

# Facilitators and Barriers to Using mHealth from Users' Attitudes: A Qualitative Meta-synthesis

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**Received:** 02 October 2022

**Revised:** 15 November 2022

**Accepted:** 05 December 2022

## Abstract

**Background:** Regarding demographic, socio-economic differences, and some other infrastructural factors, there are concerns about the access to and use of mobile health technology. This study aims to identify the facilitators and barriers to the use of mobile health from the perspective of users.

**Methods:** In this qualitative meta-synthesis, electronic databases were systematically searched. Studies included qualitative investigations published by 30th of December 2020 that examined the facilitators or barriers to using mobile health from the users' point of view. The Critical Appraisal Skills Program checklist was used to evaluate the quality of each study. A steady comparison process has been used to identify similar structures in several studies that have been summarized in thematic constructs.

**Results:** Six factors were identified as barriers and seven factors as facilitators. Barriers included difficulty in use, inaccessibility, uselessness or inapplicability, lack of adequate skills, communication barriers, and security concerns; facilitating factors included motivational factors, documentation, degree of ease, provider credibility and source of information, perceived usability, social-cultural appropriateness, and perceived benefits.

**Conclusion:** The findings of this study provide a good basis for information and communication technology practitioners as well as health care services to improve access to and use of mobile health technology by adopting appropriate policies for infrastructure development and social empowerment. Further research focusing on technological, demographic, and geriatrics aspects is suggested.

Please cite this article as: Eisapareh K, Kaveh MH, Noroozi F, Eftekharian F. Facilitators and Barriers to Using mHealth from Users' Attitudes: A Qualitative Meta-synthesis. *J Health Sci Surveillance Sys.* 2023;11(1):9-25.

**Keywords:** Qualitative research, Telemedicine, Attitude, Facilitator, Barriers

## Introduction

Telemedicine and advancement of information technology over the past decades have led to more health, education, and welfare services for people around the world, especially in remote areas.<sup>1</sup> According to statistics released in January 2020, the number of active Internet users in the world is 4.54 billion people, which is 59% of the global population.<sup>2</sup> Broad access and the increasing use of cell phones and technologies based on them have provided valuable opportunities for their use in education and health care. In 2002, the

number of wireless cell phones surpassed the number of landline *phones* worldwide, and now three-quarters of the world's population have access to a mobile phone.<sup>3</sup> Mobile penetration varies from one country to another, and in some developing countries the coverage is 100%.<sup>3</sup> There are a variety of healthcare smartphone applications available, including programs to control blood glucose or blood pressure levels, exercise or diet, and programs for cancer patients or those suffering from chronic diseases.<sup>4</sup> <sup>5</sup> Nowadays, mobile technology used to provide health care, disease surveillance, health education, and communication for changing behavior promotes health

and trains health workers.<sup>6-8</sup> Therefore, mobile health as a proprietary technology can provide educational services and health care for different groups of people at different times and places at a lower cost.<sup>9</sup>

World Health Organization (WHO) has stated that mHealth can change the face of health services worldwide.<sup>10</sup> By improving core infrastructure and integrating mobile technology into the health care system, mHealth offers innovative solutions to health problems in low- to middle-income economies that may be a feasible way to complement and improve disease management strategies in developing countries.<sup>11-13</sup> Currently, more than 97,000 health programs are available in health and fitness categories at various online stores, and this number is expected to increase by about 25% each year.<sup>9</sup>

*mHealth* is a multidisciplinary field that covers a range of healthcare tools, technologies, and models.<sup>14</sup> mHealth refers to the use of mobile telecommunication technologies and multimedia technologies for providing health care.<sup>3</sup> The aging population, heavy burden of chronic illnesses, increased health care costs, and displacement difficulty in major cities are among the key factors justifying the use of e-communications technologies, including mobile health, especially in low- and middle-income countries. In low- and middle-income countries, e-health interventions can provide many services in an affordable, effective and accessible way, especially for deprived, disadvantaged and marginalized groups, and this approach also supports achieving sustainable economic development goals.<sup>15</sup>

Studies show that the provision of health programs by using mHealth has improved the communication between patients and healthcare providers. A significant number of these studies have been interventions to evaluate the effectiveness of mobile-based programs for managing health conditions, such as diabetes,<sup>16, 17</sup> pain management,<sup>18</sup> weight loss,<sup>19, 20</sup> and so on. These studies have presented different and sometimes controversial results about the effectiveness and efficiency of these programs. Differences in demographics, different levels of literacy, users' attitudes and abilities, different types, and complexities of health conditions, including illnesses and weak or strong states of electronic communications infrastructure in countries can be some of the causes of these differences.

Unlike many health interventions, when mobile technology offers capabilities, its effectiveness depends entirely on the acceptance and compatibility of users. Therefore, understanding what affects the acceptance of the program is essential to determine the potential needed to create a behavioral change in the target population.<sup>21, 22</sup> For more understanding of the views of mHealth technology users, in some studies, although occasionally, factors such as the difficulty and complexity of using a mobile health,<sup>23</sup>

inaccessibility of mobile applications,<sup>24</sup> and lack of familiarity with mHealth<sup>23</sup> have been pointed out as some barriers to use; also, factors such as the provider's reputation and source of information,<sup>25</sup> perceived benefits,<sup>26</sup> and the experience of using cellular health<sup>27</sup> have been considered as facilitators. However, a systematic review of these factors has not been studied comprehensively. Policymaking and planning to facilitate the comprehensive use of mobile health technology in society, including different demographic, socio-economic, and geographical groups, requires a comprehensive study in different populations or a systematic aggregation of available findings. Hence, this study aimed to identify the facilitators and barriers to the use of mobile health from the perspective of users.

## Methods

This is a meta-synthesis study conducted on qualitative studies which have focused on the use of telemedicine for care, training or treatment, reported until 30<sup>th</sup> of December 2020 in the scientific databases mentioned below using the *seven-phase approach* of meta-ethnographic synthesis introduced by Noblit and Hare.<sup>28</sup> To achieve comprehensive barriers and facilitators of telemedicine from the users' point of view, we made an attempt to evaluate all the quality articles published before 30<sup>th</sup> of December 2020.

The following research questions were posed:

- i. What are the barriers to using mHealth from the perspective of users in all age groups in different countries of the world?
- ii. What are the facilitators to using mHealth from the perspective of users in all age groups in different countries of the world?

Population: All mHealth users in all age categories

Phenomena of interest: Barriers and facilitators of using mHealth

Context: All countries of the world

### Inclusion Criteria

The inclusion criteria for entering this study were: the study should be one of a kind of qualitative studies; the language of the article should be English; the time of the study should be by the end of 30<sup>th</sup> of December 2020; the study should focus on the application of mobile technology in the health service (educational, communication, care), and articles that have addressed facilitators or barriers to using this technology in the text or title.

### Exclusion Criteria

Articles that did not meet at least one of the inclusion criteria were excluded from our study.

Search Strategies and Data Extraction

First, we did a basic search in the PubMed database to identify the keywords in the title and abstract. Then, we identified the MeSH terms and a search was done in scientific data banks including *PubMed*, *Web of Science*, *ScienceDirect*, *Scopus*, *EMBASE*. To get the desired quality articles, we used the key words of Telemedicine, Mobile Health, Health Mobile, mHealth, Telehealth, eHealth, telecare, participant, participation, consumer, barrier, facilitator, qualitative, qualitative study in their title or abstract, using specific search strategies in each of the scientific data banks (Table 1).

### Screening

After a systematic search, the citation information, along with the summary of the resulting articles, was entered into reference databases (Endnote software) in the databases. The total number of articles was 4010, and after removal of duplicates, 3879 articles remained. The articles were carefully and individually assessed by the two referees at all stages and, finally, an agreement was reached on the articles that were controversial through scientific commentary and discussion.<sup>29</sup> The titles and abstracts of the articles were reviewed by two referees on the basis of inclusion criteria, and according to the decision of the two referees; if necessary, the third referee commented on the eligibility requirements. Finally, after a thorough review of the articles, 31 articles remained. After the review articles based on the CASP (Critical appraisal skills program) checklist, 17 articles met the inclusion criteria for entering the study.

