the screening queue. It allows relevant studies to be identified and included almost immediately by researchers in the screening process; conversely, studies reserved for the end of the queue are very likely irrelevant (Gates 2019; Muller 2021).
- Once we include no studies at title and abstract level in the last 200 studies screened, we will stop screening.

We will include a PRISMA flow diagram to illustrate our search results and the process of screening and selecting studies for inclusion, including any machine-assisted decisions (Page 2021; Page 2021a).

Language translation

For titles and abstracts published in a language in which none of the review team are proficient (i.e. languages other than English, Norwegian, Swedish, Danish, French, Afrikaans, and Persian), we will carry out an initial translation through a freely available online

translation service (Google Translate). If this translation indicates inclusion, or if the translation is inadequate to permit a decision, we will retrieve the full text. We will then ask members of Cochrane networks or other individuals that are proficient in that language to assist us in assessing the full text for inclusion in the review. If this cannot be done, the paper will be listed as a study awaiting classification to ensure transparency in the review process.

Sampling of studies

Qualitative evidence synthesis aims for variation in concepts rather than an exhaustive sample, and large amounts of study data can impair the quality of the analysis. Once we have identified all eligible studies, we will assess whether their number or data richness is likely to represent a problem for the analysis, and will consider selecting a sample of studies.

If we decide to sample, we will use a purposive sampling approach to achieve the broadest possible variation within the included studies (EPOC 2017). We will identify three to five sampling criteria to help us capture data that will best answer our review objectives. These criteria will be based on key areas of variation within the included studies and on discussions with stakeholders. The criteria could include the type of health worker, the type of setting, or other contextual factors identified as important. Another criterion is likely to be the richness of the data, that is information that is detailed enough to allow the researcher or reader to interpret the meaning and context of what is being researched (Popay 1998), and assessed using a data richness scale (EPOC 2017).

Data extraction

We will use a data extraction form designed specifically for the review. We will extract descriptive information about first author, publication date, study language, country, healthcare setting (e.g. nursing home or primary healthcare clinic), type and number of healthcare workers, and type of informal use. We will also extract descriptive information about how the study was designed, conducted, and funded. Finally, we will extract all data relevant to the review objective, including author interpretations as well as illustrative quotes (see further details in 'Data synthesis' section below).

One review author will extract data from all the (sampled) studies. An additional review author will double-check the data extraction performed by the first review author and verify that all relevant data have been extracted. Where review authors are authors of an included study, they will not extract data from that study.

Assessing the methodological limitations of included studies

Our inclusion criteria specify that studies need to use qualitative methods both for data collection and analysis. This criterion also constitutes a basic quality threshold. In addition, at least two review authors will independently assess methodological limitations for each study using a list of criteria used in previous Cochrane Reviews (Glenton 2021). This list was originally based on the Critical Appraisal Skills Programme (CASP) tool (CASP 2018), but has since gone through several iterations. For instance, we will not include questions about the appropriateness of qualitative methodology or the specific research design used, as this is already covered in our inclusion criteria.

We will assess methodological limitations according to the following domains.

- Were the settings and context described adequately?
- Was the sampling strategy described, and was this appropriate?
- Was the data collection strategy described and was this appropriate?
- Was the data analysis described, and was this appropriate?
- Were the claims made/findings supported by sufficient evidence?
- Was there evidence of reflexivity?
- Did the study demonstrate sensitivity to ethical concerns?
- Any other concerns?

Where any of the review authors are also authors of included studies, they will not be involved in the assessment of the study's methodological limitations. Any disagreements will be resolved by discussion or by involving a third review author when required.

We will report our assessments in a Methodological Limitations table. We will use these assessments to support our GRADE-CERQual (Confidence in the Evidence from Reviews of Qualitative research) assessment of our confidence in the review findings.

Data synthesis

At a minimum, this review will lead to a set of descriptive findings about a relatively unexplored topic, that is the informal use of mobile phones. We also hope to develop a more conceptual understanding that can help us interpret and explain healthcare workers' use of informal digital solutions. We therefore aim to use a meta-ethnographic approach, drawing on the analytical steps outlined originally by Noblit and Hare (Noblit 2019), and the eMERGe meta-ethnography reporting guidance (France 2019), and following stages described by Cooper in her recent Cochrane qualitative evidence synthesis (Cooper 2021).

