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Mobile applications for prematurity: a systematic review protocol

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ABSTRACT

Background Premature birth is a global epidemic of significant public health concern. Counselling and education of pregnant women at risk of preterm birth or mothers with premature infants are essential to improve mother and infant health. Mobile applications are an increasingly popular tool among parents to receive health information and education. This study aims to evaluate the usages and the effects of a mobile application designed for premature births in order to improve health outcomes.

Methods This review will include all studies of different designs which evaluated the use and impact of interventions provided via mobile applications on pregnant women at risk of preterm birth or mothers with premature infants in order to address all health outcomes. A combination of keywords and MeSH(Medical Subject Headings) terms is used in the search strategy. Literature databases including Scopus, PubMed, ISI Web of Science, ProQuest, CINAHL and Cochrane Library will be searched to May 2021. Furthermore, eligible studies will be chosen from the reference list of retrieved papers. Two researchers will independently review the retrieved citations to decide whether they meet the inclusion criteria. Mixed Methods Appraisal Tool (MMAT) V.2018 will be used to assess the quality of studies. Relevant data are collected in a data extraction form and analysed. Results are reported under the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.

Discussion This systematic review will recognize and combine evidence about the usages and impact of mobile application interventions on the health improvement of pregnant women at risk of preterm birth or mothers with premature infants.

What is already known on this topic?

- Pregnant women at risk of preterm birth or mothers with premature infants need ongoing training and support.
- Mobile applications are innovations and interventions used to reduce referrals to neonatal care centers.
- It needs to provide and consolidate the available evidence regarding the impact of these applications on the care management of premature births.

What this study hopes to add?

- This study will highlight the value and efficiency of mobile applications designed for the prematurity field.
- This study will provide evidence for supporting the need for more attention and investment on mobile applications by health care officials and providers.
- This support is constructive helpful during the critical situation in the covid19 epidemic.

BACKGROUND

Premature birth is a global epidemic with an annual incidence of 15 million worldwide,[1] estimated to be around 11% of all deliveries. In most countries, preterm births are increasing,[2] which is defined by the WHO as births before 37 completed weeks of gestation.[3] Preterm babies are more likely to die or experience long-term health challenges than full-term infants.[4–8] In recent decades, prematurity was the leading cause of neonatal mortality globally, which has become the leading cause of childhood mortality over the age of 5.[2] Studies suggest that about 50% of premature low-birthweight children will suffer from developmental difficulties such as severe disabilities, mental retardation, brain paralysis, blindness, deafness and epilepsy in the coming years.[9 10]

Compared with mothers of full-term infants, mothers of preterm infants have a higher prevalence of depressive symptoms, post-traumatic stress disorder, anxiety and concern for child health.[11] Moreover, antenatal counselling on child health for parents at risk of preterm birth takes place while the mother is in labour[12]; in such situations, parents typically experience severe anxiety, exhaustion and fatigue.[13] Consequently, due to the physical and emotional factors involved with the birth process, parents' capacity can be limited to make medical decisions .[14 15]

Chuang *et al*[16] in their study showed that the best way is to involve the parents in complex medical decisions; however, mothers at risk of preterm birth often do not receive the information at the right time to make informed and valuable decisions.

Preterm birth remains a significant public health concern worldwide.[3] Due to its ability to reduce infant and childhood morbidity and mortality, preterm birth prevention is considered a public health priority.[17] Evidence-based interventions are required, especially in low-resource settings, in order to prevent prematurity.[3]

In this regard, [18]mobile applications, which have increasingly become an essential tool among people,18 can transform healthcare services and consequently lead to better access to clinical interventions and diagnoses.[19] Mobile phone-based approaches have moved to a dynamic, interactive atmosphere of health communication modalities including visual, vocal and verbal messages.[20–24] Moreover, mobile interventions in antenatal care can quadruple the number of users, as well as reduce mortality during pregnancy.[25]

The term 'mobile health' (mHealth) is used to describe any practice of healthcare assisted by mobile devices.[26] mHealth technology is being touted as a fast and straightforward method of distributing information to targeted groups.[27 28] mHealth technology can provide a versatile and efficient way of informing parents about prematurity.[27] Consultation with physicians during prenatal cycle using mHealth technology can also improve parents' ability to grasp and apply intricate medical knowledge in the event of early work and delivery.[28] Besides, using mHealth applications at the user's convenience also helps minimise the frequency of unnecessary hospital referrals of stable patients.[29]

The widespread outbreak of the Covid19 has a negative impact on healthcare and a significant impact on reproductive health programmes, as well as on mothers and children. Covid19 has been raised the worries and anxieties of pregnant mothers and babies.[30 31] On the other hand, frequent visits to medical centres have become challenging for mothers than ever before[32]; therefore, there is an additional requirement for mobile applications and distance education in this situation.

