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Protocol

Detecting technical factors that influence compliance to non-pharmacological treatment using mHealth technology in children with chronic pulmonary disease: a scoping review protocol

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ABSTRACT

Background: Optimal adherence to pharmacological and non-pharmacological treatment in pediatric pulmonary diseases is crucial to address the increased morbidity levels. The purpose of this scoping review was to investigate the level of evidence about technical factors that facilitate adherence to non-pharmacological treatment with the use of mobile health (mHealth) in children with chronic respiratory diseases.
Methods: The methodological framework for scoping review recommended by Arksey and O'Malley's and Levac will be followed for conducting the present one. The preferred reporting items for systematic reviews and meta-analyses for scoping reviews (PRISMA-ScR) guidelines will be used. Methodological quality will be assessed using the critical appraisal skills programme (CASP) checklist and the mixed methods appraisal tool (MMAT). Five databases will be searched: Medline (via Ovid), PubMed, Scopus, CINAHL (EBSCOhost) and Cochrane Library. Two independent reviewers will screen titles and abstracts for assessment against the eligibility criteria. Any disagreements will be resolved through discussion and consensus among other authors. Data will be extracted and presented in a narrative summary.
Conclusions: This scoping review does not require ethics approval as it only includes information from previously published studies. The results will be disseminated through a peer-review publication, conference presentations and/or as part of stakeholder meetings with physiotherapists, clinicians, academicians, technicians and researchers.
Trial Registration: NA.

Keywords: Adherence, Chronic pulmonary disease, mHealth, Non-pharmacological treatment, Pediatrics, Technology

INTRODUCTION

Chronic lung diseases, account for almost a quarter of all pediatric visits to the hospital admission (18% of total number of visits) with an unknown worldwide prevalence and simultaneously with an increasing incidence in developing countries.[1,2] Asthma, being the most common chronic lung disease, has an incidence of 9.5% per year in children.[3] Cystic fibrosis (CF) as an irreversible damage of bronchiectasis in childhood presents an incidence of 1/2500 live births, while other non-CF bronchiectasis account for 0.2-735 cases per 100.000 children.[4,5]

Noteworthy, in the management of chronic lung disease, adherence is considered crucial to treatment (either to pharmacological or to non-pharmacological).[6] Adherence to treatment has been described as a worldwide problem of striking magnitude and it reaches approximately 50% in most chronic diseases.[7] More specifically in pediatric population, poor adherence often leads to poorer clinical outcomes such as pulmonary exacerbations, lung function decline, risk of hospitalization and increased health care costs.[8,9] Particularly, for respiratory physical therapy sessions, it is believed that children should be engaged for up to two hours per day for mitigating lung decline.[8] However, the adherence to treatment sessions declines as children become adolescents.[10] This fact suggests an urgent need for actions to increase adherence in order to reduce the physical, mental and socioeconomic effects of chronic pediatric pulmonary diseases.[11]

New technologies such as mobile phones and tablets with modern, interactive, attractive and easy to use applications, may be useful for reinforcing children and young people to comply to treatment.[12,13] A possible reason may be that a percentage over 40% of children, aged between 5 and 17 years are familiar with and use this technology for more than 3 to 5 hours daily.[12,14] Furthermore, mobile phones' use is growing increasingly worldwide and the instant access and direct communication of mobile technology allows a faster transfer of health information, which in turn supports clinical management and public health procedures. In practice, this can be achieved with simple applications such as voice and text messaging (SMS), multimedia messaging, Bluetooth technology and others that focus on user's compliance.[15]

Mobile health (mHealth) technologies refers to the use of mobile and wireless devices in the support of healthcare delivery aiming to improvement of health outcomes. The application of mHealth solutions can support the provision of high-quality care to patients with chronic respiratory diseases offering satisfaction for both patients and healthcare professionals and reducing healthcare consumption and costs.[16,17] For adolescents, who are frequent users of mobile technology, mHealth applications show potential as a strategy for improving self-management and adherence to treatment regimens for numerous chronic conditions.[10] The effectiveness of mHealth applications pose a research challenge for clinicians regarding the management of chronic disease, the improvement of symptoms and quality of life.[18]

Although literature occasionally provides evidence about the effectiveness of the mHealth applications on the compliance to non-pharmacological treatment of children, there is no known existing review which has systematically collected and presented evidence about the technical factors that influence adherence to this kind of treatment.[13,19,20] Therefore, the aim of the present scoping review will be to investigate the technical factors that influence adherence to treatment in children and adolescents with chronic pulmonary diseases.