Meta-ethnography is an interpretive qualitative evidence synthesis approach that is well-suited to producing new concepts or theories (France 2019; Noyes 2018). A possible limitation of the meta-ethnographic approach is that it may be best suited to topics where there are already a number of in-depth studies with rich data. Meta-ethnography involves the translation and synthesis of 'second order' conceptual findings from existing studies in order to develop higher-level 'third order' conceptual findings. However, topics that are relatively under-researched (and also therefore more likely to be in need of conceptual development) may be challenging to address through meta-ethnography because of a lack of existing studies.

Healthcare workers' use of mobile devices is an established research topic. Odendaal's recent Cochrane Review on this topic identified a large number of studies, and many more underway (Odendaal 2020). Nevertheless, studies that focus on healthcare workers' *informal* use of mobile devices are far fewer in number. Our review may therefore need to include data from studies that have a different or broader focus than our own, and we may therefore only have access to data on the topic that are thinner and far less conceptual. In such a case, we may need to limit ourselves to a thematic framework analysis. We will make this decision once we have familiarised ourselves with the study data.

Developing the 'Implications for practice' section

Once we have finished preparing the review findings, we will examine each finding, identify factors that planners and policymakers working in the field of mobile health should consider when considering informal uses of mobile devices, and present these as prompts (Glenton 2019). These prompts will be presented in the 'Implications for practice' section. These prompts are not intended to be recommendations, but will be phrased as questions to help implementers consider the implications of the review findings within their context. We will send this section to a selection of stakeholders identified at the beginning of the review process to gather their feedback about the relevance of these prompts and the manner in which they are phrased and presented (see 'Review co-production with relevant stakeholders' section above).

Assessing our confidence in the review findings

At least two review authors will use the GRADE-CERQual approach to assess our confidence in each finding (Lewin 2018). GRADE-CERQual assesses confidence in the evidence based on the following four key components.

- Methodological limitations of included studies: the extent to which there are concerns about the design or conduct of the primary studies that contributed evidence to an individual review finding.
- Coherence of the review finding: an assessment of how clear and cogent the fit is between the data from the primary studies and a review finding that synthesises those data. By cogent, we mean well-supported or compelling.
- Adequacy of the data contributing to a review finding: an overall determination of the degree of richness and quantity of data supporting a review finding.
- Relevance of the included studies to the review question: the extent to which the body of evidence from the primary studies supporting a review finding is applicable to the context (perspective or population, phenomenon of interest, setting) specified in the review question.

After assessing each of the four components, we will make a judgement about the overall confidence in the evidence supporting the review finding. We will judge confidence as high, moderate, low, or very low. The final assessment will be based on consensus among the review authors. All findings start as high confidence, and will then be downgraded if there are important concerns regarding any of the GRADE-CERQual components. We will use the interactive Summary of Qualitative findings (iSoQ) tool when managing the data needed to make an assessment of confidence in the evidence, undertaking the final GRADE-CERQual assessments and preparing summary of qualitative findings tables and evidence profiles (GRADE-CERQual 2022).

Summary of Qualitative Findings table(s) and Evidence profile(s)

We will present summaries of the findings and assessments of our confidence in these findings in the Summary of Qualitative Findings table(s). We will present detailed descriptions of our confidence assessment in an Evidence profile(s).

Integrating the review findings with Cochrane intervention reviews

There are no Cochrane Reviews assessing the effectiveness of informal mobile health (mHealth) interventions, nor are we aware of other non-Cochrane reviews on this topic. (This is perhaps not surprising, as it would be challenging to develop and assess the effectiveness of 'informal' interventions.)

Review author reflexivity

In keeping with quality standards for reflexivity within qualitative research, we will maintain a reflexive stance throughout all stages of the review process. We will consider how our individual and collective views, beliefs, and experiences could influence the choices we make in terms of the scope of the review and our review methods; our interpretation of the data; and our interpretation of our own findings.

This review is the first stage of a larger research project that will also include primary research and deliberative dialogues with policymakers (the mHealth-Innovate project). To support the broader project and develop a shared understanding of the topic, we have decided to involve all members of the mHealth-Innovate project team as co-authors of this review. The review team is therefore large, with 18 co-authors. These co-authors also represent a range of backgrounds and perspectives, including as patients and healthcare users; health information advocates; healthcare workers, managers, and administrators; policymakers; researchers in the fields of digital health, health systems, epidemiology, and the social sciences; and employees of universities, a public health institute, a non-governmental organisation, and the World Health Organization. Most of the co-authors have clinical or researcher experience, or both, in low- and middle-income settings, in particular from Uganda.

