



To study the impact of mHealth interventions on chronic diseases management: A systematic overview of systematic reviews protocol



Wafa Elamin*, Dorothy Hannis, Lawrence Nyanzi, Louisa Ells

School of Health and Social Care, Centuria Building, Teesside University, Middlesbrough, Tees Valley TS1 3BX United Kingdom

ARTICLE INFO

Article history:

Received 6 August 2018

Available online 17 August 2018

Introduction

Digital health is the convergence of technology with healthcare delivery and is a new field in public health and clinical medicine. It is the use of information and communications technologies to improve human health and healthcare services.¹ There has been increased adoption of health care technologies by the general public in recent years.² This was made possible with the advent of mobile technology, fast broadband, 4G internet and the falling price of technology devices. Digital health can be used for point-of-care support, emergency medical responses, reminders for clinical appointments, reporting test results, health promotion, data collection for research, real-time data streaming, disease modelling, personalised care, and public health interventions.¹ Numerous modalities for digital communication exist such as smartphones and computers with two-way cameras, web-based portals, e-mails, interactive voice response, social media platforms, online forums and personal monitoring devices.³

These modalities have been adapted to provide different types of digital health technologies that have overlapping roles in delivering healthcare. The major modalities that patients use within their homes include telehealthcare and mHealth. Telehealthcare leverages telecommunication, video imaging, and information technologies. It enables health care practitioners to provide medical services virtually. Telehealthcare can address social, cultural and geographical inequalities in healthcare delivery through non-encounter communication.⁴ It has been especially useful for remote monitoring of elderly patients within their homes.⁵

mHealth, on the other hand, is concerned with the role of mobile technology in delivering health services.⁶ mHealth uses mobile applications or short message services (SMS) to reach and

engage with patients remotely. mHealth interventions are mobile and popular, providing novel long-term disease management solutions for patients.^{7,8} However, they are not without their challenges. Many mHealth technologies require an internet connection to operate fully. While the use of technology has dramatically increased worldwide in recent years, as of 2017, only 64.5% of the global population own a mobile phone while less than 50% have access to internet services.⁹ These figures are concerning as disadvantaged groups may not be able to engage with digital health interventions. Health economists have highlighted that access to the internet services and its content depends on five factors: affordability, availability, accessibility, accommodation and acceptability.¹⁰ As with other health care services, mHealth interventions must be readily available and accessible to the patients who need them most and offered at a price they can afford. Without maintaining this balance, health inequalities will arise from mHealth technologies. If widespread access is achieved, digital health interventions may solve critical public health dilemmas such as chronic and non-communicable diseases prevention and management.

Chronic and non-communicable diseases account for the largest group of public health issues in the European region¹¹ and cost the European Union countries 115 billion euros collectively each year.¹² The most frequently targeted chronic and non-communicable diseases include type 2 diabetes, asthma, chronic obstructive pulmonary disease (COPD), cardiovascular diseases, cancer, and mental health problems.¹³ Without adherence to management plans, these diseases and illnesses gravely affect patients' quality of life.^{14,15} Innovative and cost-effective solutions, that allow patients to self-manage illnesses are urgently needed to solve these issues and lessen the financial burden on healthcare systems worldwide.

Evidence suggests that mHealth technologies produce mixed clinical outcomes for patients in the management of chronic and

* Corresponding author.

E-mail address: t7172262@live.tees.ac.uk (W. Elamin).

non-communicable conditions.^{14–17} A systematic overview of systematic reviews is needed to investigate the benefit of mHealth interventions for chronic disease prevention and management. To the best of our knowledge, this study will be the first to do so.

Study aim

The main aim of this overview is to study the impact of mHealth interventions on chronic disease management among patients. It will also explore patients' engagement with mHealth technologies and highlight barriers that may hinder their use.

Methods

The PICOS approach, an abbreviation for participants, interventions, comparators, outcomes, and study design will be used in this review.¹⁸

Types of participants

Systematic reviews looking at patients suffering from chronic diseases will be included in the overview. No age limit or geographic location restriction will be imposed. Systematic reviews that only target health care practitioners or families of patients using mHealth technologies will not be included.

Types of interventions

This overview will target chronic disease interventions that are delivered using mHealth technologies. For this study, mHealth is defined as technological interventions that use smartphone applications or mobile text-messaging services to deliver health-care. These interventions must be delivered to patients in a home-based setting. Social media interventions will not be included in this review due to the privacy issues associated with these technologies.