### Data Extraction and Synthesis

Synthesis was carried out with the meta-ethnography approach introduced by Noblit and Hare,<sup>28</sup> which included a seven-phase model. The first phase was ‘getting started’, in which the research question was determined, and the title of the study, which was an examination of the barriers and facilitators of

mHealth from the users’ perspective, was determined. The second phase was ‘deciding what is relevant’, in which studies with inclusion criteria were selected and entered into the study. In the third phase, ‘reading the studies’, each of the selected studies, which had carefully focused on the details of the study, were studied to identify the key concepts and their themes. The fourth phase was ‘determining how the studies are related’ and included the key concepts extracted together, and the relationship between them was taken into consideration. The fifth phase was ‘translating the studies into one another’; in this phase, the key concepts extracted from each article with the concepts extracted from the other papers were put together and discussed. In the sixth phase, which was ‘synthesizing translations’,<sup>30</sup> the final outcome of meta-synthesis, i.e., the final interpretation, in this phase, the concepts derived from the previous phase were tracked, organized and interpreted as factors influencing the use of mHealth under the two general themes of barriers and facilitators. Obstacles are defined as “any barrier (material or immaterial) that can disrupt the release, implementation, and/or sustainability of a program,” while a facilitator is interpreted as “any kind of element (material or non-material) that can accelerate the overcoming the obstacles or accelerate its release or implementation.<sup>31</sup> The barriers and facilitators of mHealth from the viewpoints of users were categorized in the form of 18 themes, including 10 themes of barriers and 8 themes of facilitators, and also in 13 dimensions, including the 6 dimensions of barriers and 7 dimensions of facilitators; the seventh and the final phase was ‘expressing the synthesis’, which refers to the publication of the results.

### Critical Appraisal and Analysis of the Studies

Evaluation of the quality of studies entered into this research was based on the Critical Appraisal Skills Program<sup>32</sup> checklist for qualitative research,<sup>32</sup> which is a well-known and common checklist for

**Table 1:** Summary of the search strategy used for the systematic review

1. Type of literature	Database
A published articles	PubMed Scopus Embase Web of science Science direct
B: Grey Literature	Google scholar
2.Search Terms	MeSH terms: ((telemedicine [MeSH Terms]) OR (telehealth[Title/Abstract])) OR (mhealth[Title/Abstract]) OR (ehealth[Title/Abstract]) OR (mobile health[Title/Abstract]) OR (health, mobile[Title/Abstract]) OR (telecare[Title/Abstract])) AND (barrier[Title/Abstract]) AND (facilitator[Title/Abstract]) AND (consumer[Title/Abstract]) OR (participant[Title/Abstract]) AND (qualitative research [MeSH Terms]) Filters: from 2019 – 2020  Free word: key words of Telemedicine, Mobile Health, Health Mobile, mHealth, Telehealth, eHealth, telecare, participant, participation, consumer, barrier, facilitator, qualitative, qualitative study in their title or abstract For other databases we used MeSH terms and interfaces (OR, AND, NO)

evaluating the quality of qualitative articles. The tool was then used abundantly in the CASP( Critical Appraisal Skills Program) despite its constraints;<sup>33</sup> it has been recommended for use in health studies.<sup>34</sup> The evaluation was independently done by two evaluators and the selected studies were included in the study; the studies about which there was a disagreement between the two referees were reviewed by the third referee and included if confirmed (Table 2).

Finally, from 4010 articles obtained through systematic searches, ultimately 3879 articles remained to be reviewed after removing the duplicates. After reading the title and abstract, we excluded 3848 other articles due to lack of inclusion criteria. Finally, 31

articles remained. After careful review of the abstract and the full text of the articles, 14 articles were excluded from the study due to the lack of discussion of facilitators or barriers from the perspective of users; also, two articles were excluded because they had discussed a tool other than mHealth, and only 17 articles met the inclusion criteria and were included in the study (Figure 1).

## Results

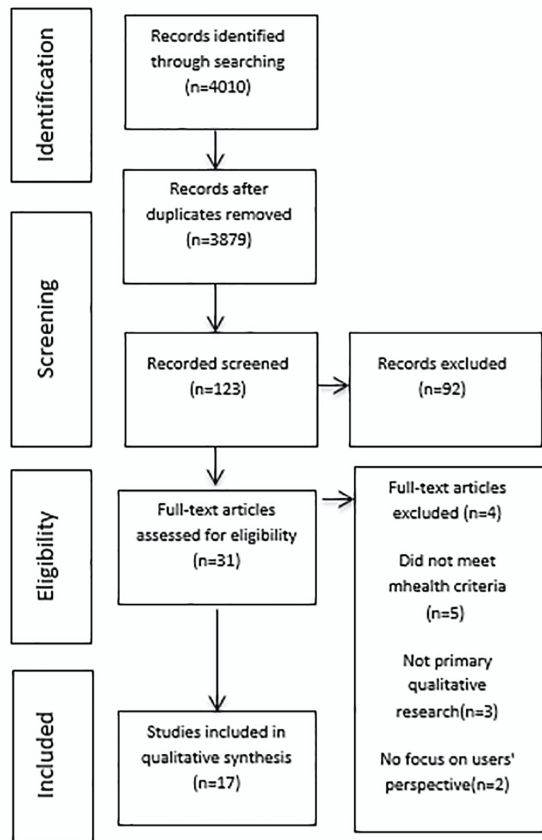
### Articles Features

Table 3 shows the general characteristics of the studies considered in the meta-synthesis.

**Table 2:** Assessment of the articles based on the CASP checklist for qualitative research

No	Criteria based on the CASP checklists	*A	B	C	D	N	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Was there a clear statement of the aims of the research?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Is a qualitative methodology appropriate?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Was the research design appropriate to address the aims of the research?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Was the recruitment strategy appropriate to the aims of the research?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Was the data collected in a way that addressed the research issue?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	Has the relationship between the researcher and participants been adequately considered?	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes	Can't tell	Yes	Can't tell	Yes	Yes	Can't tell	Yes	Yes	Yes	Can't tell	Can't tell	Yes
7	Have ethical issues been taken into consideration?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Can't tell	Can't tell	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	Was the data analysis sufficiently rigorous?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	Is there a clear statement of findings?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	How valuable is the research?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

\*A: Triantafyllou V and et al, B: Slevin P and et al, C: Isaksson R and et al, D: Palcu P and et al, E: Vergouw JW and et al, F: O'Shea O and et al, G: Garnweidner-Holme L and et al, H: Solem IKL and et al, I: Connolly SL and et al, J: Abelson JS and et al, K: Hunting G and et al, L: Burgess K and et al, M: Peng W and et al, N: Asklund I and et al, O: Duclos V and et al, P: Khatun F and et al, Q: Smillie K and et al, R: Smith R and et al.



**Figure 1:** search process and study identification meta-synthesis review of studies with a theoretical framework in Facilitators and Barriers to Using mHealth from Users’ Point of View: A Qualitative Meta-synthesis

In 17 articles entered into the main meta-synthesis stage, we examined the barriers and facilitators of the use of mHealth from the users’ point of view. Out of these articles, four were from the United States (23.52%),<sup>23, 35-37</sup> and three articles (17.64%) were from Canada;<sup>24, 38, 39</sup> Norway (5.88%),<sup>40</sup> the United Kingdom (5.88%),<sup>25</sup> Belgium (5.88%),<sup>41</sup> Netherland (5.88%),<sup>42</sup> Sweden (5.88%),<sup>43</sup> Ireland (5.88%),<sup>44</sup> Bangladesh (5.88%),<sup>45</sup> South Africa (5.88%),<sup>46</sup> India (5.88%),<sup>26</sup> and Burkina Faso in West Africa (5.88%)<sup>47</sup> each had an article. The total number of participants in this study was 1,537 people. The target group was women with ovarian cancer,<sup>24</sup> pregnant women,<sup>25, 47</sup> and women with gestational diabetes,<sup>40</sup> mobile phone subscribers,<sup>35, 36, 38, 45</sup> HIV positive patients,<sup>46</sup> patients with cardiovascular disease,<sup>26, 41</sup> Patient Perceptions of Head and Neck Ambulatory,<sup>37</sup> older adults,<sup>42</sup> women with stress urinary incontinence,<sup>43</sup> COPD (Chronic obstructive pulmonary disease) patients,<sup>44</sup> patients with osteoporosis,<sup>39</sup> and veterans with PTSD (Post-traumatic Stress Disorder).<sup>23</sup>

*Meta-synthesis*

After reviewing the articles, finally, 13 categories (6 for barriers and 7 for facilitators) and 18 sub-categories (10 sub-categories of the barriers and 8 sub-categories for facilitators) were obtained. The summary of the articles is shown in Table 2 and classification and the subcategories of the results are shown in Table 4. In the next part, there is a brief description of the categories, subcategories, and codes.