The review team has spent considerable time discussing and reaching agreement about the scope of the review and definitions of the topic. As part of this process, each co-author also prepared a reflexivity statement describing their own perspectives and experiences. An agreed-upon summary of these statements is presented below.

Although the review team have a range of backgrounds and perspectives, we share the same broad views regarding healthcare workers' informal use of mobile devices. We see these approaches first and foremost as a response to gaps and weaknesses in the formal healthcare system. We believe that many healthcare workers find themselves 'between a rock and a hard place', committed to meeting the needs of their patients and their workplace while working with the often limited resources available to them, particularly if they work in low-income settings. Several of the co-authors have experienced healthcare workers' informal uses of mobile phones in these settings. One co-author with clinical experience from a high-income setting has also experienced how healthcare workers turn to informal systems because they lack formal systems for communicating with colleagues or because formal systems are overly cumbersome and time-consuming.

We are sympathetic to the challenges that healthcare workers face and their efforts to overcome these challenges through informal, unregulated approaches. We believe that these approaches can help healthcare workers address some of the immediate needs

of their patients and may help relieve healthcare worker stress. We suspect that these approaches may be particularly well-suited to healthcare workers' local needs and settings, in contrast to solutions that have been developed elsewhere or that are developed commercially. We also admire approaches that we believe illustrate healthcare workers' creativity and ingenuity.

At the same time, we are concerned about the possible harms and disadvantages of informal digital approaches. One of our main concerns is the possibility of harm to patients through breaches in patient privacy and confidentiality. We are also concerned about the cost of informal approaches to healthcare workers who may feel under pressure to use their own personal phones, airtime, and data. Finally, we are concerned that healthcare workers who access, collect, and share information through informal channels may inadvertently undermine the formal healthcare system's opportunity to learn, co-ordinate, and improve.

By exploring healthcare workers' informal behaviour in relation to mobile digital technology, we may be inadvertently encouraging government authorities to regulate this behaviour. We agree that some level of regulation may be necessary, for instance to protect patient confidentiality. At the same time, we believe that regulation alone is not the answer, and that health system gaps that may explain this behaviour also need to be addressed. Even where these gaps have been addressed, we believe that healthcare workers need some level of independence and flexibility in order to develop locally relevant solutions, to thrive and feel empowered, and to deliver quality healthcare services.

ACKNOWLEDGEMENTS

We are grateful to Heather Ames for her support with the EPPI-Reviewer software and with the planning of the machine learning approach.

The following people conducted the editorial process for this protocol.

- Sign-off Editor (final editorial decision): Tari Turner (Monash University)
- Managing Editor (selected peer reviewers, collated peer-reviewer comments, provided editorial guidance to authors, edited the article): Anne-Marie Stephani (Cochrane Central Editorial Service)
- Editorial Assistant (conducted editorial policy checks and supported editorial team): Lisa Wydrzynski (Cochrane Central Editorial Service)
- Copy Editor (copy-editing and production): Lisa Winer, Cochrane Copy Edit Support
- Methods peer review: Jennifer Hilgart, Cochrane Central Executive Team
- Search peer review: Jo Abbott, Cochrane Information Specialist
- Clinical peer review: Sebastian J Fritsch (Department of Intensive Care Medicine, University Hospital RWTH Aachen, Aachen, Germany)
- Clinical peer review: Pauline Johansson (eHealth Institute and Department of Medicine and Optometry, Linnaeus University, Sweden)

REFERENCES

Additional references

Agarwal 2018

Agarwal S, Vasudevan L, Tamrat T, Glenton C, Lewin S, Bergman H, et al. Digital tracking, provider decision support systems, and targeted client communication via mobile devices to improve primary health care. *Cochrane Database of Systematic Reviews* 2018, Issue 1. Art. No: CD012925. [DOI: [10.1002/14651858.CD012925](https://doi.org/10.1002/14651858.CD012925)]

Agarwal 2020

Agarwal S, Glenton C, Henschke N, Tamrat T, Bergman H, Fønhus MS, et al. Tracking health commodity inventory and notifying stock levels via mobile devices: a mixed methods systematic review. *Cochrane Database of Systematic Reviews* 2020, Issue 10. Art. No: CD012907. [DOI: [10.1002/14651858.CD012907.pub2](https://doi.org/10.1002/14651858.CD012907.pub2)]

Agarwal 2021

Agarwal S, Glenton C, Tamrat T, Henschke N, Maayan N, Fønhus MS, et al. Decision-support tools via mobile devices to improve quality of care in primary healthcare settings. *Cochrane Database of Systematic Reviews* 2021, Issue 7. Art. No: CD012944. [DOI: [10.1002/14651858.CD012944.pub2](https://doi.org/10.1002/14651858.CD012944.pub2)]