Types of outcomes

The following outcomes will be reported and discussed:
Primary outcomes

- Sociodemographic of patients
- Cost efficiency of using the mHealth intervention
- Changes in health outcomes after using the intervention
- Patients' adherence to and engagement with the intervention
- Adverse events or barriers to using the intervention

Secondary outcomes

- Patients' perception of using the intervention
- Quality and reliability of the intervention
- Patients' follow-up with healthcare services after using intervention

Types of studies

Systematic reviews of quantitative studies will be included in this review, including randomised control trials, case-controls, cohort studies and cross-sectional studies. Systematic reviews that explore qualitative studies will be excluded. Reviews must be peer-reviewed and published in English. Only systematic reviews that are published after 2008 will be included. Given the fast-paced nature of technological development, restricting studies to the last

decade will ensure that only the most recent knowledge is reported and analysed.

Data search strategy

To identify studies for this review, the following electronic databases will be used:

- MEDLINE
- CINAHL
- EMBASE
- Cochrane Database of Systematic Reviews
- Google Scholar (first one-hundred citations)

Searches will be carried out using both indexed terms and free text. Search terms will be adjusted for each electronic database. To identify grey literature, the WHO's Library Database (WHOLIS) and the Web of Science Conference Proceedings Citation Index will be used. Reference lists of full-text studies that are included in the final review will also be checked for other potentially eligible studies. The proposed terms are as follows

Intervention terms	Disease terms	Study design
– digital health*	– chronic disease*/illness*	– systematic review
– mobile health/mHealth	– non-communicable disease	– review
– ehealth smartphone/mobile phone	– long-term disease*	
– mobile application*	– Cardiovascular disease*	
– short message service/SMS	– Diabetes*	
– telehealth/telecare/telemedicine	– chronic obstructive pulmonary disease/COPD	
	– Hypertension	

The search strategy will be: (digital health* OR Mobile health OR mHealth or eHealth or smartphone OR mobile phone OR mobile application* OR short message service OR SMS OR telehealth OR telecare OR telemedicine) **AND** (chronic disease* OR illness* OR non-communicable disease OR long-term disease* OR cardiovascular disease* OR diabetes* OR chronic obstructive pulmonary disease OR COPD OR hypertension) **AND** (systematic review OR review).

Data collection

All studies that are identified by the search strategy will be screened against the inclusion criteria (Table 1). RefWorks, a reference management software, will help sort the data and duplicate publications will be removed. Titles and abstracts will be screened initially.¹⁹ Those that fit the eligibility criteria will move onto the next phase of the review. The full text of these studies will be obtained and read. Only studies that fully match the inclusion criteria will be included in the final stage of the review (Table 1). During the selection process, a Prisma flow diagram will be used to show the number of studies excluded at each stage of the selection process.

Quality assessment and data extraction

As the methodological rigour of the final studies is expected to vary, quality will be assessed using the Measurement Tool to Assess Systematic Reviews (AMSTAR) checklist for systematic

Table 1
Inclusion and exclusion criteria.

	Inclusion criteria	Exclusion criteria
Language	Papers written in English	Any other language
Study period	Studies conducted and published in or after 2008	Studies conducted or published before 2008
Type of study	Systematic reviews of quantitative research	Any other types of reviews
Patient demographics	Patients with chronic diseases	Other users such as health care practitioners or family members
Types of intervention	Mobile health interventions such as SMS or mobile applications	Any other form of alternative health interventions
Setting of intervention	Home-based setting	Clinic or hospital setting
Included diseases	Chronic, communicable or life-long diseases such as Diabetes, COPD, cardiovascular diseases and Hypertension	Any other acute illnesses or other medical conditions

reviews.²⁰ The AMSTAR checklist will give an understanding of each study's generalisability, statistical issues or bias as well as the strength and quality of the reported data. Two reviewers will assess quality independently and studies of low-quality will be removed from the review to maintain high-quality output.

Data extraction will be guided by a data extraction form which has been created specifically for this overview. The key features that will be extracted onto this form include: year of publication, main research questions or objectives, setting and location, population characteristics, number of included studies, types of mobile interventions used, types of chronic diseases it addresses and the primary and secondary study outcomes. If a study has missing information the authors will be contacted directly for clarification. Both the quality assessment tool and the data extraction form will be piloted on a sample of studies to ensure that they capture all the relevant information.

Data synthesis

Data analysis will be through narrative synthesis and will be descriptive.²¹ A summary of the findings of the included studies will be produced, as a detailed tabular presentation. The following characteristics will be described: type of mHealth intervention, type of chronic disease as well as target population characteristics such as summary of age groups, gender, ethnicity, education level, socioeconomic status and country setting. Where possible, data will be summarised using the standard mean difference or mean difference with a 95% confidence interval (CI). Evidence that is high-quality will be given priority, and results that indicate potential bias will be interpreted with caution.