**Table 3:** Characteristics of the studies included in the review

First author /year/location	Participants	Methodology/ data collection	Telemedicine technology	Facilitators	Barriers
Rachel. Ontario	14 women with epithelial ovarian, primary peritoneal or fallopian tube cancer	Thematic analysis/ Focus group	Smart mobile application.	-	1. Simple to access and use. 2. Capability to interaction with the application. 3. Be able to go back and review the content
Wei Peng. Midwest region of the U.S.	44 individuals’ smartphone owners of various social economic status.	Thematic analysis / focus groups and individual interviews.	Health Applications (software NVivo)	1. Social competition. 2. Intangible Rewards. 3. Tangible rewards. 4. Internal dedication and motivation.	1. Low Awareness of health Applications 2. Lack of Applications literacy 3. The Cost of Applications 4. Lack of time and effort. 5. Ease of use and simplicity 6. Lack of motivation and discipline.
Gemma Hunting. Ontario	89 patients and/ or informal caregivers, health care providers, technicians, administrators, decision makers	Thematic analysis / In-depth semi-structured interviews and ethnographic observations	Tele homecare implementation	Communication between patients and Telehomecare health care providers patients’ satisfaction	Communication barriers related to language

Jonathan S. Abelson. New York	800 participants	Grounded theory / Used of the Empire State Poll to ask open- ended		-	1. Data security 2. Technology failure or uselessness. 3. Preference for face- to-face communication. 4. User effort. 5. Older generations.
Kathleen Burgess. Oxford university	55 childbearing women	Thematic analysis/ interview	Immunize CA	1. Documentation 2. Calendar. 3. Ease of use. 4. Credibility Language 5. Information sources. 6. General versus specialized information.	1. Privacy and security. 2. System integration.
Fatema Khatun. Bangladesh	37 Participants included the general public, students, community leaders, school teachers, and formal and informal healthcare providers	Thematic analysis / indepth interview	Mobile phone	1. Readiness 2. Receiving healthcare service-related information through SMS is useful 3. mHealth is useful for healthcare delivery to underserved populations. 4. Perceived benefit. 5. Motivational readiness is expressed as perceived usefulness of mHealth 6. Cultural norm: with use of mhealth female patients feel comfortable to share their confidential health problems with a male doctor.	1. Participants prefer to use of face to face consultation in compare with mhealth especially for diagnosis and treatment. 2. Most of the respondents were not very familiar with the use of mobile phones. 3. Literacy barrier. 4. A lack of trust in mHealth services.
Lisa Garnweidner-Holme. Oslo, Norway.	9 health care professionals providing care for women with GDM (Gestational diabetes mellitus)	Thematic content analysis/ Individual interviews	Mobile Applications	mobile Applications could be a useful tool during consultations, and in diabetes care	1. Communication barrier for pregnant woman emotions she was feeling adequately upon being diagnosed with GDM (Gestational diabetes mellitus) 2. Language barrier
Kirsten Smillie. Kenya	15 client participants with HIV-positive	Thematic analysis/ Semi- structured interviews	Phone cell	-	1. Concerns around privacy and disclosure 2. Low incomes, buying mobile phone is not their priority. 3. Illiterate, and
Rebecca Smith. Kerala, India	15 participants in total from 3 stakeholder groups: patients with CVD (Cardiovascular disease), physicians treating CVD (Cardiovascular disease) and Accredited Social Health Activists (ASHAs)	Thematic analysis/ semi structured, individual interviews.		1. Improve accessibility to health information 2. Removes the geographical and time restraints 3. Data can be shared quickly and efficiently through mobile phones. 4. Provide reminders 5. Save time, money and travel	Usability of mobile phones:

Vincent Duclos. Burkina Faso	187 Participants included healthcare workers, pregnant women, women with children aged 12–24 months, and women of childbearing age.	Thematic and content analyses/ individual semi-structured interviews and group interviews.	Mobile phone	Timesaving device, which reduces the need to travel in difficult conditions	<ol style="list-style-type: none"> <li>1. Mobile phones, are not readily accessible for many women in the Nouna Health District.</li> <li>2. Women are sometimes given very little opportunity to use mobile and they hadn't mobile set.</li> <li>3. Most women are illiterate</li> <li>4. The absence of electricity.</li> <li>5. Gender issues: women had less access to mobile set than men.</li> <li>6. Confidentiality concerns.</li> </ol>
Samantha L. Connolly. California	66 veterans from rural and urban areas in Maine, Arkansas, and California	Thematic analysis/ Semi-structured interviews.	Smart phone application	<ol style="list-style-type: none"> <li>1. A guide providing strategies to address or track symptoms.</li> <li>2. Finding applications helpful for managing mental health problems and associated symptoms</li> <li>3. The convenience of receiving support without travel and the discreetness of using an application.</li> <li>4. The compatibility of new technologies with aspects of their culture and identity.</li> <li>5. Social influence.</li> </ol>	<ol style="list-style-type: none"> <li>1. Mental health applications could not replace in-person contact with the therapist</li> <li>2. Applications are ineffective and unhelpful in addressing mental health concerns.</li> <li>3. Use of mental health smartphone applications is as a burden</li> <li>4. Smartphone technologies were often unwieldy, complicated, and mentally taxing to learn how to use.</li> <li>5. Some older veterans have trouble interacting with smartphone application.</li> <li>6. Several mentioned “hating” technology.</li> <li>7. Technology is harming society by weakening face-to-face communication skills</li> <li>8. Low level of interest in spending time on a smartphone.</li> <li>9. Unfamiliarity with new technologies.</li> <li>10. Lack of awareness of application availability.</li> </ol>
Vasiliki Triantafillou. California, USA (united states of American)	Fifty-six established patients who visits with an otolaryngology–head and neck surgery	Content analysis/ unstructured telephone interviews.	Video-based telemedicine	Accessibility and cost and time savings.	Disability to perform a physical examination.
Orlagh O’Shea. Belgium	34 patients with cardiac rehabilitation	Thematic analysis/ interviews	Websites, mobile phones	<ol style="list-style-type: none"> <li>1. Acceptability and feasibility</li> <li>2. Participants’ motivation.</li> </ol>	<ol style="list-style-type: none"> <li>1. PATHway (physical activity towards health) system were unnecessarily complicated</li> <li>2. Technical barriers</li> <li>3. Personal barriers.</li> </ol>

Johannes William Vergouw. Netherlands	19 older adults with multiple chronic conditions	Thematic analysis/ Semi-structured interviews	eHealth applications	Convenience, efficiency and the instant availability of eHealth via applications.	non-familiarity with the online eHealth applications and a mismatch of user health needs.
Ina Asklund. Sweden.	15 selected women, with a mean age of 47 years	Grounded theory/ semi structured interview	Mobile applications	1. Easily accessible 2. For calendars or to remind me to do it 3. Accessibility	Difficulties in understanding how to do the exercises.
P. Slevin. 2019. Dublin, Ireland	32 participants	Thematic analysis/ semi-structured interview	digital health technologies	1. Digital health training and education; 2. Improving digital literacy; 3. Personalized information.	1. Data quality 2. Evidence-based care 3. Resource constraints 4. Digital literacy
P. Palcu. Canada	15 patients with osteoporosis diagnosis	Thematic analysis/ telephone interviews	Telemedicine program	1. Convenience of timely care closes to home 2. Reduced burden of travel and costs, 3. Enhanced sense of confidence Perceived	poor follow-up

### Barriers

*Difficulty in use:* Some articles had listed difficulty or complexity as barriers to the use of mHealth applications.<sup>35, 45, 47</sup> In this category, two main codes were identified: (a) *the difficulty of using due to technical complexity:* mHealth users considered technical complexity as one of the main problems in using this technology;<sup>35, 41, 42</sup> for example, in an article, it was argued that in poor regions, if access to mHealth programs is possible, people are not able to use these programs due to their technical difficulty.<sup>45</sup> Another article reported that certain groups encountered technical challenges in the use of mobile applications, which make it difficult to use this technology.<sup>36</sup> It has also been used to describe the complexity and difficulty of using words such as “unwieldy” and “complicated”;<sup>23</sup> and (b) *the difficulty of use in particular groups,* such as the elderly and the handicapped. As an example, one of the participants stated:

*“Some applications are so complicated. I delete them because it’s just too much, you know. So I’m looking for something pretty straightforward. It does what you need it to do without 10 million different things to do one thing”.*<sup>35</sup>

*Inaccessibility:* Inaccessibility of mobile or mHealth applications were reported as another perceived barrier from the perspective of users.