Alshallaqi 2022

Alshallaqi M. The complexities of digitization and street-level discretion: a socio-materiality perspective. *Public Management Review* 2022;1-23. [DOI: [10.1080/14719037.2022.2042726](https://doi.org/10.1080/14719037.2022.2042726)]

Alwy 2020

Alwy Al-Beity F, Pembe AB, Kwezi HA, Massawe SN, Hanson C, Baker U. "We do what we can do to save a woman" health workers' perceptions of health facility readiness for management of postpartum haemorrhage. *Glob Health Action* 2020;**13**(1):1707403.

Ames 2019

Ames HM, Glenton C, Lewin S, Tamrat T, Akama E, Leon N. Clients' perceptions and experiences of targeted digital communication accessible via mobile devices for reproductive, maternal, newborn, child, and adolescent health: a qualitative evidence synthesis. *Cochrane Database of Systematic Reviews* 2019, Issue 10. Art. No: CD013447. [DOI: [10.1002/14651858.CD013447](https://doi.org/10.1002/14651858.CD013447)]

Anstey 2018

Anstey Watkins JOT, Goudge J, Gómez-Olivé FX, Griffiths F. Mobile phone use among patients and health workers to enhance primary healthcare: A qualitative study in rural South Africa. *Soc Sci Med* 2018;**198**:139-147.

Buchely 2015

Buchely L. Bureaucratic activism and Colombian community mothers: the daily construction of the rule of law. Rapoport Center Human Rights Working Paper Series. Austin, TX: The University of Texas School of Law, 2015.

CASP 2018

Critical Appraisal Skills Programme (CASP). CASP Qualitative Studies Checklist. casp-uk.net/images/checklist/documents/CASP-Qualitative-Studies-Checklist/CASP-Qualitative-Checklist-2018_fillable_form.pdf (accessed 28 March 2023).

Cooper 2021

Cooper S, Schmidt BM, Sambala EZ, Swartz A, Colvin CJ, Leon N, Wiysonge CS. Factors that influence parents' and informal caregivers' views and practices regarding routine childhood vaccination: a qualitative evidence synthesis. *Cochrane Database of Systematic Reviews* 2021, Issue 10. Art. No: CD013265. [DOI: [10.1002/14651858.CD013265.pub2](https://doi.org/10.1002/14651858.CD013265.pub2)]

EPOC 2017

Effective Practice and Organisation of Care Group (EPOC). EPOC Qualitative Evidence Syntheses guidance on when to sample and how to develop a purposive sampling frame. *EPOC resources for review authors*: <https://epoc.cochrane.org/resources/epoc-resources-review-authors>.

Finlay 2009

Finlay S, Sandall J. "Someone's rooting for you": continuity, advocacy and street-level bureaucracy in UK maternal healthcare. *Soc Sci Med* 2009;**69**(8):1228-35.

France 2019

France EF, Cunningham M, Ring N, Uny I, Duncan EA, Jepson RG, et al. Improving reporting of meta-ethnography: The eMERGE reporting guidance. *J Adv Nurs* 2019;**75**(5):1126-1139.

Gates 2019

Gates A, Guitard S, Pillay J, Elliott SA, Dyson MP, Newton AS, Hartling L. Performance and usability of machine learning for screening in systematic reviews: a comparative evaluation of three tools. *Syst Rev* 2019;**8**(1):278.

Glenton 2019

Glenton C, Lewin S, Lawrie TA, Barreix M, Downe S, Finlayson KW, et al. Qualitative Evidence Synthesis (QES) for Guidelines: Paper 3 - Using qualitative evidence syntheses to develop implementation considerations and inform implementation processes. *Health Res Policy Syst* 2019;**17**(1):74.

Glenton 2021

Glenton C, Carlsen B, Lewin S, Wennekes MD, Winje BA, Eilers R. Healthcare workers' perceptions and experiences of communicating with people over 50 years of age about vaccination: a qualitative evidence synthesis. *Cochrane Database of Systematic Reviews* 2021, Issue 7. Art. No: CD013706. [DOI: [10.1002/14651858.CD013706.pub2](https://doi.org/10.1002/14651858.CD013706.pub2)]

Glenton 2022

Glenton C, Nabukenya J, Agarwal S, Meltzer M, Mukendi E, Nakityo I, et al. Using an online community of practice to explore the informal use of mobile phones by health workers. *Oxford Open Digital Health* 2023;**1**. [DOI: [10.1093/oodh/oqac003](https://doi.org/10.1093/oodh/oqac003)]

Glenton 2022a

Glenton C, Bohren MA, Downe S, Paulsen EJ, Lewin S. EPOC Qualitative Evidence Synthesis: Protocol and review template, Version 1.3. EPOC Resources for review authors.