Various studies have been conducted to design and evaluate mobile-based applications[33] or mothers who have a premature baby.[34] A study has also created and designed a program using smartphones to reduce the rate of preterm birth in a typically hard-to-engage patient population.[35] Moreover, an application has supported parents with very low birthweight babies during the transition from neonatal intensive care unit (NICU) to home and has reduced hospital length of stay.[36] Nevertheless, no study has been examined the impact of published studies to determine the outcomes and efficiency of mobile applications. The use of technology in each clinical area needs sufficient evidence, as well as suitable assessments to support the effects of these applications.

The results of studies show a significant gap in the current knowledge about interventions for maternal and fetal outcomes and prematurity, and there is a vital need to provide better quality evidence on the effectiveness of the interventions.[37]

Aim

This study evaluates the usage and the effects of a mobile application designed for prematurity to improve health outcomes.

METHODS

This protocol was registered at the International Prospective Register of Systematic Reviews. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[38] guidelines were used to develop this systematic review protocol.

Inclusion criteria

Population

Studies that involved pregnant women at risk of preterm birth or mothers with premature infants will be included.

Intervention

This review includes all studies which evaluated mobile applications designed to educate parents in order to improve the health of pregnant women who are at risk of preterm delivery or mothers with premature infants. Studies are included if mobile applications meet the following:

- Designed to educate parents to help prevent, diagnose or treat diseases related to premature infants.
- Educate pregnant mothers who are at risk of preterm birth to reduce the stress and consequences of preterm birth risks.
- Training within the mobile application.

There are no limitations on who funded the intervention; for example, commercially produced mobile applications will be eligible, such as mobile applications created by health systems, hospitals or other organisations. There are also no limitations on the age of the child.

Studies will be excluded if they meet any of the following criteria:

- Target users of mobile applications are nurses and health professionals.
- The mobile phone is used only for telephone calls or text message.
- It is only a description of an application and evaluation of mobile application is not done.

Comparator/control

The following are the comparisons:

1. Mobile application versus interpersonal modes of contact (telephone or face-to-face conversation).
2. Mobile application versus paper-based or text-based communications.
3. Mobile healthcare versus no particular intervention or regular care.

Outcome

Outcomes include any mention of the following consequences and outcomes in the studies improvement in the level of parental knowledge, maternal stress/stress

coping, parenting self-efficacy, satisfaction, anxiety, partnership advocacy/improved parent–infant relationship, feeling of being safe, reassurance and confidence, discharge, application usage, application content, ease of use/user-friendly, usability and others.

Study design

Since studies are done with different designs, all types of studies are included, such as observational studies, interventional studies, qualitative studies and others. Both ongoing studies and cross-sectional studies will also be included.

Search strategy

We will conduct a systematic literature search of databases including Scopus, PubMed, Institute for Scientific Information (ISI) Web of Science, ProQuest, Cumulated Index to Nursing and Allied Health Literature CINAHL) and Cochrane Library to May 2021. Grey literature will also be searched in order to identify studies on mobile applications for prematurity.

The search strategy was written by a specialist librarian and reviewed by all authors. A combination of keywords and MeSH terms is used in the search strategy. The search is done using the keywords eHealth, telemedicine, telehealth, web application, mobile application, preterm, premature Infant, NICU and other related keywords (table 1). The search strategy for each database was separately written. Keywords will be searched with and without quotation marks (“”) and will be combined using Boolean operators (‘AND’, ‘OR’) and, if necessary, wildcard ‘*’ will be used to expand the search. Furthermore, eligible studies will be chosen from the reference list of selected papers. All English and non-English full text will be considered

