Effectiveness of technology use for engaging community dwelling adults with chronic disease in self-care behavior management in health care: a systematic review protocol

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Review question/objective: The quantitative objective is to identify the effectiveness of technology use for self-care behavior management and the patient engagement levels in health care. More specifically, the objectives are to identify: 1) the effectiveness of technology use (includes mobile health applications, text messages, telemedicine/video conferences between providers and people with chronic disease, remote monitoring and websites) in health care for engaging community-dwelling adults with chronic disease in self-care management, and 2) the patient engagement levels in health care.

Keywords Chronic disease; patient engagement; self-management; technology

Background

Today, chronic disease impacts significantly on people and healthcare systems globally. Technology is one tool that can assist with the management of chronic illness which is reaching epidemic levels and impacting aging populations, leading to unhealthy lifestyles.1 The World Health Organization2 (WHO) reports that over 17 million of the approximately 38 million deaths per year from chronic diseases are directly caused by cardiovascular disease. In addition, more than eight million deaths per year are attributed to cancer, and approximately four million deaths per year are attributed to respiratory diseases.3 The International Diabetes Federation4 reports that over 375 million people worldwide are suffering from diabetes with an additional 300 million people suffering from pre-diabetes. In response to these staggering numbers, the WHO5 is working with over 100 countries to reduce the impact of chronic disease by addressing modifiable risk factors to prevent disease and decrease the health costs associated with chronic conditions. Also, the US Centers for Disease Control and Prevention4 found chronic conditions not only to be the most costly health problems but also the most preventable. Understanding the modifiable risk factors is one facet; however, another important aspect is determining strategies that help people with chronic disease enhance their self-care behavior.5,6

One strategy found throughout the literature to enhance self-care behaviors is the use of technology in health care.7–13 “Self-management programs often occur separately from medical care, and connecting the two is difficult.”14(p.337) Technology has become an essential element in the health care industry to bridge this gap. Several studies have examined how technology is impacting on self-care management behaviors in people living with various chronic diseases.7–13 One method examined in the literature is how mobile phones could be leveraged between nurses and patients to enhance chronic condition management, especially blood glucose monitoring for patients with diabetes and communication between providers and patients going through chemotherapy for breast, lung and colorectal cancer.15,16 This study reported that health tools being used on mobile phones showed positive clinical outcomes in people with type 2 diabetes who received communication from providers and entered clinical data between health visits.15 Another method examined was the use of telemedicine and remote monitoring to help patients with hypertension and heart disease between provider visits.8
report found that technology was a useful tool for patients and providers to help encourage self-management by understanding what factors were limiting a patient’s ability to self-manage their disease.\textsuperscript{8} Other studies examined internet sites as a health tool, and these studies did not show improvements in self-management behaviors.\textsuperscript{17,18}

In addition to the literature that shows clinical outcomes related to technology use in health care, there are other factors to consider. Most importantly, healthcare technology can be defined in many different ways, and each study clearly lays out the definition used for technology. Common terms in the literature are electronic health (e-Health) or mobile health (mHealth) tools. One author posited that e-Health is the encompassing term for all healthcare technologies, and mHealth is one component.\textsuperscript{15} However, these modalities truly refer to the hardware used to access the technology software.

Technology has allowed health care to move outside of the traditional healthcare setting and allows people access to their health information at any time.\textsuperscript{1} There are benefits and risks with using technology to manage chronic diseases. Clinically, people can enter data, such as blood pressure, weight, blood glucose, food diaries, medication data for management of asthma and quality of life measures for cancer patients, from their home, and the data can be automatically transmitted to their provider.\textsuperscript{1,15,16} Although this may be seen as a significant benefit for people and their providers, providers have also expressed concern over the automation of health care and the lack of personal connection with the patients.\textsuperscript{1}

Technology has the ability to enhance self-care behavioral management. However, several factors must be considered. One factor is the number of chronic diseases a person has and whether they are at high-risk for hospitalization. One study found that people with more than one chronic disease are at increased risk for poor outcomes and need an individualized plan of care to enhance their disease management.\textsuperscript{14} Technology is one approach that can help these individuals between office visits by setting automatic reminders for visits or medication administration, developing educational tools geared toward the individuals’ situation and creating tools for patients to input key clinical data for monitoring.\textsuperscript{14–16}