Gonçalves-Bradley 2020

Gonçalves-Bradley DC, Maria ARJ, Ricci-Cabello I, Villanueva G, Fønhus MS, Glenton C, et al. Mobile technologies to support healthcare provider to healthcare provider communication and management of care. *Cochrane Database of Systematic Reviews* 2020, Issue 8. Art. No: CD012927. [DOI: [10.1002/14651858.CD012927.pub2](https://doi.org/10.1002/14651858.CD012927.pub2)]

Gonçalves-Bradley 2018

Gonçalves-Bradley DC, Buckley BS, Fønhus MS, Glenton C, Henschke N, Lewin S, et al. Mobile-based technologies to support client to healthcare provider communication and management of care. *Cochrane Database of Systematic Reviews* 2018, Issue 1. Art. No: CD012928. [DOI: [10.1002/14651858.CD012928](https://doi.org/10.1002/14651858.CD012928)]

GRADE-CERQual 2022 [Computer program]

GRADE-CERQual Interactive Summary of Qualitative Findings (iSoQ), Version 1.0 (Available at isoq.epistemonikos.org). Developed by the Epistemonikos Foundation, Megan Wainwright Consulting and the Norwegian Institute of Public Health for the GRADE-CERQual Project Group. Oslo, Norway: Norwegian Institute of Public Health, Accessed 18 Oct 2022.

Hampshire 2021

Hampshire K, Mwase-Vuma T, Alemu K, Abane A, Munthali A, Awoke T, et al. Informal mhealth at scale in Africa: Opportunities and challenges. *World Dev* 2021;**140**:105257.

Harris 2013

Harris B, Eyles J, Penn-Kekana L, Fried J, Nyathela H, Thomas L, et al. Bringing justice to unacceptable health care services? Street-level reflections from urban South Africa. *International Journal of Transitional Justice* 2013;**8**(1):141-161.

ITU 2022

International Telecommunication Union. Global ICT developments. ICT Indicators Database: <https://www.itu.int/ITU-D/ict/statistics/ict/> Accessed 18 Oct 2022.

Karimi-Shahanjarini 2019

Karimi-Shahanjarini A, Shakibazadeh E, Rashidian A, Hajimiri K, Glenton C, Noyes J, et al. Barriers and facilitators to the implementation of doctor-nurse substitution strategies in primary care: a qualitative evidence synthesis. *Cochrane Database of Systematic Reviews* 2019, Issue 4. Art. No: CD010412. [DOI: [10.1002/14651858.CD010412.pub2](https://doi.org/10.1002/14651858.CD010412.pub2)]

Lewin 2018

Lewin S, Booth A, Glenton C, Munthe-Kaas H, Rashidian A, Wainwright M, et al. Applying GRADE-CERQual to qualitative evidence synthesis findings: introduction to the series. *Implement Sci* 2018;**13**(Suppl 1):2.

Lipsky 1980

Lipsky M. Street-Level Bureaucracy: Dilemmas of the Individual in Public Services. New York: Russel Sage Foundation, 1980.

May 2007

May C, Finch T, Mair F, Ballini L, Dowrick C, Eccles M, et al. Understanding the implementation of complex interventions in health care: the normalization process model. *BMC Health Serv Res* 2007;**7**:148.

Muller 2021

Muller AE, Ames HMR, Himmels JPW, Jardim PSJ, Nguyen HL, Rose CJ, et al. Implementation of machine learning in evidence syntheses in the Cluster for Reviews and Health Technology Assessments: Final report 2020-2021. Norwegian Institute of Public Health. www.fhi.no/globalassets/dokumenterfiler/rapporter/2021/implementation-of-machine-learning-in-evidence-syntheses-in-the-cluster-for-reviews-and-health-technology-assessments-final-report-2020-2021.pdf (accessed 5 June 2023).

Munabi-Babigumira 2019

Munabi-Babigumira S, Glenton C, Willcox M, Nabudere H. Ugandan health workers' and mothers' views and experiences of the quality of maternity care and the use of informal solutions: A qualitative study. *PLoS One* 2019;**14**(3):e0213511.