Table 1 Keywords for search strategy

Concept 1	Concept 2
“Web Application”	Extremely Premature
Web Application	Premature Birth
APP-Cell phone iPads	Infant, Extremely Premature
Tablets	(MeSH)
Text Messaging (MeSH)	Premature Birth (MeSH)
“Text Messag”*	Infant, Premature (MeSH)
Text Messaging tele-	Preterm
medicine	Premature
“tele medicine” tele medicine	“Extremely Premature Infant”
“Mobile based“	“Premature Infant”
Mobile based	“Preterm Births”
Telehealth	“Birth, Premature”
“Mobile Health”	Labor, Premature (MeSH)
“Health, Mobile” mHealth	“Preterm Infant”
Telehealth eHealth	Prematurity
Telemedicine (MeSH)	Neonat*
Telemedicine m-health	“small for gestational age”
“mobile application”	NICU
“smart phone”	“Neonatal Intensive Care
“mobile-based”	unit”
“mobile phone”	“Neonatal ICU”
“smart phone app”	“Extremely Premature”
APP	“Premature Birth”
Cell Phone (MeSH)	SGA
“Cell Phone”	
Computers, Handheld	
(MeSH)	
“Cellular Telephones”	
“Portable Cellular Phone”	
Mobile Applications (MeSH)	
“Mobile App”	
“Mobile Applications”	
“Portable Software Apps”	
Concept 1 AND concept 2	

Data collection process

Four authors will separately screen the search results using titles and abstracts, and duplicate research and review will be excluded. Two reviewers will go through the full text of articles to decide if they meet the inclusion requirements. A third reviewer will fix any inconsistencies. A PRISMA flow diagram summarises the selection of studies (figure 1).

Data extraction and synthesis

A data extraction form is used to collect the various features of each included study. The data extraction form contains the following fields (table 2). Two authors will independently extract the data. A third review author will resolve any differences in opinion between the two reviewers to achieve consensus. Data will be entered and presented in tabular and descriptive form in an Excel software. A narrative report is created to summarise the extracted data around the results.

Considering the fact that we will include a variety of papers with heterogeneous study designs, we will not be able to perform a meta-analysis; instead, we will report the quality of different applications for premature infants and their outcomes.

Quality assessment

Since articles with different designs will be included, Mixed Methods Appraisal Tool (MMAT) V.2018[39] will be used to assess the quality of the studies. This tool was first developed in 2006[40] for various study designs and was improved in 2011.[41] This tool is used to concurrently assess the consistency of five types of studies, including randomised controlled trials, non-randomised studies, qualitative research, quantitative descriptive studies and mixed-method studies. For each included study, parameters should be scored due to ‘Yes’, ‘No’ and ‘Can’t tell’ responses for each section of included study after selecting the required category of studies. The tool prevents calculation of the total score from the scores of each criterion. The developers suggest the ratings of each criterion be presented in more detail. Moreover, they discourage the exclusion of any studies due to quality.[39] Two members of the study team will evaluate the quality of the articles, and