In this category, three core codes were identified: a) *Financial Lack (Financial Cost and Time):* One of the major factors mentioned in some articles as an important barrier to the use of mHealth technologies is the financial cost, so that it has been reported in several articles that low-income people have taken out mobile phone purchases,<sup>35, 46</sup> and others have referred to the time-lag factor and have expressed a lot of time for finding answers to their question; they not only

did not answer their questions, but also caused more questions.<sup>35, 36</sup>

*“You have to individually input everything. Doing that, that’s a lot of time.”*<sup>35</sup>

b) *Social-cultural inaccessibility:* In some articles, women’s access to and use of cell-based or non-mobile services has been mentioned.<sup>47</sup> Some articles refer to the issue of less access to mobile phones by women, or the lack of mobile devices in this group.<sup>47</sup> In another article, people expressed their hate of the mobile devices and have used the word “hating” and or “averse” in its description, because they believed that the use of technology and mobile phones would weaken face-to-face communication.<sup>23, 24</sup>

*“It’s pretty hard to make a relationship with a phone as opposed to having a face-to-face relationship with someone.”*<sup>23</sup>

c) *Technical inaccessibility:* In another article, the lack of electricity has been reported as another barrier to using it from the user’s point of view;<sup>47</sup> in other articles, the inability to access the mobile phone or related applications have been mentioned as the important barriers to using mHealth.<sup>24, 47</sup> As an example of inaccessibility, one participant stated:

*Unusability or inapplicability of mHealth:* In some studies, users have not been able to use applications in terms of “unusability”,<sup>26</sup> and about mental illnesses, they refer to applications as ineffective and unhelpful,<sup>23</sup> and even interpreted them as “burden”.<sup>16</sup> In another article, the fear of mobile-generated waves<sup>26</sup> and the dependence of the individual on the mobile<sup>47</sup> were considered as a barrier to the use of mobile-based applications. As an example, one of the participants stated:

*“I will just go to the website. I don’t know the benefit of these applications. I have to see what the benefit will be.”*<sup>35</sup>



**Table 4:** Categories, subcategories and codes extracted from the reviewed articles

Code	Subcategory	Category	Theme	Code	Subcategory	Category	Theme
Complexity of use, Complicated, Unwieldy		use	Difficultly of use	Social competition	External Factors		Facilitators
Inability to transfer emotions and feels				Intangible Rewards			Motivation
Lack of money, Time consuming	Financial Inaccessibility		Inaccessibility	Tangible rewards			
Gender issues: Women's Low Access to Mobile, using of husbands' mobile, hating	Social cultural Inaccessibility			Dissatisfaction of present status, Lack of need to application.	Internal factors		
Lack of electricity	Technical Inaccessibility			Providing a mobile documentation, act as a reminder, Providing strategies to address or track symptoms, General versus specialized information			Documentation
Unusability, Ineffective, Unhelpful, Unhelpful in addressing mental health concerns, The high degree of dependency and ill health, Use of mental health smartphone apps is as a burden			Unusability or inapplicability of mHealth Application	Trusting draw Simplicity of the Application. Increase access in people with specific problems Easy to use application.	User-friendly Easy to use		Degree of Easiness
Have not experience of use, Unaware of the existence of applications, Lack of familiarity with technology			Lack of sufficient skills	Trustworthy, Legitimate source of information			Provider Credibility and source of information
Illiteracy, Low application literacy	Lack of application literacy		Communication barriers	Satisfaction Easily express personal issues Sharing data quickly and efficiently, Capability of repeat the information Removes the geographical and Time saving Cost saving Time and hassle of travel	Usability or inapplicability about effectiveness Usability in remove the side expense		Perceived usability
Difficulty of application language	Communication barriers related to language			Comfortable of women to share their confidential health problems with a male doctor			Social-cultural sensitivity
Prefer face-to-face communication, Face-to-face communication as a value	Preferred communication style			Compatibility to adapting to aspects of culture Remove the genders' barriers Cultural competency			
Aging Visual complicated	Individual Inaccessibility						
Lack of trust, Uncertainty, data security Privacy and disclosure, Reliable source of information, Confidentiality concerns			Security concern				

*Not having enough skill:* Not having enough skill in using mHealth technology is another barrier expressed by users. Among several barriers expressed from the users' point of view reported by several articles low awareness of how to use the application,<sup>35, 42</sup> lack of familiarity with the mHealth,<sup>23, 45</sup> lack of prior experience of using cell phones, and lack of awareness of the existence of mHealth applications<sup>23</sup> were mentioned. In another study, the participants stated that they were not able to determine the accuracy or error of the content expressed in the applications.<sup>40</sup> As an example, one of the participant stated:

*"I never knew there were applications out there that could help with what I'm dealing with."*<sup>23</sup>

*Communication barriers:* Some articles have highlighted the barriers to communication in using mobile-based health applications.<sup>23, 35, 38, 45, 47</sup> In this category, four core codes were identified: (a) *Lack of literacy for using the application:* Among the barriers to mHealth technology, several articles have pointed to the lack of literacy or lower literacy for using the application,<sup>35, 39, 44</sup> and Illiteracy,<sup>46, 47</sup> b) *language-related communication barriers:* Obstacles related to the language used in the mobile application are other communication barriers expressed from the perspective of users reported in some articles;<sup>38, 40</sup> c) *Preferred relationship style:* Individuals prefer face-to-face communication<sup>36</sup> as compared to other communication methods, especially when they are in the process of diagnosing or treating a disease, and may even consider this face-to-face communication as a value;<sup>45</sup> in the case of psychiatric patients, face-to-face contact cannot be replaced by any other treatment;<sup>23</sup> d) *Individual barriers:* Individual barriers can be divided into the physical and psychological barriers; some of physical barriers include the inability or difficulty in interacting with the tools due to problems such as vision weakness in the elderly. Some of the psychological barriers include the inability to transfer emotions and feelings through this tool.<sup>23, 38, 39, 41</sup> As an example, in relation to communication barriers, one of the participants stated:

*"I don't like the doctor-patient interaction that is not face-to-face."*<sup>36</sup>

*Security concerns:* Several papers reported that mHealth application users expressed concerns about the protection of personal information and privacy<sup>25, 36, 46, 47</sup> and expressed it in words such as data security,<sup>36</sup> privacy and security,<sup>25</sup> lack of trust,<sup>14</sup> privacy and disclosure,<sup>46</sup> reliable source of information, and confidentiality concerns<sup>47</sup> to mHealth. As an example, one of the subjects stated:

*"I would need to know who is able to access the information, and I could see people having problems with that."*<sup>36</sup>

## Facilitators

*Motivational factors:* Some articles have highlighted motivational factors as facilitators for the use of mHealth applications.<sup>23, 35, 41</sup> In this category, the main subcategories of external and internal factors can be divided. In the subcategory of external factors, the three main codes can be identified.

*External motivators:* (a) *Social competition:* An article reported that users of mHealth technology believe that external motivational factors, such as observing others in using applications and sharing behavioral data, facilitate the use of mHealth because they can compare these factors with themselves or others on social networks and sites;<sup>35</sup> also, the subjects mentioned social influence as a facilitator of the use of mHealth.<sup>23</sup>

b) *Intangible rewards:* Some articles have reported that some programs donated intangible rewards such as donating virtual medals or achieving success by opening a lock. In some articles, these intangible rewards were considered as an incentive by creating a competitive environment among individuals, which can facilitate the use of this tool.<sup>35</sup>

c) *Tangible rewards:* Tangible rewards are what is attractive to the users and at the same time is a motivator. For example, money is a tangible motivator,<sup>35</sup> and users of mHealth technology have reported it as a facilitator in using this tool.

*"I like the rewards on there [inside the applications], but it's nothing I can touch and feel like a real reward. So, for me, if this application says once you reach 200 miles or 150 miles, you get a free t-shirt... things like that, [it will be motivating]. Rewards are good, but only if you can feel and touch them."*<sup>35</sup>

2) *Internal motivators:* Some articles reported positive relationships between patients and remote health care providers as a motivational factor that has given patients satisfaction and influenced the motivation to follow up and continue to use the program,<sup>35</sup> in other articles, expressing dissatisfaction with the current status of the provision of health care services,<sup>45</sup> and a high amount of the perceived usability of using cell phones<sup>45</sup> were considered among the internal motivational factors that are referred to as facilitating the use of mHealth from the user's perspective. As an example, on motivational factors, one of the participants stated:

*"Maybe, they need to be given that [applications], but eventually, it is an internal [thing]. People are motivated from inside out."*<sup>35</sup>

*Documentation:* The purpose of documentation is the ability to record storage and access to data in an easy manner at the time and place; this feature has been reported in many articles as a facilitator from the user's point of view.<sup>25, 26, 38, 43</sup> Documentation

creates a mobile information archive, i.e., a mobile electronic file for its users. The ability to use health application as a calendar<sup>25</sup> or a reminder<sup>26, 38, 43</sup> was among the facilitators of its use. Also, the ability to use mHealth application as a calendar<sup>25</sup> or a reminder<sup>26, 38</sup> was considered as one of the facilitators for its use. The smartphone program can act as a guide used to provide a strategy for fixing or tracing signs, or directing people to other useful resources in the event of a crisis<sup>(16)</sup> and can provide general information versus specialized information.<sup>25</sup>

*“So I just found it really convenient because those yellow books are really easy to misplace and it’s just very convenient to look up in advance how many shots he was going to get . . . and just expect at the appointment, especially when you’re preparing a little baby to get shots.”<sup>25</sup>*