Munthe-Kaas 2020

Munthe-Kaas H, Nøkleby H, Lewin S, Glenton C. The TRANSFER Approach for assessing the transferability of systematic review findings. *BMC Med Res Methodol* 2020;**20**(1):11.

Murray 2010

Murray E, Treweek S, Pope C, MacFarlane A, Ballini L, Dowrick C, et al. Normalisation process theory: a framework for developing, evaluating and implementing complex interventions. *BMC Med* 2010;**8**:63.

Noblit 2019

Noblit G. Meta-ethnography in Education. Oxford (UK): Oxford University Press, 2019.

Noyes 2018

Noyes J, Booth A, Flemming K, Garside R, Harden A, Lewin S, et al. Cochrane Qualitative and Implementation Methods Group guidance series - paper 3: methods for assessing methodological limitations, data extraction and synthesis, and confidence in synthesized qualitative findings. *J Clin Epidemiol* 2018;**97**:49-58.

Odendaal 2020

Odendaal WA, Anstey Watkins J, Leon N, Goudge J, Griffiths F, Tomlinson M, et al. Health workers' perceptions and experiences of using mHealth technologies to deliver primary healthcare services: a qualitative evidence synthesis. *Cochrane Database of Systematic Reviews* 2020, Issue 3. Art. No: CD011942. [DOI: [10.1002/14651858.CD011942.pub2](https://doi.org/10.1002/14651858.CD011942.pub2)]

Page 2021

Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;**372**:n71.

Page 2021a

Page MJ, Moher D, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. *BMJ* 2021;**372**:n160.

Palmer 2020

Palmer MJ, Henschke N, Bergman H, Villanueva G, Maayan N, Tamrat T, et al. Targeted client communication via mobile devices for improving maternal, neonatal, and child health. *Cochrane Database of Systematic Reviews* 2020, Issue 8. Art. No: CD013679. [DOI: [10.1002/14651858.CD013679](https://doi.org/10.1002/14651858.CD013679)]

Palmer 2020a

Palmer MJ, Henschke N, Villanueva G, Maayan N, Bergman H, Glenton C, et al. Targeted client communication via mobile devices for improving sexual and reproductive health. *Cochrane Database of Systematic Reviews* 2020, Issue 8. Art. No: CD013680. [DOI: [10.1002/14651858.CD013680](https://doi.org/10.1002/14651858.CD013680)]

Phillips 2015

Phillips W, Lee H, Ghobadian A, O'Regan N, James P. Social innovation and social entrepreneurship: A systematic review. *Group & Organization Management* 2015;**40**(3):428-461.

Phills 2008

Phills JA, Deiglmeier K, Miller DT. Rediscovering social innovation. *Stanford Social Innovation Review* 2008;**6**:34-43.

Pollock 2022

Pollock A, Morley R, Watts C. Involving People: A learning resource for systematic review authors. *Cochrane Training*. 21 June 2022.

Popay 1998

Popay J, Rogers A, Williams G. Rationale and standards for the systematic review of qualitative literature in health services research. *Qual Health Res* 1998;**8**(3):341-51.

Schwartz 2013

Schwartz A, Bhavsar M, Cutrell E, Donner J, Densmore M. Balancing burden and benefit: non-prescribed use of employer-issued mobile devices. In: *Proceedings of the Sixth International Conference on Information and Communications Technologies and Development*. Vol. Notes - Volume 2. Cape Town, South Africa: Association for Computing Machinery, 2013:140-143.

Sheikh 2020

Sheikh K, Agyepong I, Jhalani M, Ammar W, Hafeez A, Pyakuryal S, et al. Learning health systems: an empowering agenda for low-income and middle-income countries. *Lancet* 2020;**395**(10223):476-477.

Thomas 2010 [Computer program]

EPPI-Reviewer 4: software for research synthesis. EPPI-Centre Software. Thomas J, Brunton J, Graziosi S, Version 2018. London: Social Science Research Unit, UCL Institute of Education, 2010.

van Niekerk 2017

van Niekerk L, Chater R, Naydenova E, Lim J, Chamas L, et al. Social innovation in health: case studies and lessons learned from low- and middle-income countries. License: CC BY-NC-SA 3.0 IGO. Geneva: World Health Organization. apps.who.int/iris/handle/10665/259187.