Having technology available for people with chronic disease is not enough. One author stated that “user acceptance is a major issue.”\textsuperscript{19(p.582)} As with many healthcare interventions, people have to be willing and able to use the intervention in their day-to-day life. Clinicians can play a key role in educating patients about technology interventions; however, people must be engaged in their health care to use technology to self-manage chronic disease. As early as 2001, the Institute of Medicine identified the need for patients to become true partners in care.\textsuperscript{20} Technology has become a tool to support patients taking an active role in their health and care management.

The literature presented above has led to the formulation of this systematic review to examine the effectiveness of technology use for health care on engaging people with chronic diseases in self-care behavior management.

An initial search of systematic reviews was conducted on the review question for this study and did not result in any findings. During this initial search, several systematic reviews were examined in detail to ensure that the topics were not overlapping and that this review would fill a gap in the current literature. Several systematic reviews examined the impact of mobile phone technology interventions on specific topics such as smoking cessation, self-management of long-term illness and asthma.\textsuperscript{21–24} Other systematic reviews examined self-care management programs and chronic disease; however, they did not specifically address the use of technology as a means of self-care management.\textsuperscript{25,26} Lastly, there were several systematic reviews that addressed heart disease or diabetes and may have addressed either self-care management or a specific aspect of technology use.\textsuperscript{27–29} However, it has been determined that this review will fill a gap in the literature by providing a systematic review that addresses the effectiveness of technology use for health care on self-care behavior management in people with chronic diseases.

**Definitions for this review**

Chronic disease: “cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma) and diabetes”\textsuperscript{12(para.1)} (also known as non-communicable diseases).
Community dwelling: people living in their homes in the community rather than people seeking care at any type of healthcare facility including both the inpatient and outpatient setting for this review.

Technology: mHealth applications, text messages, telemedicine/video conferences between providers and adults with chronic disease, remote monitoring and websites for this review.

Inclusion criteria

Types of participants
This review will consider studies that include community-dwelling adults aged 18 or older with chronic disease as defined above. Although studies have shown that widespread adoption of health technology has occurred in adults aged 65 and younger, older adults cite concerns with privacy of information, discomfort with the technology itself and lack of confidence in their ability to use the technology. However, these studies do not support limiting the adult age range of participants.

Types of intervention(s)/phenomena of interest
This review will consider studies that evaluate technology use for health care (technology use includes mHealth applications, text messages, telemedicine/video conferences between providers and adults with chronic disease, remote monitoring and websites) compared with the absence of technology use in health care as the primary intervention.

Outcomes
This review will consider studies that include the following outcomes: self-care behavior management and patient engagement levels in health care.

Self-care behavior management includes outcomes that demonstrate one’s involvement in their health care. Studies that use psychometrically sound tools that measure outcomes related to lifestyle changes, knowledge about chronic conditions, medication adherence and patient engagement levels in health care will be used. An example of patient engagement levels in health care includes the Patient Activation Measure, the most widely used current measurement of patient engagement levels; however, this review will report any psychometrically sound measurement tools found in the review that are relevant to patient engagement. Examples of tools used to measure adherence to self-care behaviors include but are not limited to the Self-Care Inventory, the Self-Care of Heart Failure Index and the Chronic Disease Self-Efficacy Scales.

Types of studies
This quantitative review will consider both experimental and epidemiological study designs including randomized controlled trials, non-randomized controlled trials, quasi-experimental studies, before and after studies, prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies for inclusion. This quantitative review will also consider descriptive epidemiological study designs including case series, individual case reports and descriptive cross-sectional studies for inclusion.