**User-friendly:** User friendly is defined as being easy to use and learn.<sup>48</sup> In some articles, from the user’s point of view, ease was expressed as a facilitator of the use of the mobile-based application. In some articles, it has been argued that if an application is designed tailored to the target group, it facilitates the use of that tool.<sup>25</sup> Another study suggests that using mHealth is a simple tool for pregnant women,<sup>40</sup> also in some articles, mHealth users have expressed ease of use of mHealth as a facilitator.<sup>25, 40, 41</sup> Some participants stated that the application had high usability, especially for postoperative pains;<sup>36, 42</sup> as stated in an article, users reported that the use of technology could improve access for disabled people with special problems, and it was a facilitator for using it in these specific groups<sup>38, 49</sup>. User- friendliness is one of the key facilitators in using technology<sup>38</sup>. As an example, one of the participants said:

*“. . . it was much easier to just look on your phone than to use like the book or to look it up online or that type of thing.”<sup>25</sup>*

**The validity of the provider and source of information:** In some of the papers reviewed, mHealth users have reported the validity and legitimacy of the information provided in the application as one of the important facilitators of its use.<sup>25, 44</sup> As an example, one of the participants has stated:

*“. . . it’s a proper legitimate source, so I don’t need to double and triple check that. [It’s] a good source I trust in”<sup>25</sup>*

**Perceived usability:** In some articles, there were several perceived benefits from the use of mHealth. In this category, two codes were identified: a) *Perceived Effectiveness of use:* Receiving timely responses and expressing satisfaction with the outcome without going to the clinic was one of the benefits perceived by the participants.<sup>39, 40, 42</sup> In a study, participants reported that by using mHealth, personalized content could be easily expressed, and side effects could be observed

in a timely manner without a waste of time.<sup>46</sup> In a study, participants reported that using mHealth could improve performance and facilitate home-based home visits.<sup>26</sup> b) *The usability of the removal of the side-expenses:* Reducing the transportation costs, reducing costs, reducing travel requirements in difficult situations and leaving your workplace, spending less time were expressed as one of the most important facilitators in the use of mHealth,<sup>23, 26, 37, 39, 45, 47</sup> also, the use of this tool eliminated geographic problems<sup>23, 26</sup> and increased the rapid and effective dissemination of information.<sup>26</sup> For example, on perceived usability, one of the participants stated:

*“It’s easier because then otherwise you have to ask the patient to come again. I can ask the patient to wait for some time, and I contact [a senior] on my phone and get a response immediately, and advise them as they say.”<sup>26</sup>*

**Social and cultural appropriateness:** In some studies, it has been argued that by using mHealth, women could more easily share their confidentiality with their physician,<sup>39, 45</sup> also, the high ability of modern technologies to match cultural aspects<sup>23</sup> affects their ease of use. Some mHealth users stated that health was a useful tool for management of psychological problems and associated symptoms.<sup>23</sup> Some articles reported that mHealth use was appropriate for people with poor socioeconomic status who had less access to health care facilities.<sup>45</sup> A study reported that mHealth use was a useful tool for pregnant women with diverse backgrounds and cultural sensitivities.<sup>40</sup> For example, one of the participants stated:

*“Then, there are few diseases about which the patients feel uncomfortable to talk. Then, they can use this service [telemedicine]and talk freely to the doctor about their problems. I think this has the most importance among married couple.”<sup>45</sup>*

## Discussion

The present study revealed a relatively comprehensive range of facilitators and barriers to using mHealth. The barriers included difficulty of use, inaccessibility, unusability or inapplicability of mHealth, lack of adequate skills, communication barriers, and security concerns; also, factors such as motivational factors, documentation, degree of easiness, credibility of provider and source of information, perceived usability, social-cultural appropriateness, and perceived benefits were described as facilitators and difficulties with the use of mHealth. In the following section, we interpret the findings in light of other facts in scientific texts.

**Complexity was one of the barriers.** This can be seen as the extent to which the use of innovation can be understood fairly well, which is one of the important factors in the adoption and use of these devices.<sup>41, 50, 51</sup>

Some studies have suggested that certain age groups such as the elderly have a higher degree of difficulty in using and adopting these devices, and these groups have lower skill levels in using these devices.<sup>23, 36, 51</sup> Sensory and motor disabilities are important reasons that make it harder for these groups to use these technologies. Therefore, tailoring innovations or communication tools appropriately with the characteristics of the users is one of the principles of designing educational and communication technologies and methods that must always be addressed.

Other studies of barriers have mentioned the difficulty of accessing technology. Access to technology is an important component of international development theory<sup>52</sup> and improvement of health care outcomes;<sup>53</sup> in addition, in the opposite direction, inaccessibility of mHealth tools and technologies is another major obstacle to the adoption and use of these technologies, including the high financial costs imposed<sup>35, 46, 51, 54-57</sup> and loss of time.<sup>35, 47</sup> Also, barriers to access, including the lack of access to a power source and a mobile device,<sup>23, 24</sup> which are considered as a necessary platform for using mhealth, are other important factors affecting the use of mhealth technology.<sup>58</sup> Therefore, considering whether there are appropriate substrates and the power to access relevant tools for using mobile-oriented applications in the target group are important points that planners, educators, and designers need to consider.

Failure to understand the applicability or usability of the use of mHealth technology<sup>26</sup> and in some cases the harmful use of mobile phones for reasons such as harmful waves ...<sup>23, 26</sup> have been mentioned as an obstacle to the use of this technology. In some other studies, unusability of this technology or concern for functional disability have been suggested,<sup>51</sup> which all point to the concern about the unusability of mHealth technology and are key points in designing this tool.

In some studies, lack of proper skill, low awareness of how to use the application<sup>35, 42, 55</sup> or even its presence,<sup>23</sup> lack of familiarity with the mobile application,<sup>23, 38</sup> and lack of prior experience<sup>23, 55</sup> in using this tool are stated as other barriers to the adoption of this tool from the perspective of users. In their study, Rogers et al. considered the lack of familiarity and previous experience in the use of barriers.<sup>51, 59</sup> Therefore, lack of awareness or experience of previous use of the mHealth application can act as a barrier to its adoption by target group users.

Barriers to communication are other obstacles to using mHealth, including illiteracy,<sup>36, 39, 44, 46, 54, 57, 60, 61</sup> language barriers used in the application,<sup>38, 40, 57, 62-64</sup> and communication preferences. In communication preferences, people prefer face-to-face communication to any other type of connection.<sup>26, 36, 45</sup> In the study conducted by Parker et al., the lack of human interaction in using mHealth is mentioned as a

barrier. Communication barriers, including the target audience's literacy, their communication preferences, and the attention to the language issue used in communication devices and mHealth applications, are all that can be considered by the designers of these applications and communication professionals.

Security concerns about the dissemination of confidential information are among the concerns of users in using health applications, which assure people that maintaining their confidential information can be an important approach in overcoming this important impediment. Individuals have talked about various concerns about the privacy of their personal information.<sup>25, 36, 46, 47, 51, 54, 57</sup>

The following facilitators have been mentioned in the review of the articles.

Motivational factors such as social competition<sup>23, 35, 65</sup> and tangible and intangible rewards<sup>35, 60, 66, 67</sup> are among the motivational factors mentioned in various studies as facilitators of the adoption and use of mHealth. In addition, satisfaction with using the mHealth applications,<sup>35, 41, 45, 68, 69</sup> the sense of usability, and the sense of the need<sup>35, 45, 51, 55, 58, 67</sup> are the motivational factors expressed by the users of this technology. Attention to these motivational factors can be effective in increasing the likelihood of accepting and using this tool by individuals.

The documentation of the data as a mobile file, acting as a calendar,<sup>25, 51, 60</sup> or a reminder<sup>26, 43, 51, 58, 70, 71</sup> are among the other facilitators of the mHealth use. A mobile file that can be accessed at any time, or the use of mHealth applications that can act as a reminder, enhances the users' satisfaction and ultimately increases their willingness to use mHealth.

Degree of ease is the amount of ease of understanding the use of mobile phone and its function.<sup>72</sup> In some studies, mHealth users have shown the ease of mHealth use as a facilitator.<sup>25, 40, 41, 49, 72</sup> The higher the degree of ease perceived by the customers, the greater the likelihood of its use. The notable point is that in discussing the barriers, the users of mHealth have expressed the difficulty of using it as one of the barriers, and here the degree of ease is mentioned at the opposite point as one of the facilitators. These two form the two ends of a spectrum, so that any further progress towards ease of use reduces the degree of difficulty and increases the likelihood of using the tool.

The credibility of the provider and the source of information of users are the other factors facilitating the use of health from the mHealth technology users' viewpoint.<sup>25, 42, 49, 58, 69, 72</sup> Information provided from a valid and legitimate source can lead to consumers' confidence and its increased use.