Conclusion

This overview of systematic reviews will provide a detailed summary of the evidence regarding mHealth interventions on chronic disease management for patients. This information will add to the current body of knowledge and will be used to inform policy and practise towards the uptake of mHealth technologies among health care providers and their patients.

Declarations

Conflicting interests

The authors have no conflict of interest to declare.

Funding

This research has not received any specific grant from any public, commercial, or not-for-profit funding agencies.

Ethical approval

Ethical approval has been obtained from Teesside University to conduct the systematic review.

Authorship

Each of the four authors have contributed to the design of the research, drafted or revised the paper and approved the final version. All contributing authors have given consent for the publication of this paper.

Acknowledgements

None to declare.

References

- Kostkova P. Grand challenges in digital health. *Front Public Health*. 2015;5(3):134.
- Mosa AS, Yoo I, Sheets L. A systematic review of healthcare applications for smartphones. *BMC Med Inf Decis Making*. 2012;12(1):67.
- Newton MJ. The promise of telemedicine. *Surv Ophthalmol*. 2014;59(5):559–567.
- Lakshminarayana R. Digital health in primary care. *InnovAiT*. 2017;10(9):540–548.
- Spinsante S, Gambi E. Remote health monitoring for elderly through interactive television. *Biomed Eng Online*. 2012;11(1):54.
- Sezgin E, Yildirim SÖ. A literature review on attitudes of health professionals towards health information systems: from e-Health to m-Health. *Procedia Technol*. 2014;1(16):1317–1326.
- Free C, Phillips G, Watson L, et al. The effectiveness of mobile-health technologies to improve health care service delivery processes: a systematic review and meta-analysis. *PLoS Med*. 2013;10(1).
- Rathbone AL, Prescott J. The use of mobile apps and SMS messaging as physical and mental health interventions: systematic review. *JMIR*. 2017;19(8).
- Statista. 'Forecast of mobile phone users worldwide. 2018. Available at <https://www.statista.com/statistics/274774/forecast-of-mobile-phone-users-worldwide/> (Accessed: 10 January 2018).
- Solomonides AE, Mackey TK. Emerging ethical issues in digital health information: ICANN, health information, and the dot-health top-level domain. *Camb Q Healthc Ethics*. 2015;24(3):311–322.
- WHO. World Health Organisation. 'Action Plan for the Prevention and Control of Noncommunicable Diseases in the WHO European Region 2016–2025'. 2016. Available at http://www.euro.who.int/_data/assets/pdf_file/0008/346328/NCD-ActionPlan-GB.pdf?ua=1 (Accessed: 10 January 2018).
- OECD/EU. *Health at a Glance. Europe 2016: State of Health in the EU Cycle*. Paris: OECD Publishing; 2016.
- Nolte E, Knai C. *Assessing chronic disease management in European health systems* Country reports. WHO Regional Office for Europe; 2015.
- Whitehead L, Seaton P. The effectiveness of self-management mobile phone and tablet apps in long-term condition management: a systematic review. *JMIR*. 2016;18(5).
- Hamine S, Gerth-Guyette E, Faulx D, Green BB, Ginsburg AS. Impact of mHealth chronic disease management on treatment adherence and patient outcomes: a systematic review. *JMIR*. 2015;17(2).
- Park LG, Howie-Esquivel J, Chung ML, Dracup K. A text messaging intervention to promote medication adherence for patients with coronary heart disease: a randomized controlled trial. *Patient Educ Couns*. 2014;94(2):261–268.

17. Wald DS, Bestwick JP, Raiman L, Brendell R, Wald NJ. Randomised trial of text messaging on adherence to cardiovascular preventive treatment (INTERACT trial). *PLoS One*. 2014;9(12).
18. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS Med*. 2009;6(7).
19. Smith V, Devane D, Begley CM, Clarke M. Methodology in conducting a systematic review of systematic reviews of healthcare interventions. *BMC Med Res Method*. 2011;11(1):15.
20. Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C, Porter AC, Tugwell P, Moher D, Bouter LM. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. *BMC Med Res Method*. 2007;7(1):10.
21. Rodgers M, Sowden A, Petticrew M, et al. Testing methodological guidance on the conduct of narrative synthesis in systematic reviews: effectiveness of interventions to promote smoke alarm ownership and function. *Evaluation*. 2009;15(1):49–73.