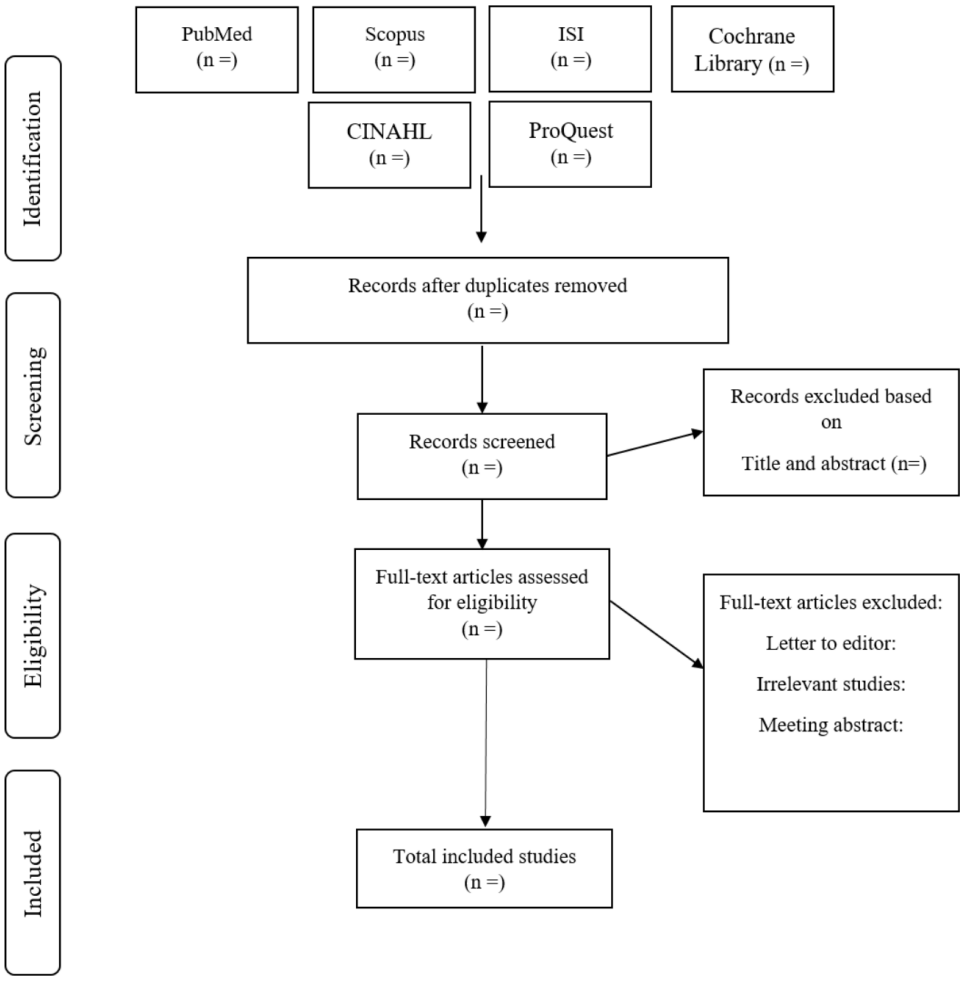

Figure 1 The flow diagram of study selection.

any dispute is overcome by contacting a third research participant.

Patient and public involvement

Patients and the public were not involved in the development of this protocol.

DISCUSSION

The 2014 National Institute of Child Health and Human Development Workshop on Management and Counseling in Periviable Pregnancy described several unresolved problems, including the timing of parental early pregnancy advice and counselling. The expert panel recognised that birth hospitalisation is not the best time for parents to obtain new medical knowledge about newborns. 'healthcare team and the family should quickly make complex, ethically challenging decisions - often in an emotionally charged setting'.[42] On the other hand, mothers of premature babies usually also have a high level of problems and a low level of knowledge about caring for their babies. Therefore, some interventions and instructional materials need more attention as well as an investment.[43] Global coverage of good quality care can prevent approximately 113 000 maternal deaths, 531 000 fetal deaths and 1.3 million infant deaths per year by 2020.[44]

During pregnancy and after the birth of the baby, many women across several countries regularly use mobile applications for acquiring information, data monitoring, information sharing, education and reassurance purposes. This systematic review is the first evaluation of the effects of mobile application interventions on pregnant women at risk of preterm birth or mothers with premature infants during pregnancy in order to improve health outcomes.

We expect our study to provide relevant information to develop effective strategies for adhering to the use of mobile applications to improve healthcare delivery, education and consultation among pregnant women at risk of preterm birth or mothers with premature babies. Furthermore, this study will help improve understanding of the role of mobile applications in this area.

The findings of this study presents an evidence supporting more attention and investment of the mobile application field in the prematurity by health care officials and providers. In fact, this is particularly beneficial in the critical situation of covid19 epidemic.

Table 2 Extracted data form

Data heading	Description
Title	Title of the article or study
Year	Research year
Author	First author/s last name
Journal	The journal where the article was published
Country	Location of the study (the country where the research was conducted)
Study type	Study design
Objective	Purpose of the research
Sample size	Number of participants in the study (intervention group and control group)
Comparison/control group treatment	Type of usual care or action that the comparison group receives
Intervention group	Characteristics of the intervention group (parents, pregnant mothers or babies), such as maternal age, maternal gestational age, neonatal age, neonatal sex, etc
Control group	Control group specification (age, sex, etc)
Application name	Mobile application name
Platform	Operating systems are used primarily in mobile technology, eg, iOS/Android
Application purpose	The purpose of application design
Application specification	Features and capabilities of the application
Intervention type	Processes that take place in the intervention
Application domain	Use area/s of mobile applications (prevention, diagnosis, care and treatment)
Communication method	Methods of providing services and transferring educational content in applications (audio, image, video, text message)
Inclusion/exclusion criteria	Inclusion and exclusion criteria for selecting the study sample
Clinical/technical participant	Clinical participants (nurse, midwife, doctor) and technical participants (computer engineer) in the study
Application location	A place where parents use the application (at home or in the hospital)
Geographical extent	The geographical area where the intervention is performed (city, state, country, between several countries)
Application implementation method	Online (internet connection) or offline
Most significant findings	Noteworthy results of the study
Outcome	Findings that contribute to the research question and the consequences mentioned in the study that were obtained after using the application
Challenges /barriers and opportunity/ benefits	Barriers and opportunities to intervene with the application
Quality score	Scores obtained from the qualitative evaluation of the article

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Contributors MS, MK, ShP, AV, FK and HS contributed to the development of the background and design of the study and planned the output of the research. MM developed the search strategy design. MS prepared the manuscript. MK, SP, AV, FK and HS reviewed the manuscript. All the authors read the paper and approved the final version of this manuscript.

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