Other facilitating factors in using technology are the perceived usability of using it, or the relative

advantage of using it refers to the degree to which an innovation can provide more benefits than the previous one, and has a positive relationship with the rate of acceptance.<sup>39, 42, 49, 73</sup> Research has shown that the user tends to adopt the same when he or she understands the relative advantage or usability of a new technology compared to an older one.<sup>74-76</sup> mHealth technology can help to grasp the perceived usability of this tool by reducing transportation costs, reducing travel and travel expenses, avoiding leaving work, spending less time,<sup>23, 26, 37-39, 45, 51, 77</sup> removing geographical barriers, disseminating information rapidly and effectively<sup>26, 51, 61, 78</sup>, and being able to browse information capabilities.<sup>22, 60, 79</sup> The study of Balaya et al. also highlights the advantage of saving time.<sup>80, 81</sup> The usability of a technology that is placed against the user's perceived ineffectiveness can encourage the user to use mHealth technology. This point is indicative of the great importance of the perceived usability; also, moving into this perceived usability or unusability range towards perceived usability will increase the likelihood of adopting and using mHealth technology by users.

Among other influential factors that have been referred as a facilitator of the use of mHealth from users' viewpoint, the socio-cultural appropriateness<sup>39, 49, 55, 56, 63, 80</sup> can be mentioned. For example, in some cultures, the group of women have stated that by using the mHealth, they can more comfortably share their confidentiality with their physician.<sup>45, 64, 82, 83</sup> In addition, the high capability of new technologies to match the cultural aspects<sup>23</sup> has an effect on easier adoption, use, and ease of use for users. Therefore, matching educational programs and mHealth applications with social-cultural factors can greatly facilitate the use of these technologies. On the other hand, the use of this tool can be very useful for patients and people who have a different gender with a physician and for diseases that present the risk of stigma.

### Sum Up

In general, this meta-synthesis revealed a wide variety of obstacles and facilitators of the use of mHealth. This profile can be used to make decisions and plans for the development of this technology. This meta-synthesis showed that the factors that were expressed from mHealth users' perspective were interwoven and interconnected at the level of both barriers and facilitators, and even in the relationship between these two general dimensions, a range of contradictions can also be drawn. For example, in the internal dimension, motivational factors with perceived usability based on Vroom's theory is the motivational factor (people do things that they believe are useful in achieving their goal)<sup>84</sup>. One of the strengths of this study is the fact that although similar

studies have looked at the barriers or facilitators' factors from the consumer perspective, they were not carried out in any of them in such a comprehensive manner, and they were examined in a specific target group. Secondly, this study is not limited in time and studies on a wide range of time are other strengths of this study.

One of the limitations of the study was that we only reviewed the English published literature and other studies were not reviewed due to the lack of access to the translator; also, most of the mHealth articles appeared to be on the searchable databases. It is possible that a number of articles in this area have been posted in databases that have not been reviewed.

### Conclusion

The findings of this systematic study revealed some of the facilitators and barriers to the use of mHealth technology from the perspective of users, which provides a good environment for physicians, information and communication technologists, as well as health care providers. To take advantage of these points, we need to improve access to low-income areas and the use of health technology and adopt appropriate policies to develop infrastructure and social empowerment. At the same time, more research is proposed focusing on the technological, demographic, and educational aspects of identifying and addressing barriers and emphasizing facilitators to provide more health services through mHealth technology.

### Limitations

In this study, we searched for a number of specific and related keywords in some databases. Searching for more relevant keywords in other databases may provide more relevant information.

**Conflict of Interest:** None declared.

### References

- 1 Mitchell J, Robinson P, McEvoy M, Gates JJJot, telecare. Telemedicine for the delivery of professional development for health, education and welfare professionals in two remote mining towns. 2001;7(3):174-80. doi.org/10.1258/1357633011936345. PubMed PMID: 11346478.
- 2 Mulaydinov FJIO. Digital Economy Is A Guarantee Of Government And Society Development. 2021;20(3):1474-9. doi: 10.17051/ilkonline.2021.03.164.
- 3 Beratarrechea A, Lee AG, Willner JM, Jahangir E, Ciapponi A, Rubinstein AJT, et al. The impact of mobile health interventions on chronic disease outcomes in developing countries: a systematic review. 2014;20(1):75-82. doi: 10.1089/tmj.2012.0328. Epub 2013 Nov 8. PubMed PMID: 24205809

- 4 Wang B, Park J, Choi IJKCS. Acceptance of applications for smartphones healthcare key influencers. 2011;11:396-404.
- 5 Sim Y-B, Seo Y-J, Kim J-M, Kim S-H, Sung D-HJHP, Management. Factors related to the intent to use the medical application (M-APP) of smart phone of hospital nurses. 2012;22(2):249-62. <https://doi.org/10.4332/KJHPA.2012.22.2.249>.
- 6 Haberer JE, Kiwanuka J, Nansera D, Wilson IB, Bangsberg DRJA, Behavior. Challenges in using mobile phones for collection of antiretroviral therapy adherence data in a resource-limited setting. 2010;14(6):1294-301. DOI: 10.1007/s10461-010-9720-1. PMID: 20532605, PMCID: PMC2975780
- 7 Zurovac D, Sudoi RK, Akhwale WS, Ndiritu M, Hamer DH, Rowe AK, et al. The effect of mobile phone text-message reminders on Kenyan health workers' adherence to malaria treatment guidelines: a cluster randomised trial. 2011;378(9793):795-803. DOI: 10.1016/S0140-6736(11)60783-6. PMID: 21820166, PMCID: PMC3163847.
- 8 Zurovac D, Talisuna AO, Snow RWJPM. Mobile phone text messaging: tool for malaria control in Africa. 2012;9(2):e1001176. DOI: 10.1371/journal.pmed.1001176. PMID: 22363212, PMCID: PMC3283546.
- 9 Becker S, Miron-Shatz T, Schumacher N, Krocza J, Diamantidis C, Albrecht U-VJm, et al. mHealth 2.0: experiences, possibilities, and perspectives. 2014;2(2):e24. DOI: 10.2196/mhealth.3328. PMID: 25099752, PMCID: PMC4114478.
- 10 Kay M, Santos J, Takane MJWHO. mHealth: New horizons for health through mobile technologies. 2011;64(7):66-71. [https://www.who.int/ehealth/mhealth\\_summit.pdf](https://www.who.int/ehealth/mhealth_summit.pdf).
- 11 Mechael P, Batavia H, Kaonga N, Searle S, Kwan A, Goldberger A, et al. Barriers and gaps affecting mHealth in low and middle income countries: Policy white paper. 2010.
- 12 Chan CV, Kaufman DRJJobi. A technology selection framework for supporting delivery of patient-oriented health interventions in developing countries. 2010;43(2):300-6. DOI: 10.1016/j.jbi.2009.09.006. PMID: 19796709, PMCID: PMC2838941.
- 13 Chib A, van Velthoven MH, Car JJohc. mHealth adoption in low-resource environments: a review of the use of mobile healthcare in developing countries. 2015;20(1):4-34. DOI: 10.1080/10810730.2013.864735. PMID: 24673171.
- 14 Kabra SK, Lodha R. Management of unresponsive asthma. Indian J Pediatr. 2004 Aug;71(8):729-32. DOI: 10.1007/BF02730664. PMID: 15345875.
- 15 Piette JD, Lun K, Moura Jr LA, Fraser HS, Mechael PN, Powell J, et al. Impacts of e-health on the outcomes of care in low-and middle-income countries: where do we go from here? 2012;90:365-72. DOI: 10.2471/BLT.11.099069. PMID: 22589570, PMCID: PMC3341688.
- 16 Cafazzo JA, Casselman M, Hamming N, Katzman DK, Palmert MRJmIr. Design of an mHealth app for the self-management of adolescent type 1 diabetes: a pilot study. 2012;14(3):e70. DOI: 10.2196/jmir.2058. PMID: 22564332, PMCID: PMC3799540.
- 17 Kirwan M, Vandelanotte C, Fenning A, Duncan MJJmIr. Diabetes self-management smartphone application for adults with type 1 diabetes: randomized controlled trial. 2013;15(11):e235. DOI: 10.2196/jmir.2588. PMID: 24225149, PMCID: PMC3841374.
- 18 Stinson JN, Jibb LA, Nguyen C, Nathan PC, Maloney AM, Dupuis LL, et al. Development and testing of a multidimensional iPhone pain assessment application for adolescents with cancer. 2013;15(3):e51. DOI: 10.2196/jmir.2350. PMID: 23475457, PMCID: PMC3636147.
- 19 Carter MC, Burley VJ, Nykjaer C, Cade JEJmIr. Adherence to a smartphone application for weight loss compared to website and paper diary: pilot randomized controlled trial. 2013;15(4):e32. DOI: 10.2196/jmir.2283. PMID: 23587561, PMCID: PMC3636323.
- 20 Turner-McGrievy GM, Beets MW, Moore JB, Kaczynski AT, Barr-Anderson DJ, Tate DFJotAMIA. Comparison of traditional versus mobile app self-monitoring of physical activity and dietary intake among overweight adults participating in an mHealth weight loss program. 2013;20(3):513-8. DOI: 10.1136/amiajnl-2012-001510. PMID: 23429637, PMCID: PMC3628067.
- 21 Dennison L, Morrison L, Conway G, Yardley LJmIr. Opportunities and challenges for smartphone applications in supporting health behavior change: qualitative study. 2013;15(4):e86. DOI: 10.2196/jmir.2583. PMID: 23598614, PMCID: PMC3636318.
- 22 Liu C, Zhu Q, Holroyd KA, Seng EKJJoS, Software. Status and trends of mobile-health applications for iOS devices: A developer's perspective. 2011;84(11):2022-33. <https://doi.org/10.1016/j.jss.2011.06.049>.
- 23 Connolly SL, Miller CJ, Koenig CJ, Zamora KA, Wright PB, Stanley RL, et al. Veterans' attitudes toward smartphone app use for mental health care: qualitative study of rurality and age differences. 2018;6(8):e10748. DOI: 10.2196/10748. PMID: 30135050, PMCID: PMC6125614.
- 24 Vogel RI, Niendorf K, Lee H, Petzel S, Lee HY, Geller MAJHciop. A qualitative study of barriers to genetic counseling and potential for mobile technology education among women with ovarian cancer. 2018;16(1):1-7. DOI: 10.1186/s13053-018-0095-z. PMID: 29997716, PMCID: PMC6031189.
- 25 Burgess K, Atkinson KM, Westeinde J, Crowcroft N, Deeks SL, Wilson KJJoPH. Barriers and facilitators to the use of an immunization application: a qualitative study supplemented with Google Analytics data. 2017;39(3):e118-e26. DOI: 10.1093/pubmed/fdw032. PMID: 27247122, PMCID: PMC5939700.