Rationale for conducting a scoping review

Theoretically, the creation of mHealth Apps facilitates compliance in the use of the application to achieve the desired treatment outcome.[16] This is evidenced by the fact that children are familiar in technology and want to use it in their daily lives.[10] To date, it is unclear what is more or less known about factors that promote children's adherence to currently used mHealth Apps. Scoping reviews are useful for examining emerging evidence when it is still unclear what other, more specific questions can be posed.[21,22] The aim of this scoping review is to establish the level of evidence for the technical factors that influence adherence to non-pharmacological treatment with the use of mHealth technology in children with chronic pulmonary diseases.

METHODS

This scoping review will follow the preferred reporting items for systematic reviews and meta-analyses-ScR to ensure that all suggested items are reported.[23] The methods were developed based on the methodological framework for scoping review recommended by Arksey et al. According to this framework, there are six different stages in undertaking a scoping review: identifying the research question; identifying relevant studies; selecting studies; charting the data; collating, summarizing and reporting the results and consultation with stakeholders.[24,25]

Stage 1: Identifying the research question

Our intention is to comprehensively examine the body of evidence regarding technical factors that influence (facilitate or obstacle) the adherence to mHealth apps use in children and/or adolescents (<18 years old) with chronic pulmonary diseases. To meet this objective this review asks the following questions:

"What are the technical characteristics of a mobile application that influence children's adherence to treatment?"

"Are the technical characteristics of a mHealth App adapted according to the needs of the target population?"

"Do economic factors influence children's adherence to the use of mHealth app?"

As scoping is an iterative process, additional questions might be added based on the findings along the review process. Since the eventual goal of this study is to contribute to the understanding of the determinants of children's adherence to mHealth apps use, the results that are relevant to the topic will be synthesized.

Stage 2: Identifying relevant studies

Table 1: Search strategy for PubMed.

S. no.	Search strategy
1.	"Patient Compliance"[Mesh] OR "adher*"[tw] OR "adhear*"[tw] OR "compliance"[tw] OR "fidelity"[tw] OR "barrier*"[tw] OR "persistence"[tw] OR "participa*"[tw] OR "facilitator*"[tw] OR "adopt*"[tw] OR "maintenance"[tw] OR "behavior change"[tw] OR "behaviour change"[tw] OR "daily treatment"[tw] OR "self-care"[tw] OR "self-management"[tw] OR "disease management"[tw] OR "patient education"[tw]
2.	"Physical Therapy Modalities"[Mesh] OR "physiotherap*"[tw] OR "chest physical therapy*"[tw] OR "rehabilitation*"[tw] OR "drainage"[tw] OR "airway clearance"[tw] OR "respiratory therap*"[tw] OR "bronchial hygiene"[tw] OR "exercis*"[tw] OR "home program*"[tw] OR "physical fitness"[tw] OR "nutrition"[tw] OR "diet"[tw]
3.	"Lung Diseases, Obstructive"[Mesh] OR "chronic respiratory disease"[tw] OR "bronchiectasis"[tw] OR "cystic fibrosis"[tw] OR "primary ciliary dyskinesia"[tw] OR "asthma"[tw] OR "pulmonary disease"[tw] OR "chronic obstructive"[tw] OR "lung disease"[tw] OR "chronic bronchitis"[tw]
4.	"Technology"[Mesh] OR "application*"[tw] OR "smartphone"[tw] OR "telehealth"[tw] OR "tele-health"[tw] OR "tele-medicine"[tw] OR "telemedicine"[tw] OR "mHealth"[tw] OR "m-Health"[tw] OR "e-Health"[tw] OR "health care delivery"[tw] OR "mobile phone app"[tw] OR "mobile phone" [tw] OR "mobile telephone"[tw] OR "telephone"[tw] OR "health care system*"[tw] OR "app"[tw] OR "mobile computing"[tw] OR "mobile technolog*"[tw] OR "handheld computer"[tw] OR "video game console"[tw] OR "software"[tw]
5.	#1 AND #2 AND #3 AND #4