Search strategy
The search strategy aims to find both published and unpublished studies. A three-step search strategy will be utilized in this review. An initial limited search of MEDLINE and CINAHL will be undertaken followed by an analysis of the text words contained in the title and abstract and of the index terms used to describe article. A second search using all identified keywords and index terms will then be undertaken across all included databases. Third, the reference list of all identified reports and articles will be searched for additional studies. Studies published in English will be considered for inclusion in this review. Studies published between 2005 and 2015 will be considered for inclusion in this review.

The databases to be searched include: CINAHL, MEDLINE, Embase, Clinicaltrials.gov, ProQuest Dissertations and Thesis, MedNar, NYAM.

Initial keywords to be used will be: technology, technology use, health care, patient engagement, community dwelling, adults, chronic disease, self care, self care management, behavior management.

Assessment of methodological quality
Papers selected for retrieval will be assessed by two independent reviewers for methodological validity prior to inclusion in the review using standardized critical appraisal instruments from the Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) (Appendix I).
Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer.

**Data extraction**

Quantitative data will be extracted from papers included in the review using the standardized data extraction tool from JBI-MAStARI (Appendix II). The data extracted will include specific details about the interventions, populations, study methods and outcomes of significance to the review question and specific objectives.

**Data synthesis**

Quantitative data will, where possible, be pooled in statistical meta-analysis using JBI-MAStARI. All results will be subject to double data entry. Effect sizes expressed as odds ratio (for categorical data) and weighted mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis. Heterogeneity will be assessed statistically using the standard Chi-square and also explored using subgroup analyses based on the different study designs included in this review. As statistical pooling is not possible, the findings will be presented in a narrative form including tables and figures to aid in data presentation where appropriate. We will conduct a subgroup analysis to examine adults aged 65 and younger, compared with adults aged 66 and older.

**Acknowledgements**

The authors acknowledge the support of the TCU staff and library services.

**References**

Appendix I: Appraisal instruments

**MASTARI appraisal instrument**

### JBI Critical Appraisal Checklist for Descriptive / Case Series

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Unclear</th>
<th>Not Applicable</th>
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</thead>
<tbody>
<tr>
<td>1. Was study based on a random or pseudo-random sample?</td>
<td>☐</td>
<td>☐</td>
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<td>2. Were the criteria for inclusion in the sample clearly defined?</td>
<td>☐</td>
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<td>3. Were confounding factors identified and strategies to deal with them stated?</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
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<td>4. Were outcomes assessed using objective criteria?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>5. If comparisons are being made, was there sufficient descriptions of the groups?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>6. Was follow up carried out over a sufficient time period?</td>
<td>☐</td>
<td>☐</td>
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<td>7. Were the outcomes of people who withdrew described and included in the analysis?</td>
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<td>8. Were outcomes measured in a reliable way?</td>
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<td>9. Was appropriate statistical analysis used?</td>
<td>☐</td>
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**Overall appraisal:**
- Include ☐
- Exclude ☐
- Seek further info ☐

**Comments (including reason for exclusion):**

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# JBI Critical Appraisal Checklist for Comparable Cohort/ Case Control

**Reviewer**  
**Date**

**Author**  
**Year**  
**Record Number**

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<th>No</th>
<th>Unclear</th>
<th>Not Applicable</th>
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<td>1. Is sample representative of patients in the population as a whole?</td>
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<td>2. Are the patients at a similar point in the course of their condition/illness?</td>
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<td>3. Has bias been minimised in relation to selection of cases and of controls?</td>
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<td>4. Are confounding factors identified and strategies to deal with them stated?</td>
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**Overall appraisal:**  
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Exclude [ ]  
Seek further into. [ ]

**Comments (Including reason for exclusion)**

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Appendix II: Data extraction instruments

MAStARI data extraction instrument

**JBI Data Extraction Form for Experimental / Observational Studies**

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<td>Journal</td>
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**Study Method**

- RCT
- Quasi-RCT
- Longitudinal
- Retrospective
- Observational
- Other

**Participants**

- Setting

**Population**

**Sample size**

- Group A
- Group B

**Interventions**

- Intervention A

**Intervention B**

**Authors Conclusions:**

**Reviewers Conclusions:**
### Study results

#### Dichotomous data

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#### Continuous data

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