- 26 Smith R, Menon J, Rajeev JG, Feinberg L, Kumar RK, Banerjee AJBo. Potential for the use of mHealth in the management of cardiovascular disease in Kerala: a qualitative study. 2015;5(11):e009367. DOI: 10.1136/bmjopen-2015-009367. PMID: 26576813, PMCID: PMC4654349.
- 27 Huang KT, Lu TJ, Alizadeh F, Mostaghimi AJHhcsq. Homebound patients' perspectives on technology and telemedicine: A qualitative analysis. 2016;35(3-4):172-81. DOI: 10.1080/01621424.2016.1264341. PMID: 27897466.
- 28 Buman MP, Epstein DR, Gutierrez M, Herb C, Hollingshead K, Huberty JL, et al. BeWell24: development and process evaluation of a smartphone "app" to improve sleep, sedentary, and active behaviors in US Veterans with increased metabolic risk. 2016;6(3):438-48. DOI: 10.1007/s13142-015-0359-3. PMID: 27528532, PMCID: PMC4987607.
- 29 Wilson PM, Petticrew M, Calnan MW, Nazareth IJIS. Disseminating research findings: what should researchers do? A systematic scoping review of conceptual frameworks. 2010;5(1):1-16. DOI: 10.1186/1748-5908-5-91. PMID: 21092164, PMCID: PMC2994786.
- 30 Barnett-Page E, Thomas JJBmrm. Methods for the synthesis of qualitative research: a critical review. 2009;9(1):1-11. DOI: 10.1186/1471-2288-9-59. PMID: 19671152, PMCID: PMC3224695.
- 31 Hossain LN, Fernandez-Llimos F, Luckett T, Moullin JC, Durks D, Franco-Trigo L, et al. Qualitative meta-synthesis of barriers and facilitators that influence the implementation of community pharmacy services: perspectives of patients, nurses and general medical practitioners. 2017;7(9):e015471. DOI: 10.1136/bmjopen-2016-015471. PMID: 28877940, PMCID: PMC5588935.
- 32 CASP. Critical Appraisal Skills Programme, CASP (Qualitative) Checklist. 2018.
- 33 Hannes K, Lockwood C, Pearson AJQhr. A comparative analysis of three online appraisal instruments' ability to assess validity in qualitative research. 2010;20(12):1736-43. DOI: 10.1177/1049732310378656. PMID: 20671302.
- 34 Ciliska D, Thomas H, Buffett CJL. A compendium of critical appraisal tools for public health practice. 2008.
- 35 Peng W, Kanthawala S, Yuan S, Hussain SAJBph. A qualitative study of user perceptions of mobile health apps. 2016;16(1):1-11. DOI: 10.1186/s12889-016-3808-0. PMID: 27842533, PMCID: PMC5109835.
- 36 Abelson JS, Kaufman E, Symer M, Peters A, Charlson M, Yeo HJS. Barriers and benefits to using mobile health technology after operation: A qualitative study. 2017;162(3):605-11. DOI: 10.1016/j.surg.2017.05.007. PMID: 28651777.
- 37 Triantafyllou V, Layfield E, Prasad A, Deng J, Shanti RM, Newman JG, et al. Patient perceptions of head and neck ambulatory telemedicine visits: a qualitative study. 2021;164(5):923-31. DOI: 10.1177/0194599820943523. PMID: 32662749.
- 38 Hunting G, Shahid N, Sahakyan Y, Fan I, Moneyppenny CR, Stanimirovic A, et al. A multi-level qualitative analysis of Telehomecare in Ontario: challenges and opportunities. 2015;15(1):1-15. DOI: 10.1186/s12913-015-1196-2. PMID: 26645639, PMCID: PMC4673764.
- 39 Palcu P, Munce S, Jaglal S, Allin S, Chishtie J, Silverstein A, et al. Understanding patient experiences and challenges to osteoporosis care delivered virtually by telemedicine: a mixed methods study. 2020;31(2):351-61. DOI: 10.1007/s00198-019-05182-5. PMID: 31760454, PMCID: PMC7010610.
- 40 Garnweidner-Holme L, Andersen TH, Sando MW, Noll J, Lukasse MJJm, uHealth. Health care professionals' attitudes toward, and experiences of using, a culture-sensitive smartphone app for women with gestational diabetes mellitus: qualitative study. 2018;6(5):e9686. DOI: 10.2196/mhealth.9686. PMID: 29759959, PMCID: PMC5972202.
- 41 O'Shea O, Woods C, McDermott L, Buys R, Cornelis N, Claes J, et al. A qualitative exploration of cardiovascular disease patients' views and experiences with an eHealth cardiac rehabilitation intervention: The PATHway Project. 2020;15(7):e0235274. DOI: 10.1371/journal.pone.0235274. PMID: 32628688. PMCID: PMC7337342.
- 42 Vergouw JW, Smits-Pelser H, Kars MC, van Houwelingen T, van Os-Medendorp H, Kort H, et al. Needs, barriers and facilitators of older adults towards eHealth in general practice: a qualitative study. 2020;21. DOI: 10.1017/S1463423620000547. PMID: 33263272, PMCID: PMC7737186.
- 43 Asklund I, Samuelsson E, Hamberg K, Umefjord G, Sjöström MJJomIr. User experience of an app-based treatment for stress urinary incontinence: qualitative interview study. 2019;21(3):e11296. DOI: 10.2196/11296. PMID: 30869644, PMCID: PMC6437616.
- 44 Slevin P, Kessie T, Cullen J, Butler M, Donnelly S, Caulfield BJQAIJoM. Exploring the barriers and facilitators for the use of digital health technologies for the management of COPD: a qualitative study of clinician perceptions. 2020;113(3):163-72. doi: 10.1093/qjmed/hcz241. PMID: 31545374.
- 45 Khatun F, Heywood AE, Ray PK, Bhuiya A, Liaw S-TJJjomi. Community readiness for adopting mHealth in rural Bangladesh: a qualitative exploration. 2016;93:49-56. DOI: 10.1016/j.ijmedinf.2016.05.010. PMID: 27435947.
- 46 Smillie K, Borek NV, Kop MLvd, Lukhwara A, Li N, Karanja S, et al. Mobile health for early retention in HIV care: a qualitative study in Kenya (WelTel Retain). 2014;13(4):331-8. DOI: 10.2989/16085906.2014.961939. PMID: 25555099, PMCID: PMC5585007.
- 47 Duclos V, Yé M, Moubassira K, Sanou H, Sawadogo NH, Bibeau G, et al. Situating mobile health: a qualitative study of mHealth expectations in the rural health district of Nouna, Burkina Faso. 2017;15(1):41-53. DOI: 10.1186/s12961-017-0211-y. PMID: 28722558, PMCID: PMC5516845.