Vasudevan 2021

Vasudevan L, Glenton C, Henschke N, Maayan N, Eysers J, Fønhus MS, et al. Birth and death notification via mobile devices: a mixed methods systematic review. *Cochrane Database of Systematic Reviews* 2021, Issue 7. Art. No: CD012909. [DOI: [10.1002/14651858.CD012909.pub2](https://doi.org/10.1002/14651858.CD012909.pub2)]

WHO 2018

World Health Organization. Agenda item 12.4. Digital health resolution. Seventy-first World Health Assembly. 26 May 2018. www.who.int/publications/i/item/10665-279505 (accessed 5 June 2023).

WHO 2019

World Health Organization. WHO releases first guideline on digital health interventions. www.who.int/news/item/17-04-2019-who-releases-first-guideline-on-digital-health-interventions.

WHO 2019a

World Health Organization. WHO Recommendations on Digital Interventions for Health Systems Strengthening. Geneva: World Health Organization, 2019.

WHO 2021

World Health Organization. Global strategy on digital health 2020-2025. Licence: CC BY-NC-SA 3.0 IGO. www.who.int/docs/default-source/documents/g4dhd2a2a9f352b0445bafbc79ca799dce4d.pdf (accessed 5 June 2023).

Wikipedia 2022

Wikipedia contributors. Shadow IT. Wikipedia, The Free Encyclopedia. Retrieved 08:45, 18 October 2022, from https://en.wikipedia.org/w/index.php?title=Shadow_IT&oldid=1114504202 6 October 2022.

APPENDICES
Appendix 1. Search strategy
Ovid MEDLINE(R) ALL 1946 to August 10, 2022

#	Searches	Results
1	Cell Phone/	9718
2	"Cell Phone Use"/	352
3	Smartphone/	8080
4	Mobile Applications/	10415
5	Medical Informatics Applications/	2550
6	Text Messaging/	4191
7	Internet-Based Intervention/	996
8	Social Media/	13940
9	(mobile device* or mobile phone* or mobile telephone* or cellphone* or cell* phone* or smartphone* or smart phone*).ti,ab,kf.	38403
10	(mobile adj (app or apps or application*)).ti,ab,kf.	8418
11	(mobile technolog* or short messag* or text messag* or texting or electronic messag* or social media*).ti,ab,kf.	33168
12	(mobile health or mhealth or m-health or electronic health or ehealth or e-health or digital health).ti,ab,kf.	49626
13	or/1-12 [Mobile device]	123504
14	health personnel/ or allied health personnel/ or community health workers/ or dental auxiliaries/ or dental assistants/ or dental hygienists/ or dental technicians/ or denturists/ or emergency medical technicians/ or home health aides/ or licensed practical nurses/ or medical record administrators/ or medical secretaries/ or medical receptionists/ or nursing assistants/ or psychiatric aides/ or operating room technicians/ or pharmacy technicians/ or physical therapist assistants/ or physician assistants/ or ophthalmic assistants/ or pediatric assistants/ or anatomists/ or anesthetists/ or anesthesiologists/ or nurse anesthetists/ or audiologists/ or caregivers/ or case managers/ or "coroners and medical examiners"/ or dental staff/ or dental staff, hospital/ or dentists/ or dentists, women/ or endodontists/ or "oral and maxillofacial surgeons"/ or orthodontists/ or doulas/ or emergency medical dispatcher/ or epidemiologists/ or health facility administrators/ or hospital administrators/ or chief executive officers, hospital/ or infection control practitioners/ or medical laboratory personnel/ or medical staff/ or medical staff, hospital/ or hospitalists/ or nurses/ or nurse administrators/ or nurse practitioners/ or family nurse practitioners/ or pediatric nurse practitioners/ or nurse specialists/ or nurse clinicians/ or nurse midwives/ or nurses, pediatric/ or nurses, neonatal/ or nurses, community health/ or nurses, international/ or nurses, male/ or nurses, public health/ or nursing staff/ or nursing staff, hospital/ or nutritionists/ or occupational therapists/ or optometrists/ or personnel, hospital/ or hospital volunteers/ or pharmacists/ or physical therapists/ or physician executives/ or physicians/ or allergists/ or cardiologists/ or dermatologists/ or endocrinologists/ or gastroenterologists/ or general practitioners/ or geriatricians/ or nephrologists/ or neurologists/ or occupational health physicians/ or oncologists/ or radiation oncologists/ or ophthalmologists/ or osteopathic physicians/ or otolaryn-	557519