A scoping search will be conducted in the following databases: Medline (via Ovid), PubMed, Scopus, CINAHL (via EBSCOhost) and Cochrane Library. To ensure search effectiveness, up-to-date and comprehensive search strategies will be developed, based on databases suggestions. The key words to be used will be in English and will be combined using Boolean logical operators (AND and OR). Additionally, the bibliographic references of the relevant articles will be checked for possible additional selected articles (avalanche procedure) to be identified. An initial search strategy was developed in PubMed (Table 1). Key index terms were determined through discussions between two authors (VS and EKor). The concepts and key index terms used in this preliminary search will later be adapted to the selected databases. The search will be iterative; as reviewers become more familiar with the evidence bases, additional keywords, sources and search terms found to be useful will be incorporated into a strategy. A search of the unpublished and grey literature will also be conducted through general search. This systematic search will be conducted in June 2022 and the searches will be re-run before the final analyses to retrieve more recent studies for inclusion to ensure accuracy.

Stage 3: Selecting studies

Studies will be considered for inclusion if they include children and/or adolescences (<18 years) with a chronic pulmonary disease as participants and if they evaluate factors that influence (facilitate or obstacle) the adherence to mHealth apps use. Articles published from database inception to the present will be included to ensure that all reports are relevant to children's adherence to mHealth apps use.

The inclusion criteria will be developed in an iterative process. Studies will be excluded if the publication is not available in English. This review will not include results from abstracts or conference presentations, book reviews, book chapters, narrative reviews, case series/reports, commentaries, letters to the editor, editorials, clinical practice guidelines and protocols. No restrictions regarding the time of publication will be applied. For some studies that may have incomplete data or are not available online one reviewer (VS) will communicate with the authors. Given the rigorous study timetable, the authors will have 2 weeks to answer our questions. Otherwise, the study will be excluded.

Following the search, recovered publications will be collated and uploaded into the EndNote software package (EndNote20, Clarivate 2022). Duplicates will be deleted, and references exported in the Rayyan web application (Qatar computing research institute) to facilitate independent record selection by the reviewers.[26] Selection process will be performed in two stages.

Firstly, titles and abstracts will be screened against the inclusion criteria by a single reviewer (VS). At this primary stage of the review, any uncertainty with a title will not eliminate the citation for consideration in the second stage. The second stage of the selection process will include two independent reviewers (VS and EKor). Then, all potentially relevant full-text articles will be retrieved and screened for inclusion in the final review. Any disagreements will be resolved through discussion and consensus with the rest of the authors. The exclusion of full-text papers that do not meet the inclusion criteria will be recorded and reported in the scoping review. The results of the search will be reported in full in the final scoping review and presented in a preferred reporting items for systematic reviews and meta-analyses for scoping reviews flow diagram.[23] Methodological quality of all studies will be assessed using the CASP checklist and the MMAT.[34,35]

Stage 4: Charting the data

Table 2: The data extraction instrument.

Scoping review details	
Scoping review title	
Review objective	
Review questions	
Eligibility criteria	
Population	Children and adolescents aged under 18 years old with chronic pulmonary diseases
Concept	mApps use for adherence to disease management
Context	Compliance on non-pharmacological interventions (exercise, physiotherapy, bronchial hygiene techniques, physical activity, nutrition) using mHealth technology
Types of evidence source	Qualitative and quantitative studies
Details and characteristics	
Citation details (e.g. author/s, date, title, journal, volume, issue, pages)	
Country	
Context	
Participants (details e.g. age/sex and number)	Children/adolescents, males/females, chronic pulmonary diseases (diagnosed over 3 years)
Details/results extracted from source of evidence (in relation to the concept of the scoping review)	
mHealth Apps mapping	
Design based on patient's needs	
Classification of reported outcomes	Any outcome reported after the use of the mHealth Apps
Technical factors of the App that influence adherence to treatment	e.g., simplicity of the App, availability at different mobile app platforms
Summary of findings	
Limitations	
Future perspectives	

Pieces of information from the abstracts of the selected articles will be collected and classified. A data collection instrument was developed by two reviewers to confirm study relevance and to extract study characteristics (Table 2). This tool developed similar to that recommended by the Joanna Briggs Institute.[27] Specifically, the data extracted will include details about participants, concept, context, study methods and key findings relevant to the review questions. This form will be reviewed by the research team and pretested by all reviewers before implementation to ensure that the form is capturing the information accurately. If additional data extraction categories are needed or if missing data emerge, consultation with our research team will guide decisions and will be reported with the findings.