- 48 Al-Emadi KA, Kassim ZA, Razzaque A. User Friendly and User Satisfaction Model Aligned With FinTech. *Innovative Strategies for Implementing FinTech in Banking*: IGI Global; 2021. p. 291-301. DOI: 10.4018/978-1-7998-3257-7.ch017.
- 49 Solem IKL, Varsi C, Eide H, Kristjansdottir OB, Mirkovic J, Børøund E, et al. Patients' needs and requirements for eHealth pain management interventions: Qualitative study. 2019;21(4):e13205. DOI: 10.2196/13205. PMID: 30877780, PMCID: PMC6462891.
- 50 Cheung W, Chang MK, Lai VSJDss. Prediction of Internet and World Wide Web usage at work: a test of an extended Triandis model. 2000;30(1):83-100. [https://doi.org/10.1016/S0167-9236\(00\)00125-1](https://doi.org/10.1016/S0167-9236(00)00125-1).
- 51 Parker SJ, Jessel S, Richardson JE, Reid MCJBg. Older adults are mobile too! Identifying the barriers and facilitators to older adults' use of mHealth for pain management. 2013;13(1):1-8. DOI: 10.1186/1471-2318-13-43. PMID: 23647949, PMCID: PMC3673892.
- 52 Bradshaw YW, Fallon KM, Viterna JJRiSS, Mobility. Wiring the world: Access to information technology and development in poor countries. 2005;23:369-92. [https://doi.org/10.1016/S0276-5624\(05\)23012-3](https://doi.org/10.1016/S0276-5624(05)23012-3).
- 53 Hongsermeier TJHMT. Improved access to patient data and improved public perception are two potential benefits of technology-enabled clinical guidelines in electronic medical records. 1997;18(8):66-68.
- 54 Mechael PNJIT, Governance, Globalization. The case for mHealth in developing countries. 2009;4(1):103-18.
- 55 Dietrich DRJSI. Avatars of whiteness: Racial expression in video game characters. 2013;83(1):82-105. <https://doi.org/10.1111/soin.12001>.
- 56 Spann A, Stewart EJHtaijohiIe. Barriers and facilitators of older people's mHealth usage: A qualitative review of older people's views. 2018;14(3):264-96. doi:10.17011/ht/urn.201811224834.
- 57 Brian RM, Ben-Zeev DJAjop. Mobile health (mHealth) for mental health in Asia: objectives, strategies, and limitations. 2014; 10:96-100. doi: 10.1016/j.ajp.2014.04.006. PMID: 25042960.
- 58 Jain N, Singh H, Koolwal GD, Kumar S, Gupta AJAjop. Opportunities and barriers in service delivery through mobile phones (mHealth) for severe mental illnesses in Rajasthan, India: a multi-site study. 2015;14:31-5. DOI: 10.1016/j.ajp.2015.01.008. PMID: 25701069.
- 59 Rogers WA, Fisk AD, Mead SE, Walker N, Cabrera EFJHF. Training older adults to use automatic teller machines. 1996;38(3):425-33. DOI: 10.1518/001872096778701935. PMID: 8865767.
- 60 Pramana G, Parmanto B, Kendall PC, Silk JSJT, e-Health. The SmartCAT: an m-health platform for ecological momentary intervention in child anxiety treatment. 2014;20(5):419-27. DOI: 10.1089/tmj.2013.0214. PMID: 24579913, PMCID: PMC4011472.
- 61 Martin TJJohcftp, underserved. Assessing mHealth: opportunities and barriers to patient engagement. 2012;23(3):935-41. DOI: 10.1353/hpu.2012.0087. PMID: 24212144.
- 62 De Tolly K, Alexander H, Cell-Life CJC-L, Cape Town. Innovative use of cellphone technology for HIV/AIDS behaviour change communications: 3 pilot projects. 2009.
- 63 Chib AJMM, Communication. The promise and peril of mHealth in developing countries. 2013;1(1):69-75. <https://doi.org/10.1177/2050157912459502>.
- 64 Skaria GJJoMTiM. MHealth in health information delivery: The Indian scenario. 2013;2(1):26-9. DOI:10.7309/jmtm.2.1.5.
- 65 Thorsteinsen K, Vittersø J, Svendsen GBJJot, applications. Increasing physical activity efficiently: an experimental pilot study of a website and mobile phone intervention. 2014;2014. DOI: 10.1155/2014/746232. PMID: 24963290, PMCID: PMC4055100.
- 66 Cole SW, Yoo DJ, Knutson BJPo. Interactivity and reward-related neural activation during a serious videogame. 2012;7(3):e33909. DOI: 10.1371/journal.pone.0033909. PMID: 22442733, PMCID: PMC3307771.
- 67 Brown-Johnson CG, Berrean B, Cataldo JKJPe, counseling. Development and usability evaluation of the mHealth Tool for Lung Cancer (mHealth TLC): a virtual world health game for lung cancer patients. 2015;98(4):506-11. DOI: 10.1016/j.pec.2014.12.006. PMID: 25620075, PMCID: PMC4451946.
- 68 Akter S, D'Ambra J, Ray P. User perceived service quality of mHealth services in developing countries. 2010. <https://aisel.aisnet.org/ecis2010/134>.
- 69 Ja-Chul G, Sang-Chul L, Yung-Ho S. Determinants of behavioral intention to mobile banking; Expert Systems with Applications. Vol.; 2009. doi.org/10.1016/j.eswa.2009.03.024.
- 70 Kharbanda EO, Stockwell MS, Fox HW, Rickert VIJAjoph. Text4Health: a qualitative evaluation of parental readiness for text message immunization reminders. 2009;99(12):2176-8. DOI: 10.2105/AJPH.2009.161364. PMID: 19833982, PMCID: PMC2775765.
- 71 Bezabhe WM, Chalmers L, Bereznicki LR, Peterson GM, Bimirew MA, Kassie DMJJo. Barriers and facilitators of adherence to antiretroviral drug therapy and retention in care among adult HIV-positive patients: a qualitative study from Ethiopia. 2014;9(5):e97353. DOI: 10.1371/journal.pone.0097353. PMID: 24828585, PMCID: PMC4020856.
- 72 Al-Jabri IM, Sohail MSJJoECR. Mobile banking adoption: Application of diffusion of innovation theory. 2012;13(4):379-91.
- 73 Moore GC, Benbasat IJIsr. Development of an instrument to measure the perceptions of adopting an information technology innovation. 1991;2(3):192-222. doi.org/10.1287/isre.2.3.192.



- 74 McCloskey DWJJoO, Computing EU. The importance of ease of use, usefulness, and trust to online consumers: An examination of the technology acceptance model with older customers. 2006;18(3):47-65. DOI: 10.4018/joeuc.2006070103.
- 75 Rogers EMJNY. Diffusion of innovations. Free Press. 2003;551.
- 76 Norris AC, Stockdale R, Sharma SJHij. A strategic approach to m-health. 2009;15(3):244-53. DOI: 10.1177/1460458209337445. PMID: 19713398.
- 77 Becker AE, Kleinman AJNEJoM. Mental health and the global agenda. 2013;369(1):66-73. DOI: 10.1056/NEJMcl309899. PMID: 24088110.
- 78 Atkinson NL, Gold RSJAJoHB. The promise and challenge of eHealth interventions. 2002;26(6):494-503. DOI: 10.5993/ajhb.26.6.10. PMID: 12437024.
- 79 Gurley D, Cohen P, Pine DS, Brook JJJoAD. Discriminating depression and anxiety in youth: A role for diagnostic criteria. 1996;39(3):191-200. DOI: 10.1016/0165-0327(96)00020-1. PMID: 8856423.
- 80 Blaya JA, Fraser HS, Holt BJHA. E-health technologies show promise in developing countries. 2010;29(2):244-51. DOI: 10.1377/hlthaff.2009.0894. PMID: 20348068.
- 81 Razzouk D, Sharan P, Gallo C, Gureje O, Lamberte EE, de Jesus Mari J, et al. Scarcity and inequity of mental health research resources in low-and-middle income countries: a global survey. 2010;94(3):211-20. DOI: 10.1016/j.healthpol.2009.09.009. PMID: 19846235.
- 82 Alonso J, Buron A, Bruffaerts R, He Y, Posada Villa J, Lepine JP, et al. Association of perceived stigma and mood and anxiety disorders: results from the World Mental Health Surveys. 2008;118(4):305-14. DOI: 10.1111/j.1600-0447.2008.01241.x. PMID: 18754833, PMCID: PMC3040096.
- 83 Milner A, De Leo DJBotWHO. Suicide research and prevention in developing countries in Asia and the Pacific. 2010;88:795-6. DOI: 10.2471/BLT.09.070821. PMID: 20931067, PMCID: PMC2947038.
- 84 Van Eerde W, Thierry HJJoap. Vroom's expectancy models and work-related criteria: A meta-analysis. 1996;81(5):575. doi.org/10.1037/0021-9010.81.5.575.