(Continued)

	gologists/ or pathologists/ or pediatricians/ or neonatologists/ or physiatrists/ or physicians, family/ or physicians, primary care/ or physicians, women/ or pulmonologists/ or radiologists/ or rheumatologists/ or surgeons/ or barber surgeons/ or neurosurgeons/ or orthopedic surgeons/ or urologists/ or psychotherapists/	
15	Health Workforce/	14214
16	((health* or health care or medical) adj (personnel* or practitioner* or professional* or provider* or staff or worker*)).ti,ab,kf.	226922
17	((health* or health care or medical) adj (administrator* or assistant* or auxiliary* or manager* or receptionist* or technician* or technologist* or secretary*).ti,ab,kf.	8547
18	(dental adj (personnel* or practitioner* or professional* or provider* or staff or worker*)).ti,ab,kf.	9734
19	(dental adj (administrator* or assistant* or auxiliary* or hygienist* or manager* or receptionist* or technician* or technologist* or secretary*).ti,ab,kf.	6034
20	(laboratory adj (assistant* or personnel* or staff or technician* or technologist* or worker*)).ti,ab,kf.	5653
21	((hospital or health facility) adj (administrator* or manager* or officer* or personnel* or staff or volunteer* or worker*)).ti,ab,kf.	13407
22	((health* or health care or medical) adj (manpower or man power or workforce or work force)).ti,ab,kf.	7356
23	(case manager* or clinical officer* or chief executive officer*).ti,ab,kf.	5034
24	(physician* or doctor* or clinician* or practitioner* or hospitalist*).ti,ab,kf.	948606
25	(nurse or nurses or nursing assistant* or nursing staff).ti,ab,kf.	303669
26	(midwife or midwives or doula* or birth attendant* or childbirth attendant* or birth assistant* or childbirth assistant*).ti,ab,kf.	22681
27	(paraprofessional* or paramedic or paramedics or paramedical worker* or paramedical personnel* or emergency medical dispatcher*).ti,ab,kf.	8656
28	(allergist* or anatomist* or anesthetist* or anesthesiologist* or audiologist* or cardiologist* or caregiver* or coroners examiner* or dentist* or denturist* or dermatologist* or endocrinologist* or endodontist* or epidemiologist* or gastroenterologist* or geriatrician* or gyn?ecologist* or hematologist* or home health aide* or medical examiner* or medical record administrator* or neonatologist* or nephrologist* or neurologist* or neurosurgeon* or nutritionist* or obstetrician* or oncologist* or operating room technician* or ophthalmic assistant* or ophthalmologist* or optometrist* or orthodontist* or otolaryngologist* or pathologist* or paediatric assistant* or pediatric assistant* or paediatrician* or pediatrician* or pharmacist* or pharmacy technician* or psychiatric aide* or physiatrist* or psychiatrist* or psychologist* or physiotherapist* or pulmonologist* or radiologist* or rheumatologist* or surgeon* or therapist* or urologist*).ti,ab,kf.	828515
29	or/14-28 [Health personnel]	2238108

(Continued)

30	((("semi-structured" or semistructured or unstructured or informal or "in-depth" or indepth or "face-to-face" or structured or guide*) adj3 (discussion* or questionnaire*)) or (focus group* or qualitative or ethnograph* or fieldwork or "field work" or "key informant" or interview*)).ti,ab,kf. or interviews as topic/ or focus groups/ or narration/ or qualitative research/ [Based on a Qualitative filter from University of Texas]	689441
31	13 and 29 and 30	6899
32	limit 31 to yr="2008 -Current"	6775

CONTRIBUTIONS OF AUTHORS

All authors participated in the conceptualisation of the review through discussions of the overarching research goals and aims, key definitions, and inclusion criteria. CG, EP, and SL developed the methodology with input from all other authors. CG wrote the first draft and managed and co-ordinated the development of the protocol. All authors approved the protocol.

DECLARATIONS OF INTEREST

Simon Lewin is the Joint Co-ordinating Editor for the Cochrane Effective Practice and Organisation of Care (EPOC) group, but was not involved in the editorial process for this review. None of the other authors declared any financial conflicts of interest. A number of non-financial issues, including personal, political, and academic factors, could have influenced the review authors' input when conducting this review. The review authors have discussed this further in the sections on reflexivity in the [Methods](#) section.

SOURCES OF SUPPORT

Internal sources

- Source of support, South Africa

SL receives additional funding from the South African Medical Research Council.

External sources

- Source of support, Norway

This review is part of the mHEALTH-INNOVATE project, which is funded through a research grant from the Research Council of Norway (prosjektbanken.forskingsradet.no/en/project/FORISS/325476).