For each of the included studies, the following data will be extracted: author; year of publication; aims/purpose; study population and sample size; study design (qualitative or quantitative); interventions (duration); reported outcomes; technical factors; limitations.

Stage 5: Collating, summarizing and reporting the results

All extracted data will be synthesized and collated in a descriptive table summary. A narrative description will focus on the technical factors of the apps that influence children's adherence to non- pharmacological treatment.

Stage 6: Consultation with stakeholders

The stage of consultation with stakeholders is an important step in all scoping reviews.[23] Therefore, the results of this scoping review will be discussed with physiotherapists, clinicians, academicians, technicians and researchers in order to inform and validate the findings regarding the technical factors that influence children's adherence to non-pharmacological treatment. Furthermore, stakeholders will be requested to provide their views and clarify possible research gaps found in the study. Specifically, the stakeholders will arrange and execute focus groups in order to evaluate those elements that are considered necessary to exist in an application and are useful and effective.

DISCUSSION

To our knowledge, this is the first scoping review that aims to investigate the technical factors that influence adherence to non-pharmacological treatment with the use of mHealth technology, in children with chronic pulmonary diseases. In the last decade there has been emerging interest in using mHealth apps to improve self-management in chronic illness.[28] Therefore, several previous studies investigated the use of mHealth apps on adherence to pharmacological and non-pharmacological treatment in children with chronic pulmonary or other chronic diseases.[29,30] In this context, previous systematic reviews or systematic evaluations of the available apps used qualitative analysis and investigated the potential use and feasibility of mHealth apps in pediatric pulmonary diseases.[28,30]

The successful outcome of chronic disease depends on best management and adherence to any therapeutic intervention. Adherence is affected by various factors that are directly related to the child or not. Such factors are the child's relationship with the family, practical treatment management, trust in the health professional, acceptance of treatment as well as factors such as low level of education, low family income, low level of

maternal education, second hand smoke and parental belief in the importance of treatment.[31-33] Further to the aforementioned factors, there may exist other ones such as technical issues that play an important role in children's adherence.[20]

To the best of our knowledge, there are no systematic reviews that analytically present the technical factors that can facilitate or hinder treatment. Investigating the suitability of technical characteristics may affect compliance with treatment. Therefore, our limited analysis will gather and analyze all the studies that used mobile health in children with chronic lung diseases and will present the importance of the technical parameters that affect children's compliance with the use of treatment plans. Therefore, the results of the review will help the understanding of the determinants of children's adherence to mHealth apps use and will contribute to further research into this topic.

Strengths and weaknesses

Scoping reviews are relevant to research areas with emerging evidence in which the paucity of the number of studies makes it difficult for researchers to undertake systematic reviews. The strength of this scoping review is the assessment of the methodological quality of evidence and the risk of bias using the CASP and the MMAT. Initially, the review meticulously will follow the PRISMA ScR methodology as it is described in the corresponding publication.

Implications

We anticipate that this scoping review will reveal a research gap and the findings will provide a critical insight into what is known and what is unknown about factors that facilitate or obstruct the use of the mHealth apps.

Therefore, the results might guide future researchers to design improved applications that are more child-friendly and designed to avoid technical or operational issues. Furthermore, modified methodological study designs may be followed, focusing on children's needs and beliefs.

CONCLUSION

The dissemination plan includes publishing results in scientific journals as well as presentations at pediatric conferences. Furthermore, the results will be disseminated with to stakeholders such as physiotherapists, clinicians, academicians, technicians and researchers and a summary of the key results will be presented in national and international relevant symposiums.

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